



# DELL EMC MX9116N FABRIC SWITCHING ENGINE

High-performance, scalable 25 Gigabit Ethernet fabric switch with multi-chassis fabric scaling capabilities for the PowerEdge MX platform

The Dell EMC Networking MX9116n Fabric Switching Engine is a scalable, high-performance, low latency 25Gbps Ethernet switch purpose-built for the PowerEdge™ MX platform providing enhanced capabilities and cost-effectiveness for the enterprise, mid-market, Tier 2 cloud and NFV service providers with demanding compute and storage traffic environments.

Delivering industry leading performance in a modular switch, the non-blocking switching architecture in the MX9116n provides line-rate 25GbE L2 and L3 forwarding capacity to all connected servers with no oversubscription and a sub 450ns latency. In addition to 16 internal 25GbE ports, the MX9116n provides four QSFP28 100GbE ports for uplinks and twelve QSFP28-Double Density ports. These QSFP28-DD ports provide capacity for additional uplinks, ICLs, connections to rack servers at 10GbE or 25GbE via breakout cables, and fabric expansion connections for up to 9 additional MX7000 chassis.

## Maximum performance and functionality

The Dell EMC Networking MX9116n is a high-performance, multifunction, 25GbE Fabric Switching Engine purpose-built for applications in demanding data center, cloud and computing environments. The MX9116n also supports the open source Open Network Install Environment (ONIE) for zero touch installation of alternate operating systems in future releases.

## Built-in convergence capabilities

The MX9116n is fully IEEE data center bridging (DCB) compliant, supporting iSCSI, NAS, and FCoE transit. Two of the QSFP28 ports can support eight 32Gb Fibre Channel connections (4 per QSFP28), enabling direct attachment of a FC storage array and as a NPIV Proxy Gateway to an existing FC SAN.

## MX Scalable Fabric Architecture

The MX Scalable Fabric Architecture allows the MX9116n to seamlessly support up to 80 MX compute sleds and 10 MX7000 chassis via the ultra-low latency MX7116n Fabric Expander Module.

## SmartFabric OS10

The Dell EMC Networking SmartFabric OS10 is a Network Operating System supporting multiple architectures and environments. The networking world is moving from a monolithic stack to a pick-your-own-world. The OS10 solution is designed to allow multi-layered disaggregation of network functionality. While OS10 contributions to Open Source provide users freedom and flexibility to pick their own 3rd party networking, monitoring, management and orchestration applications, OS10 bundles an industry hardened networking stack featuring standard L2 and L3 protocols over a standard and well accepted CLI interface.

## SmartFabric Services

Included in OS10, SmartFabric Services provides single pane of glass management and automation across every fabric in a PowerEdge MX deployment, up to the 20 chassis Multi-Chassis Management group limit\*. SmartFabric Services key features include:

- I/O Aggregation to simplify connectivity to existing networks
- Integration of VLAN and automated QoS settings with Server Deployment Template
- Fabric-wide firmware upgrades and configuration consistency checks
- Automatic topology validation – detects physical topology misconfigurations and provides corrective guidance
- Automatically heals fabric upon failure condition removal

## Key applications

- Organizations looking to enter the software-defined data center era with a choice of networking technologies designed to deliver the flexibility they need
- Native high-density 25 GbE server access in high-performance data center environments
- 25 GbE backward compatible to 10G and 1G for future proofing and data center server migration to faster uplink speeds
- Capability to support 25G and 10G rack mount servers
- iSCSI storage deployment including DCB converged lossless transactions
- Suitable as a ToR or Leaf switch in 100G leaf/spine CLOS Fabric implementations

## Key features

- Up to 6.4Tbps of switching I/O bandwidth (full duplex) available and non-blocking switching fabric delivering line-rate performance under full load with sub 450ns latency
- Scalable L2 and L3 Ethernet switching with QoS and a full complement of standards-based IPv4 and IPv6 features, including OSPF and BGP routing support
- Up to eight 32Gb Fibre Channel connections supporting both NPG and Direct Attach FC configurations
- L2 multipath support via Virtual Link Trunking (VLT) and multiple VLT (mVLT) multi-chassis link aggregation technology
- NVMe-oF ready to support the next generation of high performance storage

