

Cisco NX-OS: Industry Leading Data Center Operating System



Product overview

The Cisco NX-OS Software advantage

Cisco NX-OS Software is an extensible, open, and programmable network operating system, the fulcrum of networking solutions for next-generation data centers and cloud networks. It is the industry's most deployed data center operating system, based on a highly resilient, Linux-based software architecture, from its very foundation built to enable the most performance-demanding cloud environments. Cisco NX-OS runs on Cisco Nexus data center and storage networking switches.

The Cisco NX-OS Network operating system's key capabilities include the following:



Extensive programmability:

- Day-zero automation through Power On Auto Provisioning, drastically reducing provisioning time
- Industry-leading integrations for leading DevOps configuration-management applications, including Ansible, Chef, Puppet, and SaltStack
- Extensive Native YANG and industry-standard OpenConfig model support through RESTCONF/NETCONF and gRPC
- Pervasive APIs for all-switch CLI functions with NX-API (JSON-based RPC over HTTP/HTTPS)
- Comprehensive software development kit for custom Cisco NX-OS applications with NX-SDK on Python, Go, and C++
- Modular and secure application integration architecture, with support for Secure LXC and Docker application hosting options natively in Cisco NX-OS

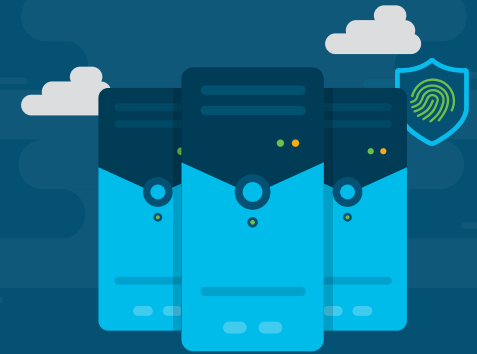


Pervasive visibility:

- Network-software state is exposed through a comprehensive publish/subscribe centralized database (DME) accessible through gRPC/Protobufs, http/JSON, and YANG-state streaming
- Cloud-scale ASICs enable flow-state awareness and granular subsecond access to utilization metrics for microburst awareness and queue occupancy for large-scale RDMA over Converged Ethernet (RoCE) storage environments
- Advanced buffer monitoring reports real-time buffer use per port and per queue, which allows organizations to monitor traffic bursts and application traffic patterns
- Network traffic monitoring with Cisco Nexus® Data Broker builds simple, scalable, and cost-effective network Test Access Points (TAPs) and Cisco® Switched Port Analyzer (SPAN) aggregation for network traffic monitoring and analysis



Cisco NX-OS: Industry Leading Data Center Operating System



Highly available:

- Enables network high availability through a network operating system with support for hitless zero-packet-loss upgrade of Cisco NX-OS (ISSU) architected using seamless switchover between Cisco NX-OS LXC containers
- Fast reload of network platforms for upgrade, with stateless process restart with minimal impact to the control and data plane
- Graceful insertion and removal allows devices to be seamlessly removed from and reinserted into the network during maintenance operations
- All processes support stateful process restart and are patchable through RPMs or software maintenance upgrade packages through Cisco NX-OS CLI or Linux workflows



Architectural flexibility:

- Industry-leading support for standards-based VXLAN EVPN fabrics, inclusive of hierarchical multisite support
- Three-tier BGP architectures, enabling horizontal, nonblocking IPv6 network fabrics at webscale
- Segment routing allows the network to forward Multiprotocol Label Switching (MPLS) packets and engineer traffic without Resource Reservation Protocol (RSVP) Traffic Engineering (TE). It provides a control-plane alternative for increased network scalability and virtualization
- Comprehensive protocol support for Layer 3 (v4/v6) unicast and multicast routing protocol suites, including BGP, Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Information Protocol Version 2 (RIPv2), Protocol Independent Multicast Sparse Mode (PIM-SM), Source-Specific Multicast (SSM), and Multicast Source Discovery Protocol (MSDP)



Network modeling:

- N9Kv (Virtual NX-OS) extends automation and operational models for DevOps and NetOps integration, with images based on VMware, KVM, and Fusion
- Extensive support for N9Kv is available through Virtual Internet and Routing Lab (Cisco VIRL) and Cisco Modeling Labs (CML). Not available on Azure at this time

