DELL EMC NETWORKING 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, multi-function, 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.

OS10 Enterprise Edition

The Dell EMC Networking OS10 Enterprise Edition 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 Enterprise Edition 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 Enterprise Edition, 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

*10 at RTS

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

- VRF-lite enables sharing of networking infrastructure and provides L3 traffic isolation across tenants

- 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 Dell EMC Networking 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 Enterprise Edition 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
MX9116n Fabric Switching Engine	
Optics	Transceiver, 2x100GbE, 2SR4 QSFP28-DD Transceiver, 100GbE, SR4 QSFP28 Transceiver, 100GbE, LR4 QSFP28 Transceiver, 100GbE, CWDM4 2Km QSFP28 Transceiver, 100GbE, PSM4 500m 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+

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Product	Description
MX9116n Fabric Switching Engine	
Cables	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 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
Software	Dell EMC OS10 Enterprise Edition Select third-party operating system offerings (future)

Technical specifications

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%, non-condensing
Max. non-operating specifications:
Storage temperature: -40°C to 65°C (-40°F to 149°F)
Storage humidity: 5 to 95% (RH), non-condensing
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: 4K
Layer 3 VLANs: 500
MST: 32 instances
PVST+: 128 instances
LAG: 128 groups, 16 members per LAG group
ACL Entries-Layer 2 Egress: 1000
ACL Entries-Layer 2 Ingress: 767
ACL Entries-IPv4 Egress: 767
ACL Entries-IPv4 Ingress: 767
ACL Entries-IPv6 Egress: 500
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+

VLT (Virtual Link Trunking)
VRRP Active/Active
RSTP & RPVST+
Port Mirroring on VLT ports
DCB, iSCSI, FSB on VLT
RPM/ERPM over VLT
VLT Minloss upgrade

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	DCHPv4 (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
2596	Assured Forwarding PHB Group
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
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)
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

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Technical specifications

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

draft-eitf-idr-add-paths-04.txt ADD PATH

Linux Distribution
Debian Linux version 8
Linux Kernel 3.16

MIBS
IP MIB
IP Forward MIB
Host Resources MIB
IF MIB
LDDP EXT1/3 MIB
Entity MIB
LAG MIB
Dell-Vendor MIB
TCP MIB
UDP MIB
SNMPv2 MIB

Network Management and Monitoring
SNMPv1/2c
IPv4/IPv6 Management support (Telnet, FTP, TACACS, RADIUS, SSH, NTP)
Syslog
Port Mirroring
RPM/ERPM
SFlow
Management VRF
Support Assist (Phone Home)
RestConf API (Layer 2 features)
XML Schema
CLI Commit (Scratchpad)
Uplink Failure Detection
Object Tracking
Management VRF

Automation
Control Plane Services APIs
Linux Utilities and Scripting Tools
CLI Automation (Multiline Alias)
Ansible, Puppet, Chef, SaltStack

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

** partial support

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)

Fibre Channel
FCF F-Port
FC Zoning
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 S9999 components are EU RoHS compliant

IT Lifecycle Services for Networking

Experts, insights and ease
Our highly trained experts, with innovative tools and proven processes, help you transform your IT investments into strategic advantages.

Plan & Design
Let us analyze your multivendor environment and deliver a comprehensive report and action plan to build upon the existing network and improve performance.

Deploy & Integrate
Get new wired or wireless network technology installed and configured with ProDeploy. Reduce costs, save time, and get up and running fast.

Educate
Ensure your staff builds the right skills for long-term success. Get certified on Dell EMC Networking technology and learn how to increase performance and optimize infrastructure.

Manage & Support
Gain access to technical experts and quickly resolve multivendor networking challenges with ProSupport. Spend less time resolving network issues and more time innovating.

Optimize
Maximize performance for dynamic IT environments with Dell EMC Optimize. Benefit from in-depth predictive analysis, remote monitoring and a dedicated systems analyst for your network.

Retire
We can help you resell or retire excess hardware while meeting local regulatory guidelines and acting in an environmentally responsible way.

Learn more at
DellEMC.com/Services

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