PLURIBUS NETWORKS

Freedom Server-Switch Datasheet

Overview

The Pluribus Freedom architecture presents a unique combination of switch, compute, storage and bare-metal hypervisor OS technologies, and is designed to accelerate the integration of services and applications into the network.

At the heart of the Freedom platform is the Netvisor® OS, the industry's first and only distributed network operating system with hypervisor bare-metal virtualization capabilities of computing resources - CPU, memory, and storage - and merchant silicon switch chip. Unleashing the full power of the Netvisor OS is the novel Freedom Server-Switch architecture, which includes a powerful server platform, combined with a high-density 10/40 GbE merchant silicon switch and network processor.

In the Freedom architecture, the network switch becomes a true extension of the server. Merchant silicon chips are fully integrated into the operating system, controlled and virtualized like a NIC, and used as an offload/HW acceleration engine for application flows and network functions. The network switch is managed by a server-class control plane through multiple10Gbps high-speed connections, thus unleashing a new class of services and functions to run directly "inside" the network, such as the ability to run scalable monitoring and analytics for "physical" and "virtual" (tunneled) flows, free of taps and external monitoring gear.

The Freedom platform brings full bare metal control and visibility into the network through powerful, Unix-style API to deliver true inNetwork™ Application Programmability, inNetwork virtualization, inNetwork analytics and inNetwork automation. DevOps and NetOps now have an open architecture to program, virtualize and automate the network exactly like a server, with bare-metal performance efficiency, availability and security.

Technology Highlights of the Freedom Architecture

1. Bare-metal compute and network programmability for L4-L7 applications and services to advance true bare metal SDN/NFV/and transport-aware applications. Customers in fields such as financial HFT, CDN, big data, cloud and real-time messaging infrastructure are building a new breed of transport-aware applications.

2. The ability to operate physical and virtual infrastructure without the need to run separate underlay-overlay networks, dramatically simplifying operations and reducing the time to deploy new applications with "wire-once and re-wire virtually" technology.

3. By leveraging HPC cluster-style technology, Netvisor creates a fully automated and distributed fabric-cluster with the following advantages:

    a. Applications and services deployed on top of the cluster have fabric-wide visibility without the complexity of having to understand the network topology.

    b. Any node in the cluster has the same view of the network and offers a single point of management with no single point of failure.

    c. The clustering technology allows SDN-centralized controllers to overcome their intrinsic scalability limitations by allowing controllers to interact only with one node while the cluster hides the physical fabric topology.

4. Fabric-wide analytics - You can monitor up to hundreds of millions of flows in real time, with the option of up to 6.4 TB of Fusion IO storage, or keep historical logging with no performance penalty, including the ability to correlate host-network analytics, with VM granularity for any traffic including VXLAN tunnels. The network does not require separate specialized network gear for monitoring activity.

5. Fabric-wide flow programmability with bare-metal performance and scale - Monitor, intercept, re-route, or drop any flow across the fabric without the need to understand the physical topology or the exact route of the flow through the network.

6. Elastic provisioning of virtual services with bare metal performance - The Freedom Server-Switch platform is an ideal point in the rack to consolidate and virtualize orchestration services, for example, Red Hat Openstack™ or VMware vCenter™ Server/vSphere®, as well as network services such as DHCP, PXE, DNS, SLB, Argus auditing software, Wireshark, and others. Pluribus is actively engaged with L4-L7 services partners to bring more services on the Freedom Server-Switch platform in future releases.

Pluribus Networks Netvisor 2.0

Pluribus Networks Netvisor is available in three different packages that allow you to customize the features that you want to implement on your network.

1. **Advanced Software Defined Fabric (ASDF)** contains advanced virtualization services, advanced fabric features, Analytics, logging, and the features included in Software Defined Fabric and IP Services.

2. **Software Defined Fabric (SDF)** includes advanced fabric-cluster automation, real-time monitoring and analytics, integrated network orchestration controllers, and fabric services. Also included are the features available in IP Services.

3. **IP Services (IPS)** includes enterprise Layer 2 and Layer 3 switching features including IPv4 and IPv6 routing as well as multicast, AAA, QoS, and ACLs.

Learn more by downloading Pluribus Networks white papers at
http://www.pluribusnetworks.com/products.

Features by Software Package

The following table lists the specific features available in each software package.

Table 1 - Features by Software Package

Features	ASDF	SDF	IPS
Advanced Virtualization and Fabric Clustering			
Virtual Networks	√		
Netvisor Machines (KVM and FreeBSD)	√		
Advanced Storage Protocols (iSCSI, NFS, Mirror, RAID, CIFS)	√		
vRouter (Static Routers, RIP, OSPF, BGP)	√		
Fabric Cluster	√	√	
Fabric-wide Analytics	√	√	
VXLANS	√	√	
VXLAN central MAC Learning	√	√	
VTEP (VXLAN Gateway)	√	√	
Layer 2 Features			
MAC address caching and ARP pruning	√	√	
Layer 2 Switch Ports	√	√	√
VLAN Encapsulation 802.1Q	√	√	√
Spanning Tree Protocol (STP) 802.1d	√	√	√
Rapid Spanning Tree Protocol 802.1W*	√	√	√
Multiple Spanning Tree (MST) 802.1s*	√	√	√
STP Port Fast	√	√	√
STP BPDU Guard	√	√	√
STP PVST	√	√	√
LLDP 802.1AB	√	√	√
Jumbo Frames (9216 bytes)	√	√	√
Layer 3 IPv4 and IPv6 Features			
Routing Protocols (Static, RIP, OSPF, BGP)	√	√	√
Virtual Router Redundancy Protocol (VRRP)*	√	√	√
IEEE 802.3ad Link Aggregation and Link Aggregation Control Protocol (LACP)	√	√	√
Multi-Chassis Link Aggregation			
VLAG Multi-Chassis Link Aggregation (flow-based bridged or routed multicast/ unicast traffic)	√	√	
High Availability Cluster	√	√	
Data Center Bridging			
Edge Virtual Bridging (IEEE 802.1Qbg)	√	√	
Data Center Bridging eXchange Protocol (DCBX)*	√	√	
Priority Flow Control (802.1Qbb)*	√	√	
Enhanced Transmission Selection (ETS) – IEEE 802.1Qaz*	√	√	
Quantized Congestion Management (QCN) – IEEE 802.1Qau*	√	√	
Multicast			
Internet Group Management Protocol (IGMP) and IGMP Snooping v1 and v2	√	√	√
Protocol Independent Multicast (PIM) Source Specific Mode (PIM-SSM)	√	√	√
Protocol Independent Multicast (PIM) Dense Mode (PIM-DM)	√	√	√
Protocol Independent Multicast (PIM) Sparse Mode (PIM-SM)*	√	√	√
Distance Vector Multicast Routing Protocol (DVRMP)*	√	√	√
Multicast Source Directory Protocol (MSDP)*	√	√	√