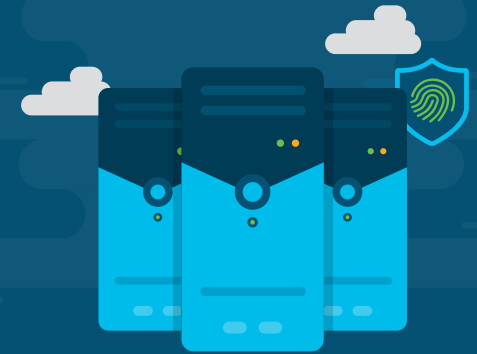


Closed-loop automation:

- Data Center Network Manager (DCNM) 11 is the network management platform for all Cisco NX-OS-enabled deployments, spanning new fabric architectures, IP Fabric for media, and storage networking deployments for the Cisco Nexus-powered data center
- Accelerate provisioning from days to minutes and simplify deployments from day zero through day N
- Reduce troubleshooting cycles with graphical operational visibility for topology, network fabric, and infrastructure
- Eliminate configuration errors and automate ongoing changes in a closed loop, with templated deployment models and configuration compliance alerting with automatic remediation
- Real-time health summary for fabric, devices, and topology
- Correlated visibility for fabric (underlay and overlay, and virtual and physical endpoints), including compute visualization with VMware



Cisco NX-OS: Industry Leading Data Center Operating System



Cloud-scale platform-enhanced buffering, forwarding, security and scale:

- Wire-rate Layer 2 and 3 switching on all ports
- Flexible forwarding tables support up to 1 million shared entries on FX2 models and up to 2 million shared entries on FX models. Flexible use of TCAM space and profiles allows for customized definition of scale profiles depending on your deployment needs
- IEEE 802.1ae MAC Security (MACsec) support with speeds greater than or equal to 10 Gbps allows traffic encryption at the physical layer and provides secure server, border leaf, and leaf-to-spine connectivity
- Platform offers lossless transport for RDMA over Converged Ethernet (RoCE) with support of Data Center Bridging (DCB) protocols:
 - Priority-based Flow Control (PFC) prevents drops in the network and pauses frame propagation per priority class
 - Enhanced Transmission Selection (ETS) reserves bandwidth per priority class in network contention situations
 - Data Center Bridging Exchange Protocol (DCBX) discovers and exchanges priority and bandwidth information with endpoints
 - Explicit Congestion Notification (ECN) provides end-to-end notification per IP flow by marking packets that experienced congestion without dropping traffic. The platform is capable of tracking ECN statistics on the number of marked packets that have experienced congestion
 - Fiber Channel and Fibre Channel over Ethernet (FCoE) N-Port Virtualization (NPV) enables LAN and SAN converged networks on a lossless, reliable ethernet network



Cisco Tetration™ platform support:

- The telemetry information from the Cisco Nexus 9300 Series Switches is exported every 100 milliseconds by default directly from the switch's Application-Specific Integrated Circuit (ASIC). This information consists of three types of data: (a) flow information, which contains information about endpoints, protocols, ports, when the flow started, how long the flow was active, etc.; (b) information on inter-packet variations, which captures any inter-packet variations within the flow (examples include variation in Time To Live (TTL), IP and TCP flags, payload length, etc.); and (c) context information, which is derived outside the packet header and includes variations in buffer utilization, packet drops within a flow, association with tunnel endpoints, etc.

The Cisco Tetration platform consumes this telemetry data and, by using unsupervised machine learning and behavior analysis, can provide outstanding pervasive visibility across everything in your data center in real time. By using algorithmic approaches, the Cisco Tetration platform provides deep application insights and interactions, enabling dramatically simplified operations, a zero-trust model, and migration of applications to any programmable infrastructure. To learn more, go to <https://www.cisco.com/go/tetration>.



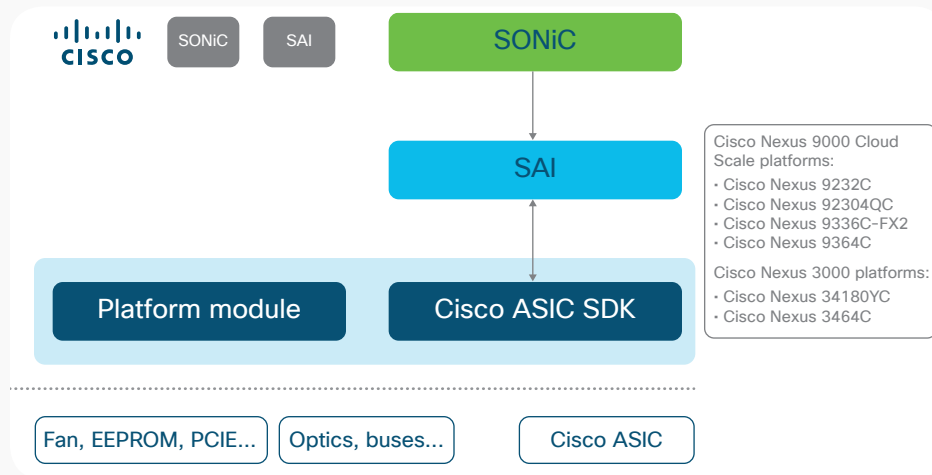
Cisco NX-OS: Industry Leading Data Center Operating System