- Jumbo frame support for large data transfers
  - 128 link aggregation groups with up to sixteen members per group, using enhanced hashing
  - Converged network support for DCB, with priority flow control
  - (802.1Qbb), ETS (802.1Qaz), DCBx and iSCSI TLV support
  - Supports Routable RoCE to enable convergence of compute and storage
- Key features with OS10**
- Consistent DevOps framework across compute, storage and networking elements
  - Standard networking features, interfaces and scripting functions for legacy network operations integration
  - Standards-based switching hardware abstraction via Switch Abstraction Interface (SAI)
  - Pervasive, unrestricted developer environment via Control Plane Services (CPS)
  - Open and programmatic management interface via Common Management Services (CMS)
- OS10 software enables Dell EMC layer 2 and 3 switching and routing protocols with integrated IP Services,
  - Quality of Service, Manageability and Automation features
  - Platform agnostic via standard hardware abstraction layer (OCP-SAI)
  - Unmodified Linux kernel and unmodified Linux distribution
  - Leverage common open source tools and best-practices (data models, commit rollbacks)
  - Scalable L2 and L3 Ethernet Switching with QoS, ACL and a full complement of standards based IPv4 and IPv6 features including OSPF, BGP and PBR
  - Enhanced mirroring capabilities including local mirroring, Remote Port Mirroring (RPM), and Encapsulated Remote Port Mirroring (ERPM)
  - Converged network support for DCB, with priority flow control
  - (802.1Qbb), ETS (802.1Qaz), DCBx and iSCSI TLV
  - Rogue NIC control provides hardware-based protection from NICS sending out excessive pause frames

Product	Description
<b>MX9116n Fabric Switching Engine</b>	
<b>Optics</b>	Transceiver, 2x100GbE, 2SR4 QSFP28-DD Transceiver, 2x40GbE, 2SR4 QSFP28-DD Transceiver, 100GbE, SR4 QSFP28 Transceiver, 100GbE, LR4 QSFP28 Transceiver, 100GbE, ESR4 QSFP28 Transceiver, 100GbE, PSM4 500m QSFP28 Transceiver, 100GbE, CWDM4 2Km QSFP28 Transceiver, 100GbE, SWDM4 100m QSFP28 Transceiver, 100GbE, BIDI optic QSFP28 Transceiver, 40GbE, SR4 optic QSFP+ Transceiver, 40GbE, eSR4 optic QSFP+ Transceiver, 40GbE, LR4 optic QSFP+ Transceiver, 40GbE, BIDI optic QSFP+ Transceiver, 40GbE, PSM4 10Km QSFP+ Transceiver, 40GbE, LM4 Duplex QSFP+ Transceiver, 40GbE, SM4 Duplex QSFP+ Transceiver, 4x32G FC SW optic QSFP28 Transceiver, 4x16G FC SW optic QSFP+
<b>Cables</b>	2x 100GbE, QSFP28-DD to QSFP28-DD, active optical, passive DAC 2x 100GbE, QSFP28-DD to 2xQSFP28, active optical, passive DAC 2x 100GbE, QSFP28-DD to 8xSFP28 (8x10/25GbE), active optical, passive DAC 2x 100GbE, MPO12-DD to MPO12-DD optical 2x 100GbE, MPO12DD to 2xMPO12 optical breakout 2x 100GbE, MPO12DD to 8xLC optical breakout 2x 40GbE, QSFP28-DD to 2xQSFP+, active optical, passive DAC 2x 40GbE, QSFP28-DD to 8xSFP+ (8x10/10GbE), active optical, passive DAC 100GbE, QSFP28 to QSFP28, active optical, passive DAC 100GbE, QSFP28 to 4xSFP28 (4x10/25GbE), active optical, passive DAC 100GbE, MTP to MTP optical 100GbE, MTP to 4xLC optical breakout 40GbE, QSFP+ to QSFP+, active optical & passive DAC 40GbE, QSFP+ to 4xSFP+ (4x10GbE), active optical & passive DAC
<b>Software</b>	SmartFabric OS10 Select third-party operating system offerings (future)

## Physical

Full featured 25/100GE switch in PowerEdge MX

Fabric A/B I/O sled form factor

1 USB 2.0 type A storage port

1 micro USB type B port for console/management port access

Indicators:

Power/Health LED

ID LED

Link/activity LEDs

Size: 1.18”h x 17.11”w x 10.94”d

Weight: 8.49lbs (3.85kg)

Max. power consumption: 260 Watts w/5W

QSFP28-DD Optics

Typ. power consumption: 237 Watts w/5W

QSFP28-DD Optics

Max. operating specifications:

Standard Operating Temperature 10°C to 35°C (50°F to 95°F)

Operating Relative Humidity 5% to 85%, noncondensing

Max. non-operating specifications:

Storage temperature: -40°C to 65°C (-40°F to 149°F)

Storage humidity: 5 to 95% (RH), noncondensing

Expanded Operating Temperature, Continuous

Operation: Not Supported

## Redundancy

Redundant Power and Cooling provided by Dell

EMC PowerEdge MX7000 Chassis

## Performance

Switching I/O bandwidth: 6.4Tbps

Forwarding capacity: 2380 Mpps

Latency: Sub 450ns

MAC addresses: 137K

IPv4 Unicast routes: 130K

IPv6 Unicast routes: 130K

ARP entries: 48K

Layer 2 VLANs: 60K P\*V in Full Switch mode

Layer 3 VLANs: 30K P\*V in Full Switch mode

MST: 32 instances

PVST+: 128 instances

LAG: 128 groups, 16 members per LAG group

ACL Entries-Layer 2 Egress: 256

ACL Entries-Layer 2 Ingress: 767

ACL Entries-IPv4 Egress: 767

ACL Entries-IPv4 Ingress: 767

ACL Entries-IPv6 Egress: 512

ACL Entries-IPv6 Ingress: 767

iSCSI Number of sessions: 256

Jumbo Frames: 9K

## IEEE Compliance

802.1AB LLDP

TIA-1057 LLDP-MED

802.3ad Link Aggregation

802.1D Bridging, STP

802.1p L2 Prioritization

802.1Q VLAN Tagging

802.1Qbb PFC

802.1Qaz ETS

802.1X Network Access Control

802.3ac Frame Extensions for VLAN

Tagging

802.3x Flow Control

## Layer2 Protocols

802.1D Compatible

802.1p L2 Prioritization

802.1Q VLAN Tagging

802.1s MSTP

802.1w RSTP

802.1t RPVST+

7348 VxLAN

## VLT (Virtual Link Trunking)

VRRP Active/Active

RSTP, MSTP, RPVST+

Port Mirroring on VLT ports

DCB, iSCSI, FSB on VLT

RPM/ERPM over VLT

VLT Minloss upgrade

VxLAN with VLT

VRF with VLT

ICMP/MLD snooping over VLT

PIM SM/SSM over VLT

## RFC Compliance

768 UDP

793 TCP

854 Telnet

959 FTP

1321 MD5

1350 TFTP

2474 Differentiated Services

2698 Two Rate Three Color Marker

3164 Syslog

4254 SSHv2

## General IPv4 Protocols

791 IPv4

792 ICMP

826 ARP

1027 Proxy ARP

1035 DNS (client)

1042 Ethernet Transmission

1191 Path MTU Discovery

1305 NTPv4

1519 CIDR

1812 Routers, Static Routes

1858 IP Fragment Filtering

2131 DHCPv4 (server and relay)

5798 VRRPv3

3021 31-bit Prefixes

1812 Requirements for IPv4 Routers

1918 Address Allocation for Private Internets

2474 Diffserv Field in IPv4 and Ipv6 Headers

3195 Reliable Delivery for Syslog

3246 Expedited Forwarding PHB Group

## General IPv6 Protocols

1981 Path MTU for IPv6

2372 IPv6 Addressing

2460 IPv6 Protocol Specification

2461 Neighbor Discovery

2462 Stateless Address AutoConfig

2463 ICMPv6

2464 Ethernet Transmission

2675 IPv6 Jumbograms

3493 Basic Socket Interface

3542 Advanced Socket, API

3587 Global Unicast Address Format

3848 Default Address Selection

4291 IPv6 Addressing

3633 DHCPv6 Relay

IPv6 Static Routes

2464 Transmission of IPv6 Packets over Ethernet Networks

2711 IPv6 Router Alert

4007 IPv6 Scoped Address Architecture

4213 Basic Transition Mechanisms for IPv6 Hosts and Routers

## OSPF (V2/V3)

1745 OSPF/BGP interaction

1765 OSPF Database overflow

2154 OSPF with Digital Signatures

2328 OSPFv2

2370 Opaque LSA

3101 OSPF NSSA

4552 OSPFv3 Authentication

## Multicast

2236 IGMPv2 Snooping

3810 MLDv2 Snooping

## Security

1492 TACACS (Authentication, Accounting, Authorization)

2865 RADIUS

3162 RADIUS and IPv6

3579 RADIUS support for EAP

3580 802.1X with RADIUS

3826 AES Cipher in SNMP

Control Plane, VTY ACLS

IP Access Control Lists

## BGP

1997 Communities

2385 MD5

2439 Route Flap Damping