Features	ASDF	SDF	IPS
Quality of Service (QoS)			
vFlow-based QoS Classification Layers 2, 3, 4	√	√	
Guaranteed Bandwidth with the built-in network processor up to 40Gbps (F64 platform only)	√	√	
Lossless traffic classes with the built-in network processor and up to 2G ultra deep queuing (F64 platform only)	√	√	
Strict priority queuing (LLQ), smoothed deficit round robin (SDWRR), weighted random early detection (WRED), weighted tail drop*	√	√	√
Layer 2 802.1p Class of Service (CoS)	√	√	√
Differentiated Services Code Point (DSCP)	√	√	√
Security and ACLs			
Root Login	√		
vFLow-based ingress and egress filters – allow and deny, port filters, VLAN filters, routed filters	√	√	
TACACS+	√	√	√
SSH v1 and v2	√	√	√
Layer 2 ACLs – source and destination MAC, VLAN and or EtherType-based	√	√	√
Layer 3 ACLs – source and destination IP/mask, protocol and TCP/UDP port-	√	√	√
Storm control, port error disable, and auto-recovery	√	√	√
Control Plane Denial of Service (DoS) protection	√	√	√
Static Address Resolution Protocol	√	√	√
Filter Actions – logging, system, reject, mirror to an interface, counters assign forwarding class, permit, drop, police, mark	√	√	√
Secure Socket Layer (SSL)	√	√	√
Management			
Secure File Transfer Protocol (SFTP) server	√	√	√
SNMP v1, v2, v3	√	√	√
Telnet	√	√	√
Syslog	√	√	√
Enhanced SNMP MIB Support	√	√	√
Role-based Access Management (RBAC)	√	√	√
Traffic Mirroring			
Port Mirror to local virtual machine and storage	√		
Application flow-based mirror	√	√	
Port Mirror to remote destination (SPAN)	√	√	√
Statistics			
Optional Fusion IO Storage (F64 platform only)	√		
Port	√	√	
Application-based connections	√	√	
Fabric	√	√	
vFlow	√	√	
sFlow	√	√	√
Precision Timing			
Precision Time Protocol (PTP) version 2 (IEEE 1588-2008): Transparent Clock and Boundary Clock modes	√		
Optional PCIe GPS time receiver (F64 platform only)	√		

*Available in future software releases

Table 2 - Services by Software Package

Services	ASDF	SDF	IPS
Advanced Virtualization and Fabric Clustering			
API Programming with C and Java	√		
InNetwork™ Wireshark, tShark (tcpdump)	√		
InNetwork™ Argus	√		
Virtual Resource Groups (VRGs)	**Per VNET**		
Built-in OpenFlow Controller	**Per VNET**	√	
DHCP	**Per VNET**	√	
DNS	**Per VNET**	√	
NAT	**Per VNET**	√	
Load Balancing	**Per VNET**	√	
PXE	**Per VNET**	√	
Built-in OpenStack Controller (Folsom, Grizzly, and Havana)	√	√	
Red Hat Certified for Red Hat Enterprise Linux OpenStack Platform (RHOSP)	√	√	

Table 3 - Netvisor OS Licensing

Software Product ID	Description
F-IPS-NVOS2.0	Freedom F-Series IP Services License for Netvisor 2.x
F-SDF-NVOS2.0	Freedom F-Series Software Defined Fabric License for Netvisor 2.x
F-ASDF-NVOS2.0	Freedom F-Series Advanced Software Defined Fabric License for Netvisor 2.x
E-IPS-NVOS2.0	Freedom E-Series IP Services License for Netvisor 2.x
E-SDF-NVOS2.0	Freedom E-Series Software Defined Fabric License for Netvisor 2.x
F-IPSUPSDF-NVOS2.0	Freedom F-Series Upgrade License from IPS to SDF for Netvisor 2.x
F-IPSUPASDF-NVOS2.0	Freedom F-Series Upgrade License from IPS to ASDF for Netvisor 2.x
F-SDFUPASDF-NVOS2.0	Freedom Line Upgrade License from SDF to ASDF for Netvisor 2.x F-Series
E-IPSUPSDF-NVOS2.0	Freedom E-Series Upgrade License from IPS to SDF for Netvisor 2.0

Pluribus Freedom Platform Delivers on the Promise of Open Networking

The Pluribus Networks Freedom platform, completely based on merchant silicon hardware and open networking protocols, promises Enterprise and Service Provider customers an open, programmable platform with a cloud and virtualization architecture plus freedom from proprietary devices.

You can select from four levels of the Freedom server-switch to match the needs of your specific network:

- E68-M offers an entry level into the Freedom product line server-switch with advanced fabric-cluster features and automation.
- F64-M offers a 2U server-class single socket with fabric-wide analytics and underlay virtualization.
- F64-L offers a high performance control plane for highly virtualized large scale Layer 2 and Layer 3 networks and fabric services.
- F64-XL offers high performance for Layer 4 through Layer 7 applications and advanced storage options.