Cisco Nexus flexible consumption options

Some of the largest web-scale customers require the flexibility to run their own operating system, and Cisco Nexus support for the SAI industry standard hardware abstraction interface (Figure 1) enables open integration of operating systems like Sonic for our platforms. This open integration for our industry leading Cisco Nexus 9300 Cloud Scale and Cisco Nexus 3400 platforms allows customers the freedom to run the network operating system of their choice on our SAI-ready Cisco Nexus platforms.

Figure 1. Cisco Nexus SAI architecture



Cisco Nexus 9000 switches support both Cisco NX-OS mode and Cisco ACI™ mode. Organizations can use Cisco NX-OS Software to deploy the switches in standard Cisco Nexus Switch environments (when using Cisco NX-OS mode). For intent-driven architecture with centralized turnkey automation and policy-based application profiles, the Cisco Application Centric Infrastructure (Cisco ACI) provides full advantage of an automated, policy-based, system-management approach (when using Cisco ACI mode).

Cisco Nexus 9300 Switches

The Cisco Nexus 9300 belongs to the fixed Cisco Nexus 9000 Series Switches based on Cisco Cloud Scale technology. The platform supports cost-effective cloud-scale deployments, an increased number of endpoints, and cloud services with wire-rate security and telemetry. The platform is built on modern system architecture designed to provide high performance and meet the evolving needs of highly scalable data centers and growing enterprises.

These switches offer a variety of interface options to transparently migrate existing data centers from speeds of 100 Mbps, 1 Gbps, and 10 Gbps to 25 Gbps at the server, and from speeds of 10 and 40 Gbps to 50 Gbps, 100 Gbps, and 400 Gbps at the aggregation layer. The platform provides investment protection for customers, delivering large buffers, highly flexible Layer 2 and Layer 3 scalability, and performance to meet the changing needs of virtualized data centers and automated cloud environments. The Cisco Nexus 9300-GX Switches are the next generation of fixed Cisco Nexus 9000 Series Switches. The platform introduces a fully backward-compatible 400G optical interface Quad Small Form-Factor Pluggable-Double Density (QSFP-DD) to transparently migrate existing data center fabrics from speeds of 40 Gbps and 100 Gbps to 400 Gbps.

Cisco Nexus 9300 Switches deployed in the Cisco ACI mode support Network Assurance Engine (NAE). NAE continuously verifies if the network infrastructure is operating as per policy intent; it leverages the power of mathematical models to reason on behalf of the operator in policy, configuration, and dynamic state level. NAE can precisely indicate problems in the network, identify which application or part of a network is impacted, root-cause the problem, and suggest how to fix it. Its continuous verification approach transforms Day 2 Operations from reactive to proactive mode and does so without using any packet data. NAE helps avoid outages by predicting the impact of changes, reducing network-related IT incidents, and shrinking the mean time to repair by up to 66 percent. NAE also helps ensure network security and segmentation compliance. To learn more about NAE, visit <https://www.cisco.com/c/en/us/products/data-center-analytics/network-assurance-engine/index.html>.



Cisco NX-OS: Industry Leading Data Center Operating System



Cisco Nexus 9300 Switch models

The Cisco Nexus 9300 Switches offer industry-leading density and performance with flexible port configurations that can support existing copper and fiber cabling (Tables 1, 2).