2545 BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing

2796 Route Reflection

2858 Multiprotocol Extensions

2918 Route Refresh

3065 Confederations

4271 BGP-4

4360 Extended Communities

4893 4-byte ASN

5396 4-byte ASN Representation

5492 Capabilities Advertisement

5549 BGP Unnumbered

BGP ADD PATH

BGP to OSPF route distribution

BGP EVPN

L2 & L3 Gateway with VxLAN Tunnels

BGP EVPN Asymmetric IRB

Symmetric IRB

Type 5 Routes

## Linux Distribution

Debian Linux version 8

Linux Kernel 3.16

## MIBS

BRIDGE-MIB

ENTITY-MIB

EtherLike-MIB

HOST-RESOURCES-V2-MIB

IEEE8021-PFC-MIB

IEEE8023-LAG-MIB

IF-MIB

IP-FORWARD-MIB

IP-MIB

LLDP-EXT-DOT1-MIB

LLDP-EXT-DOT3-MIB

LLDP-MIB

OSPF-MIB  
OSPFV3-MIB  
Q-BRIDGE-MIB (Get)  
RFC1213-MIB  
SFLOW-MIB  
SNMP-FRAMEWORK-MIB  
SNMP-MPD-MIB  
SNMPv2-MIB  
TCP-MIB  
UDP-MIB  
SNMP-USER-BASED-SM-MIB  
SNMP-VIEW-BASED-ACM-MIB  
SNMP-TARGET-MIB

#### **Network Management and Monitoring**

SNMPv1/v2c/v3  
IPv4/IPv6 Management support  
(Telnet, FTP, TACACS, RADIUS, SSH,  
NTP)  
Port Mirroring  
RPM/ERPM  
3176 SFlow  
Support Assist (Phone Home)  
RestConf APIs, Auto-docs  
XML Schema  
CLI Commit (Scratchpad)  
Uplink Failure Detection  
Object Tracking  
FarEnd Failure Detection  
Bidirectional Forwarding Detection  
(BFD) – BGPv4/6, OSPFv2/3, Static  
Routes  
Streaming Telemetry  
System, Buffers, Data monitoring  
gRPC Transport with gPB encoding

#### **Automation**

Control Plane Services APIs  
Linux Utilities and Scripting Tools  
CLI Automation (Multiline Alias)  
Ansible, Puppet, Chef, SaltStack  
Zero Touch Deployment (ZTD)  
3rd party packages support on Docker Container

#### **Quality of Service**

Prefix List  
Route-Map  
Rate Shaping (Egress)  
Rate Policing (Ingress)  
Scheduling Algorithms  
Round Robin  
Weighted Round Robin  
Deficit Round Robin  
Strict Priority  
Weighted Random Early Detect

#### **Data center bridging**

802.1Qbb Priority-Based Flow Control  
802.1Qaz Enhanced Transmission  
Selection (ETS)  
Explicit Congestion Notification  
Data Center Bridging eXchange (DCBx)  
DCBx Application TLV (iSCSI, FCoE)  
RoCEv2

#### **Fibre Channel**

FIP Snooping

#### **Regulatory compliance**

##### **Safety**

UL/CSA 60950-1, Second Edition  
EN 60950-1, Second Edition  
IEC 60950-1, Second Edition Including all National  
Deviations and Group Differences  
EN 60825-1 Safety of Laser Products Part 1:  
Equipment Classification Requirements and User's  
Guide  
EN 60825-2 Safety of Laser Products Part 2:  
Safety of Optical Fiber Communication Systems  
FDA Regulation 21 CFR 1040.10 and 1040.11

##### **Emissions**

Australia/New Zealand: AS/NZS CISPR 32:2015,  
Class A  
Canada: ICES-3/NMB-3, Class A  
Europe: EN 55024:2010 (CISPR 24:2010), Class A  
Japan: VCCI V-3/2010.04 Class A  
USA: FCC CFR 47 Part 15, Subpart B:2011, Class A  
Immunity  
EN 300 386 V1.6.1 EMC for Network Equipment  
EN 55024:2010  
EN 61000-3-2: Harmonic Current Emissions  
EN 61000-3-3: Voltage Fluctuations and Flicker  
EN 61000-4-2: ESD  
EN 61000-4-3: Radiated Immunity  
EN 61000-4-4: EFT  
EN 61000-4-5: Surge  
EN 61000-4-6: Low Frequency Conducted Immunity

##### **RoHS**

EN 50581:2012 All MX9116n components are EU  
RoHS compliant



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