The Freedom Server-Switch Product Line

The Freedom architecture, combining the industry's only network hypervisor with the server-switch architecture, entirely based on merchant silicon and open L2/L3 protocols, is designed to unify DevOps and NetOps automation to drive ultimate network simplification and ease of management.

The Freedom product line has a revolutionary design using a switch component, and a server component connected by a fast PCIe bus, to create a Freedom server-switch.

The Pluribus Networks Freedom Series offers the industry's first cloud underlay technology. The Pluribus Freedom Series is available in a compact one-rack-unit (1RU) or 2RU form factor, and runs the industry leading Netvisor® hypervisor, which provides you with cloud underlay, virtualization, multi-tenancy, L2-L7 services features and functions that are widely deployed in the Data Center.

The Pluribus Networks Freedom Series server-switch is an environment-friendly solution reducing operational expenses. Variable-speed fans dynamically adjust their speed based on ambient temperature top optimize operating power. With a maximum power consumption of 1100 W, the Pluribus Networks Freedom Series server-switch can consolidate up to 4 kW of load balancer, router, and security appliances otherwise required.

Key Features of the Freedom Server-Switch Product Line

The Pluribus Networks Freedom line server-switch provides the following key features:

- Line-rate Layer 2 and 3 switching on all 10 Gigabit Ethernet ports and 40 Gigabit ports.
- Ultra-low latency - The Pluribus Networks Freedom Line server-switch delivers ultra-low latency of 300 nanoseconds independent of packet size for Layer 2 and Layer 3 traffic in cut-through mode and is ideally suited for HPC and latency-sensitive applications.
- The Pluribus Networks server-switch provides Layer 2 and 3 switching of up to 1.2 terabits per second (Tbps) and 960 Mpps of switching capacity to sustain line-rate capacity with full performance for Layer 2 and Layer 3 traffic, with the option to operate in either cut-through or store-and-forward mode.
- High availability - The Pluribus Networks Freedom Line server-switch is designed with robust high availability features that include redundant power supplies and fan modules to ensure hardware availability. Control plane and data plane separation, combined with the Pluribus Networks nvOS® distributed network operating system, ensures maximum systems level availability.
- Precision Time Protocol (PTP; IEEE 1588) provides accurate clock synchronization and improved data correlation with network captures and system events.

The Freedom Line Portfolio

The Freedom line is available in four different configurations designed to meet your networking needs.

Table 4 - The Freedom Server-Switch Capabilities

Capability	E68-M	F-64M	F-64-L	F-64-XL[1]	F64-FL1T-SDF[1]
Processors	1 Xeon E3-1265L (4C)	1 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)
Memory	16GB	32GB	64GB	256GB	128GB
Internal Storage[2]	2 x 120GB SSD	2 x120GB SSD	2 x120GB SSD	2x 300GB SSD	2x 120GB SSD
Additional Storage	N/A	Optional	Optional	2 x1TB HDD	825GB FusionIO
CPU-Switch Chip Ethernet Band-width	4 x 1GE	2 x 10GE + 20G PCIe	2 x 10GE + 20G PCIe	4 x 10GE + 20G PCIe	4 x 10GE + 20G PCIe
Number of PCIe Slots	N/A	6 (ASDF Required)	6 (ASDF Required)	6 (ASDF Required)	6 (ASDF Required)
Advanced QoS/2GB Buffering via NPU	N/A	N/A	Yes (up to 100G)	Yes (up to 100G)	Yes (up to 100G)
Networking Chip	Broadcom Trident 2	Intel FM6000	Intel FM6000	Intel FM6000	Intel FM6000
Ethernet Ports	44 x 10G/1G + 6 x 40G	48 x 10G/1G + 4 x40G	48 x 10G/1G + 4 x 40G	48 x 10G/1G + 4 x 40G	48 x 10G/1G + 4 x 40G
Power Supplies	2 x 650W	2 x 1100W	2 x 1100W	2 x 1100W	2 x 1100W

[1] Available in a future release

[2] Fusion IO available for custom configuration

Hardware Components

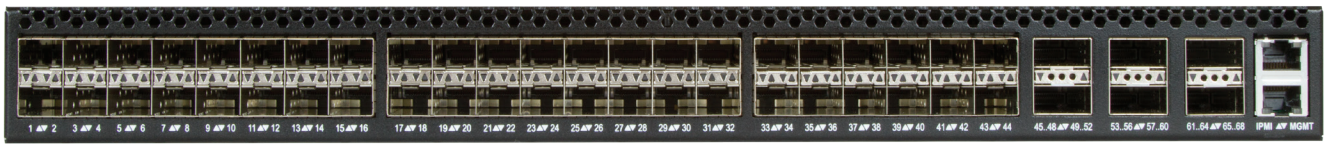


Figure 1 - The E68-M Freedom Rear Panel

Figure 2 - The E68-M Freedom Front Panel

Figure 3 - The F64 Freedom Front Panel

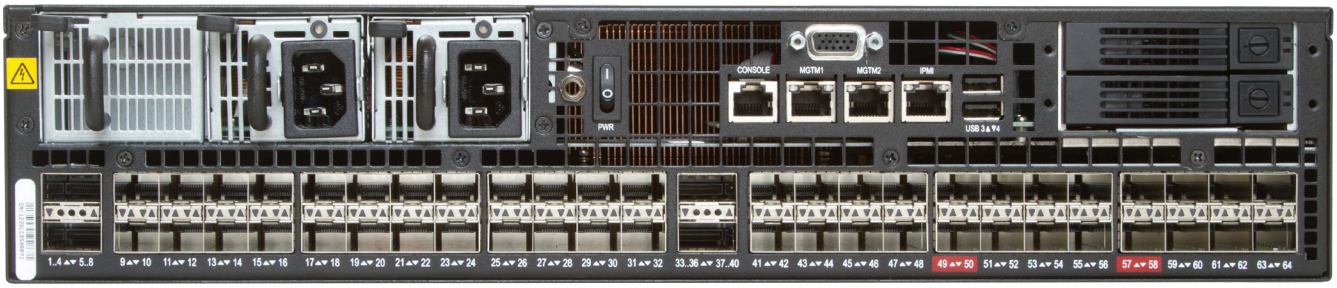


Figure 4 - The F64 Freedom Rear Panel

Table 5 - Network Hardware and Software Scalability

Features	F-Series	E-Series
Forwarding Rate	1 Bpps Line rate on L2 and L3 on all ports 64 ports	1 Bpps Line rate on L2 and L3 on all 68 ports
Latency	350 ns	480 ns
Max MAC Addresses (Hardware Cache)*	64,000	288,000
Spanning Tree Instances	256	256
Spanning Tree Protocol (STP):	Multiple Spanning Tree (MST) instances: 64* Per VLAN Spanning Tree Protocol (PVSTP) instances: 256	Multiple Spanning Tree (MST) instances: 64* Per VLAN Spanning Tree Protocol (PVSTP) instances: 256
VLANs	4095 active 4092 user configurable	4095 active 4092 user configurable
VXLAN IDs	16,000,000	16,000,000
Max IPv4 Host Routes	64,000	16,000
Max IPv4 Unicast Rou	64,000 shared with host routes	16,000
Max IPv4 Multicast Routes	20,000	8,000 shared with host routes
Max IPv6 Host Routes*	32,000	8,000
Max IPv6 Unicast Routes*	32,000	4,000
IGMP groups	36,000	8,000
ACL Entries	20,000	4,000 ingress / 1,000 egress
Packet Buffer	9MB shared	12MB shared
Network Processor Queuing Memory	2GB (L and XL models)	N/A
Hardware Queues (QoS)	8	8
Link Aggregation Groups	64	64
Ports per IEEE 802.3ad LAG	16	16
Multicast groups	36,000	8,000
Jumbo frames	9,216 byte	9,216 byte
Traffic mirroring	Mirroring destination ports per switch: 4 Maximum number of mirroring sessions: 4 Hardware Flow-based analytic probes: 16,000	Mirroring destination ports per switch: 4 Maximum number of mirroring sessions: 4

Table 6 - Mechanical and Environmental Specifications

Attribute	F64 Series	E68 Series
Width	17.3 in (43.9 cm)	17 in (43.2 cm)
Height	3.47 in (8.8 cm) 2 RU	1.7 in (4.4 cm) (1RU)
Depth	29.2 in (74.2 cm)	22 in (55.9 cm)
Weight	55 lb (25 kg)	30 lb (13.6 kg)
Cooling	• Front to back airflow • Redundant, hotswappable fans	• Front to back airflow • Redundant, hotswappable fans
Power Supplies	2x1100W	2x650W
Maximum Power Draw	1200W	840W
Rack Mount Options	4 post EIA cabinets perforated or solid wall	4 post EIA cabinets perforated or solid wall
Operating Temperature	32 to 104°F (0 to 40°C)	32 to 104°F (0 to 40°C)
Operating Altitude Range	0 to 10,000 ft (0 to 3050 m	0 to 10,000 ft (0 to 3050 m
Relative Humidity Operating	10% to 85% (noncondensing)	10% to 85% (noncondensing)
Relative Humidity Nonoperating	5% to 95% (noncondensing)	5% to 95% (noncondensing)
Storage Temperature	-40 to 158°F (-40 to 70°C)	-40 to 158°F (-40 to 70°C)

Attribute	F64 Series	E68 Series
Management	2 Ethernet management ports (10/100/1000,RJ-45), IPMI, console, VGA, and 4 USB ports	1 Ethernet management port (10/100/1000,RJ-45), IPMI, console, VGA, and 2 USB ports

Table 7 - Regulatory Standards Compliance

Specification	Description
EMC Emissions	• FCC 47CFR, Part 15 Class A (2009) USA Radiated Emissions • EN 55022 Class A (2006) +A1 2007 European Radiated Emissions • VCCI Class A (2007) Japanese Radiated Emissions • BSMI CNS 13438 and NCC C6357 Taiwan Radiated Emissions • AS/NZS CISPR22:2009
RoHS	• RoHS 5 compliant except for lead press-fit connectors
Power	• Gold Power Supply Efficiency
Safety	• CAN/CSA-C22.2 No. 60950-1 (2007) Information Technology Equipment – Safety • UL 60950-1 (2nd Ed.) Information Technology Equipment – Safety • EN 60950-1 (2005) Information Technology Equipment – Safety • IEC 60950-1 (2005) Information Technology Equipment – Safety (all country deviations): CB Scheme report • EN 60825-1 +A1+A2 (1994) Safety of Laser Products – Part 1: Equipment Classification

Freedom Series Deployment Scenarios

The Freedom Series of Server-Switches can be inserted into leaf-spine architectures with three different roles in the network:

1. As a TOR device providing L2/L3 switching, as well as network services and NAS storage for the entire rack. Multiple Server-Switches can be clustered to offer a single point of management and fabric-wide services, such as Analytics (see Figure 5)
2. Both as a TOR and as an aggregation (spine) switch for the POD (see Figure 6). In this configuration the spine switch is ideally suited to provide services to the entire POD, which can leverage either E68-M or F64 TOR server-switches.
3. The Freedom Server-Switches can also be deployed as server appliances with high-density 10G ports (see Figure 7). In this configuration the Server-Switches can offer monitoring/analytics services for the entire POD, and to run additional network and orchestration services network services including DHCP, PXE, DNS, NAS storage, Red Hat OpenStack controller and VMware orchestration software suite in a KVM container.

Entirely relying on merchant silicon and traditional L2/L3 protocols, the Freedom Server-Switches can interoperate with any traditional network while running its clustering algorithms over TCP/IP and virtual networking functionalities.

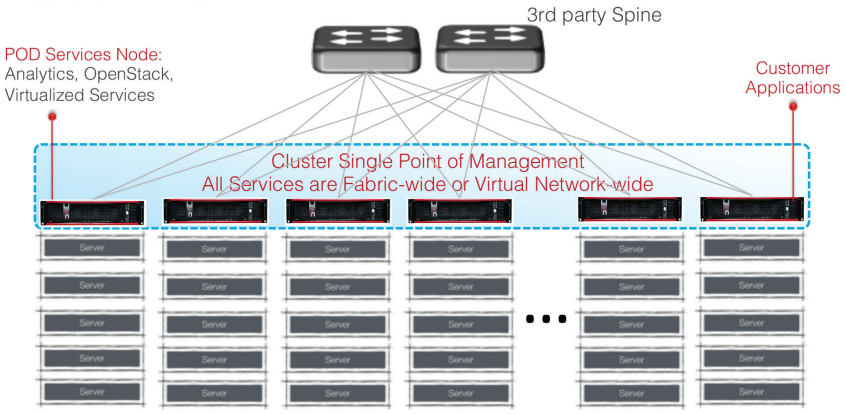


Figure 5 - Greenfield TOR

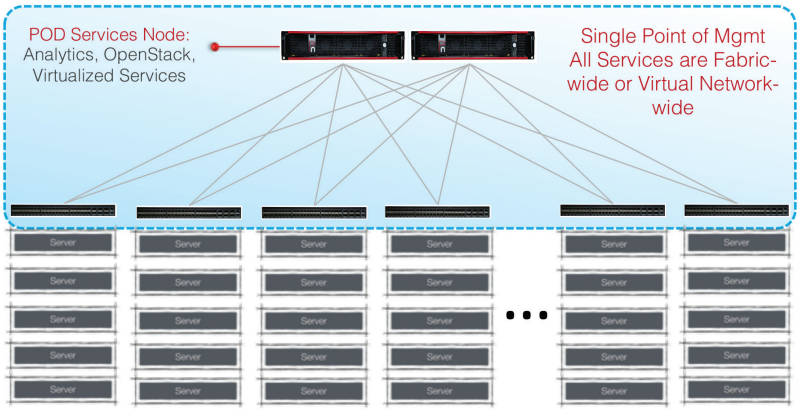


Figure 6 - Greenfield TOR and Spine

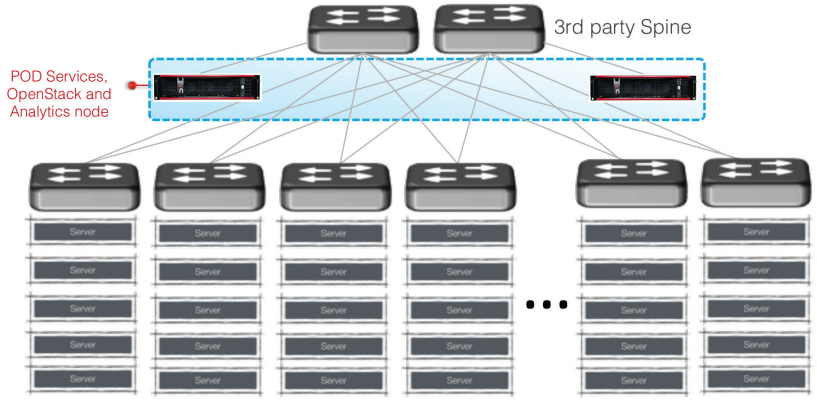


Figure 7 - Brownfield POD Deployment

Supported IEEE Standards

- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1W: Rapid Spanning Tree Protocol
- IEEE 802.1p: CoS Prioritization
- IEEE 802.1Q: VLAN Tagging
- IEEE 802.3z: Gigabit Ethernet
- IEEE 802.3ad: Link Aggregation Control Protocol (LACP)
- IEEE 802.3ae: 10 Gigabit Ethernet
- IEEE 802.3ba: 40 Gigabit Ethernet
- IEEE 802.1ab: LLDP
- IEEE 1588-2008: Precision Time Protocol (Boundary Clock)
- IEEE 802.1: 802.1Qbb - Priority-based Flow Control
- IEEE 802.1Qaz - Enhanced Transmission Selection
- IEEE 802.1: 802.1Qau - Congestion Notification
- 802.1Qbg - Edge Virtual Bridging

Supported RFC

- RFC 1997: BGP Communities Attribute
- RFC 2385: Protection of BGP Sessions with the TCP MD5 Signature Option
- RFC 2439: BGP Route Flap Damping
- RFC 2519: A Framework for Inter-Domain Route Aggregation
- RFC 2545: Use of BGPv4 Multiprotocol Extensions
- RFC 2858: Multiprotocol Extensions for BGPv4
- RFC 3065: Autonomous System Confederations for BGP
- RFC 3392: Capabilities Advertisement with BGPv4
- RFC 4271: BGPv4
- RFC 4273: BGPv4 MIB: Definitions of Managed Objects for BGPv4
- RFC 4456: BGP Route Reflection
- RFC 4486: Subcodes for BGP Cease Notification Message
- RFC 4724: Graceful Restart Mechanism for BGP
- RFC 4893: BGP Support for Four-Octet AS Number Space
- RFC 2328: OSPF Version 2
- RFC 3101: OSPF Not-So-Stubby-Area (NSSA) Option
- RFC 3137: OSPF Stub Router Advertisement
- RFC 3509: Alternative Implementations of OSPF Area Border Routers
- RFC 3623: Graceful OSPF Restart
- RFC 1724: RIPv2 MIB Extension
- RFC 2082: RIPv2 MD5 Authentication
- RFC 2453: RIP Version 2
- RFC 768: User Datagram Protocol (UDP)
- RFC 783: Trivial File Transfer Protocol (TFTP)
- RFC 791: IP
- RFC 792: Internet Control Message Protocol (ICMP)
- RFC 793: TCP
- RFC 826: ARP
- RFC 854: Telnet
- RFC 959: FTP
- RFC 951, 1542 BootP
- RFC 1305: Network Time Protocol (NTP) Version 3
- RFC 1519: Classless Interdomain Routing (CIDR)
- RFC 1542: BootP Relay
- RFC 1591: Domain Name System (DNS) Client
- RFC 1812: IPv4 Routers
- RFC 2236: Internet Group Management Protocol, version 2
- RFC 3376: Internet Group Management Protocol, Version 3
- RFC 3569: An Overview of SSM
- RFC 4607: Source-Specific Multicast for IP

Supported MIBs

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1212, 1213, 1215 MIB-II, Ethernet-like MIB and TRAPs
- RFC 1901 Introduction to Community-based SNMPv2
- RFC 2011 SNMPv2 for Internet Protocol using SMIv2
- RFC 2012 SNMPv2 for Transmission Control Protocol using SMIv2
- RFC 2013 SNMPv2 for User Datagram Protocol using SMIv2
- RFC 2233, The Interfaces Group MIB using SMIv2
- RFC 2287 System Application Packages MIB
- RFC 2570 Introduction to Version 3 of the Internet standard Network Management Framework
- RFC 2571, An Architecture for describing SNMP Management Frameworks (read-only access)
- RFC 2572, Message Processing and Dispatching for the SNMP (read-only access)
- RFC 2576 Coexistence between SNMP Version 1,Version 2, and Version 3
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2580 Conformance Statements for SMIv2
- RFC 2665 Ethernet-like Interface MIB

Transceiver and Cabling Options

The Pluribus Networks Freedom Series supports a wide variety of 1, 10, and 40 Gigabit Ethernet transceiver options.

1 and 10 Gigabit Ethernet connectivity is available on ports 9 – 31, 41-64, and 40 Gigabit Ethernet connectivity is achieved using QSFP+ transceivers in ports 1-4, 5-8, 32-36, 37-40.

For switch-to-switch or server-to-switch cabling, the Pluribus Networks Freedom Series supports SFP+ direct-attach 10 Gigabit Ethernet Copper, for longer cable runs, multimode and single-mode optical SFP+ transceivers are supported.

The Pluribus Networks Freedom Series supports connectivity over copper and fiber cables, providing excellent physical-layer flexibility. For low-cost cabling, copper-based 40-Gbps Twinax cables are available.

Also supported is the ability to create additional 40Gbps ports on the server-switch by aggregating 4 10Gbps ports together. Additional QSFP+ transceivers and cables are needed to create the 40Gbps ports. The following table lists the ports that you can group together on the server-switch to create additional 40 Gbps ports.

Table 8 - Port Mapping for Additional 40 Gbps Ports

New 40 Gbps port	Lane A	Lane B	Lane C	Lane D
12	12	11	10	9
16	16	15	14	13
17	17	18	19	20
22	22	23	24	21
25	25	26	27	28
30	30	29	28	31
42	42	44	46	48
41	41	43	45	47
50	50	52	54	56
49	49	51	53	55

Table 9 - Pluribus Networks Transceiver Power Consumption and Latency

Connector	Media	Distance	Power per Side	Transceiver Latency per Link	Standard
QSFP+ SR4	MM OM2 MM OM3	82m 300m	4W	~0µs	IEEE 802.3ae
QSFP+ CU	Copper Twinax	1,2,3m	Ca. 0.4W	~0.1µs	SFF 8431
QSFP+ AO	Active Fiber Optic	10, 50m	Ca. 0.5W	~6.8ns	SFF 8461
SFP+ SR	MM OM2 MM OM3	82m 300m	4W	~0µs	IEEE 802.3ae
SFP+ CU	Copper Twinax	1, 2, 3m	Ca. 0.4W	~0.1µs	SFF 8431
SFP+ AO	Active Fiber Optic Cable	10, 50m	Ca. 0.5W	~6.8ns	SFF 8461

Ordering Information

Table 10 - Part Numbers and Descriptions

Part No.	Description
Chassis	
E68-M	E68-M (1U) Server-Switch 44x10G SFP+ 4x40G QSFP, Single Xeon E3-class CPU, 2x PSU
F64-XL	F64 (2U) Server-Switch Series with 48x10G SFP+ 4x40G QSFP, 256GB Mem, Dual Xeon E5-class CPU, NPU, Dual SSD 300G, Dual 1TB HDD, 2xPSU, ext. storage option.
F64-L	F64 (2U) Server-Switch Series with 48x10G SFP+ 4x40G QSFP, 64GB Mem, Dual Xeon E5-class CPU, NPU, Dual SSD 120G, 2PSU, ext. storage option
F64-M	F64 (2U) Server-Switch Series with 48x10G SFP+ 4x40G QSFP, 32GB Mem, Single CPU, Dual SSD 120G, 2 xPSU, ext. storage option
Software	
F-IPS-NVOS2.0	Freedom F-Series IP Services License for Netvisor 2.x
F-SDF-NVOS2.0	Freedom F-Series Software Defined Fabric License for Netvisor 2.x
F-ASDF-NVOS2.0	Freedom F-Series Advanced Software Defined Fabric License for Netvisor
E-IPS-NVOS2.0	Freedom E-Series IP Services License for Netvisor 2.x
E-SDF-NVOS2.0	Freedom E-Series Software Defined Fabric License for Netvisor 2.x
F-IPSUPSDF-NVOS2.0	Freedom Line Upgrade License from IPS to SDF for Netvisor 2.x
F-IPSUPASDF-NVOS2.0	Freedom Line Upgrade License from IPS to ASDF for Netvisor 2.x
F-SDFUPASDF-NVOS2.0	Freedom Line Upgrade License from SDF to ASDF for Netvisor 2.x
E-IPSUPSDF-NVOS2.0	Freedom E-Series Upgrade License from IPS to SDF for Netvisor 2.0
Bundles	
E68-M-SDF	E68-M with E-ASDF-NVOS2.0 Fixed Price Bundle, 2 PS
F64-M-ASDF-X2	F64-M with E-ASDF-NVOS2.0 Fixed Price Bundle, 2 PS

Part No.	Description
Accessory and Replacement Kits	
F64-HD1TB	F64 Series 1TB 2.5” Hard Disk Drive
F64-PSU1.1K	F64 Series Power Supply Unit (AC 105-240V 50/60Hz)
F64-FAN	F64 Series Fan Module
F64-ACC	F64 Series Accessory Kit (Rails, Documentation, Setup Cables)
Cables and Transceivers	
SFP-T	1000BASE-T, Transceiver
SFP-SX	GE LC connector SX transceiver (MMF)
SFP-LX	GE LC connector LX/LH transceiver (SMF)
SFP10-SR	SFP+, 10GbE, SR, 850nm Wavelength, 300 Meter, Transceiver
SFP10-LR	SFP+, 10GbE, LR, 1310nm Wavelength, 10 Kilometer, Transceiver
SFP10-CU0P5M	SFP+, 10GbE, Passive Copper Direct Attach, 0.5 Meter, Cable
SFP10-CU1M	SFP+, 10GbE, Passive Copper Direct Attach, 1 Meter, Cable
SFP10-CU2M	SFP+, 10GbE, Passive Copper Direct Attach, 2 Meter, Cable
SFP10-CU3M	SFP+, 10GbE, Passive Copper Direct Attach, 3 Meter, Cable
SFP10-AO3M	SFP+, 10GbE, Active Fiber Optic, 3 Meter, Cable
SFP10-AO5M	SFP+, 10GbE, Active Fiber Optic, 5 Meter, Cable
SFP10-AO7M	SFP+, 10GbE, Active Fiber Optic, 7 Meter, Cable
SFP10-AO10M	SFP+, 10GbE, Active Fiber Optic, 10 Meter, Cable
SFP10-AO20M	SFP+, 10GbE, Active Fiber Optic, 20 Meter, Cable
SFP10-AO20M	SFP+, 10GbE, Active Fiber Optic, 20 Meter, Cable
QSFP40-SR4	QSFP+, 40GbE, SR, 850nm Wavelength, 100 Meter over OM3 MMF or 150
QSFP40-CU0P5M	QSFP, 40GbE Passive Copper Direct Attach, 0.5 Meter, Cable
QSFP40-CU1M	QSFP, 40GbE Passive Copper Direct Attach, 1 Meter, Cable
QSFP40-CU2M	QSFP, 40GbE Passive Copper Direct Attach, 2 Meter, Cable
QSFP40-CU3M	QSFP, 40GbE, Passive Copper Direct Attach, 3 Meter, Cable
QSFP40-AO3M	QSFP, 40GbE, Active Fiber Optic, 3 Meter, Cable
QSFP40-AO5M	QSFP, 40GbE, Active Fiber Optic, 5 Meter, Cable
QSFP40-AO7M	QSFP, 40GbE, Active Fiber Optic, 7 Meter, Cable
QSFP40-AO10M	QSFP, 40GbE, Active Fiber Optic, 10 Meter, Cable
QSFP40-AO20M	QSFP, 40GbE, Active Fiber Optic, 20 Meter, Cable
QSFP10-CU1M	QSFP to 4x SFP+ Passive Copper Splitter, 1 Meter, Cable
QSFP10-CU2M	QSFP to 4x SFP+ Passive Copper Splitter, 2 Meter, Cable
QSFP10-CU3M	QSFP to 4x SFP+ Passive Copper Splitter, 3 Meter, Cable

Power Cord Ordering Information

Table 11 - Power Cord Information

Specification	Description
CAB-NA	AC Power Cord, North America (13A/125V, 10 Feet)
CAB-EU	AC Power Cord, Europe (10A/250V, 2.5 Meter)
CAB-UK	AC Power Cord, United Kingdom (10A/250V, 2.5 Meter)
CAB-IT	AC Power Cord, Italy (10A/250V, 2.5 Meter)
CAB-CH	AC Power Cord, Switzerland (10A/250V, 2.5 Meter)
CAB-JP	AC Power Cord, Japan (10A/250V, 2.5 Meter)
CAB-AU	AC Power Cord, Australia (10A/250V, 2.5 Meter)
CAB-CN	AC Power Cord, China (10A/250V, 2.5 Meter)
CAB-KR	AC Power Cord, Korea (10A/250V, 2.5 Meter)
CAB-BR	AC Power Cord, Brazil (10A/250V, 3 Meter)
CAB-JMPR	Cabinet Jumper Power Cord, C13-C14 Connectors (13A/250VAC, 2.3 Feet)

Warranty

The Pluribus Networks F64 Series switch has a 13-month limited warranty. The warranty includes hardware replacement with a 10-day turnaround from receipt of a return materials authorization (RMA).

Complete the Package

Pluribus Networks is committed to safeguarding your investment by providing a variety of support services that meet your needs and keep your network up and running. To augment our services we have assembled an industry-best team of support professionals who are always at your disposal anywhere in the world, day or night. Due to our commitment to your success, our support team is only comprised of escalation engineers - there is no scripted tier-I 'helpdesk' to slow your progress - you will have direct access to highly skilled Engineers, making this an invaluable addition to your resources and enabling your team to focus on more strategic business initiatives.

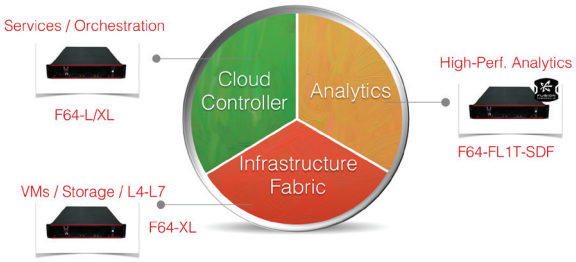
FreedomCare Support Offerings

		Warranty Support	FreedomCare Enterprise	FreedomCare Enterprise NBD	FreedomCare 4-Hour	FreedomCare Premier
Phone Support	Mon-Fri, 8am-5pm US PT	First 90 Days				
	Mon-Fri, 12x5x365	-				
	24x7x365	-	√	√	√	√
Online Self Service	Case Management	First 90 Days	√	√	√	√
	Knowledge Base	First 90 Days	√	√	√	√
	Asset Management	First 90 Days	√	√	√	√
Software Distribu-tion	Major Feature Release	-	√	√	√	√
	Maintenance & Patch Release	√	√	√	√	√
Hardware Replace-ment	DOA Policy[1]	√	√	√	√	√
	RMA Service Level	Return for Repair[2]	Return for Repair[2]	Next Business Day[3]	4-Hours[4]	Next Business Day[3]
Premier Services	Designated Support Engineer	-	-	-		√
	Quarterly Business Reviews	-	-	-		√
	On-Site Network Audit	-	-	-		√

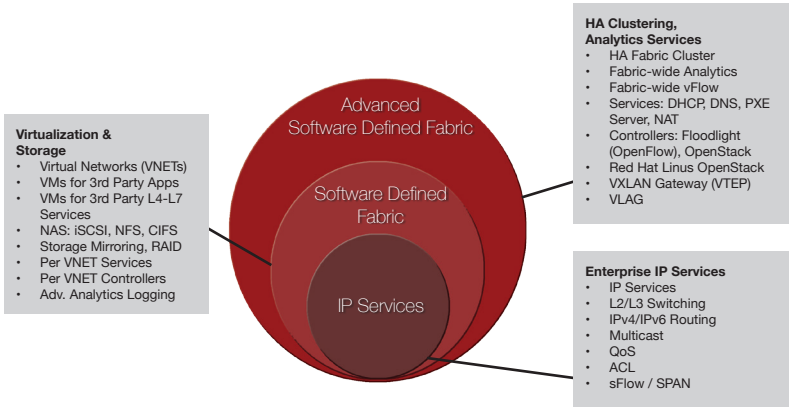
Services Program Notes

[1] 30 days from receiving the product, the replacement product ships next business day after Pluribus Networks confirms the product is DOA.
[2] Product ships 10 days after Pluribus Networks receipt of the RMA'ed hardware.
[3] Next business day hardware replacement is not available in all countries. Please consult with your reseller or Pluribus Networks Account Representative to confirm availability.
[4] Discounted, multi-year support contracts exist for 2, 3, 4 and 5-year FreedomCare support offerings. Please consult with your reseller or your Pluribus Networks Account Representative to obtain the most current pricing for each service offering.

For more information, please visit www.pluribusnetworks.com.
All features subject to change without prior notice.



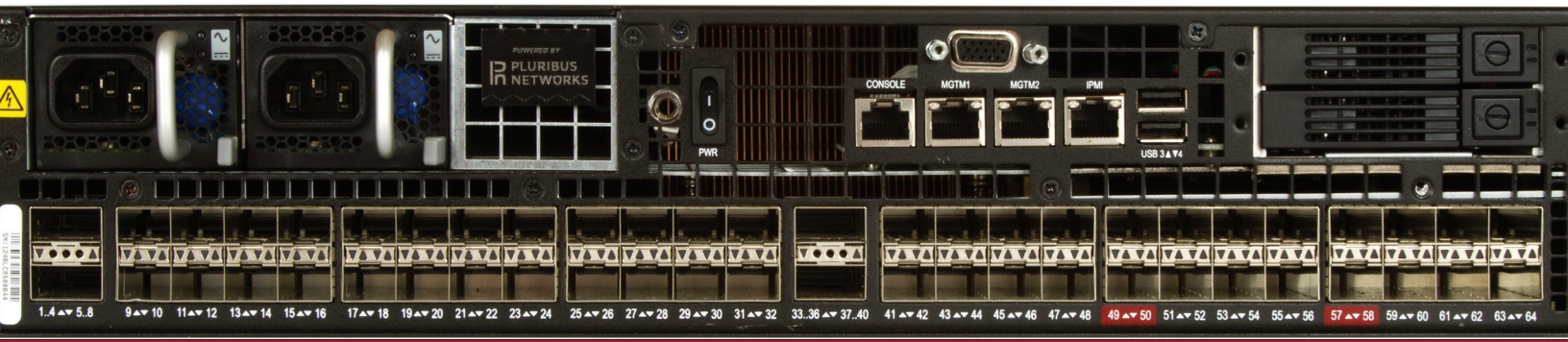
Pluribus Applications



NetvisorOS Options

	E68-M	F64M	F64L	F64XL[1]	F64-FL1T-SDF[1]
Processors	1 Xeon E3-1265L (4C)	1 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)	2 Xeon E5-2620 (6C)
Memory	16GB	32GB	64GB	256GB	128GB
Internal Storage[2]	2 x 120GB SSD	2 x120GB SSD	2 x120GB SSD	2x 300GB SSD	2x 120GB SSD
Additional Storage	N/A	Optional	Optional	2 x1TB HDD	825GB FusionIO
CPU-Switch Chip Ethernet	4 x 1GE	2 x 10GE + 20G	2 x 10GE + 20G	4 x 10GE + 20G	4 x 10GE + 20G PCIe
Number of PCIe Slots	N/A	6 (ASDF Required)	6 (ASDF Required)	6 (ASDF Required)	6 (ASDF Required)
Advanced QoS/2GB Buffering	N/A	N/A	Yes (up to 100G)	Yes (up to 100G)	Yes (up to 100G)
Networking Chip	Broadcom Trident 2	Intel FM6000	Intel FM6000	Intel FM6000	Intel FM6000
Ethernet Ports	44 x 10G/1G + 6 x 40G	48 x 10G/1G + 4 x40G	48 x 10G/1G + 4 x 40G	48 x 10G/1G + 4 x 40G	48 x 10G/1G + 4 x 40G
Power Supplies	2 x 650W	2 x 1100W	2 x 1100W	2 x 1100W	2 x 1100W

[1] Available in a future release
[2] Fusion IO available for custom configuration



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