Table 1. Cisco Nexus 9300 Switch access platform specifications

Feature	100M/1GT	100M/1/10GT	1/10/25G SFP28	
	Cisco Nexus 9348GC-FXP	Cisco Nexus 93108TC-FX	Cisco Nexus 93180YC-FX	Cisco Nexus 93240YC-FX2
Ports	48 x 1-GBASE-T ports, 4 x 10/25-Gbps SFP28 ports and 2 x 40/100 QSFP28 ports	48 x 10GBASE-T and 6 x 40/100-Gbps QSFP28 ports	48 x 10/25-Gbps and 6 x 40/100-Gbps QSFP28 ports	48 x 1/10/25-Gbps and 12 x 40/100-Gbps QSFP28 ports
CPU	4 cores	4 cores	6 cores	4 cores
System memory	24 GB	24 GB	24 GB	16 GB
SSD drive	128 GB	128 GB	128 GB	128 GB
System buffer	40 MB	40 MB	40 MB	40 MB
Management ports	2 ports: 1 RJ-45 and 1 SFP+	2 ports: 1 RJ-45 and 1 SFP+	1 RJ-45 port (L1 and L2 ports are unused)	2 ports: 1 RJ-45 and 1 SFP+
USB ports	1	1	1	1
RS-232 serial ports	1	1	1	1
Power supplies (up to 2)	350W AC, 440W DC	500W AC, 930W DC, or 1200W HVAC/HVDC	500W AC, 930W DC, or 1200W HVAC/HVDC	1100W AC, 1100W DC
Typical power (AC/DC)*	178W	276W	260W	298W
Maximum power (AC/DC)*	287W	460W	425W	708W
Fans	3	4	4	5
Airflow	Port-side intake and exhaust	Port-side intake and exhaust	Port-side intake and exhaust	Port-side intake and exhaust
Physical dimensions (H x W x D)	1.72 x 17.3 x 19.7 in. (4.4 x 43.9 x 49.9 cm)	1.72 x 17.3 x 22.5 in. (4.4 x 43.9 x 57.1 cm)	1.72 x 17.3 x 22.5 in. (4.4 x 43.9 x 57.1 cm)	2.1 x 17.3 x 23.3 in. (5.3 x 43.9 x 59.1 cm)

* Typical and maximum power values are based on input drawn from the power circuit. The power supply value (for example, 500W AC power supply: NXA-PAC-500W-PI) is based on the output rating to the inside of the switch.



Cisco NX-OS: Industry Leading Data Center Operating System



Table 2. Cisco Nexus 9300 Switch high-density platform specifications

Feature	40/100G		40/100/400G	
	Cisco Nexus 9336C-FX2	Cisco Nexus 9364C	Cisco Nexus 93600CD-GX	Cisco Nexus 9316D-GX
Ports	36 x 40/100-Gbps QSFP28 ports	64 x 40/100-Gbps QSFP28 ports and 2 x 1/10-Gbps SFP ports	28 x 40/100-Gbps QSFP28 ports and 8 x 40/100/400-Gbps QSFP-DD ports	16 x 40/100/400-Gbps QSFP-DD ports
CPU	4 cores	4 cores	4 cores	4 cores
System memory	24 GB	32 GB	24 GB	32 GB
SSD drive	128 GB	128 GB	128 GB	128 GB
System buffer	40 MB	40 MB	80 MB	80 MB
Management ports	2 ports: 1 RJ-45 and 1 SFP+	2 ports: 1 RJ-45 and 1 SFP+	2 ports: 1 RJ-45 and 1 SFP+	2 ports: 1 RJ-45 and 1 SFP+
USB ports	1	1	1	1
RS-232 serial ports	1	1	1	1
Power supplies (up to 2)	1100W AC, 1100W DC, 1100W HVAC/HVDC	1200W AC, 930W DC ¹ or 1200W HVAC/HVDC	1100W AC, 1100W DC, 1100W HVAC/HVDC	1100W AC, 1100W DC, 1100W HVAC/HVDC
Typical power (AC)	367W	429W	590W	650W
Maximum power (AC)	777W	1245W		
Fans	3 dual fan trays	5	6	6
Airflow	Port-side intake and exhaust	Port-side intake and exhaust	Port-side intake and exhaust	Port-side intake and exhaust
Physical dimensions (H x W x D)	1.72 x 17.3 x 24.5 in. (4.4 x 43.9 x 62.3 cm)	3.38 x 17.37 x 22.27 in. (8.59 x 44.13 x 56.58 cm)	1.72 x 17.37 x 25.5 in. (4.37 x 44.13 x 64.8 cm)	3.38 x 17.37 x 22.27 in. (8.59 x 44.13 x 56.58 cm)

¹930W-DC PSU is supported in redundancy mode if 3.5W QSFP+ modules or Passive QSFP cables are used and the system is used in 40°C ambient temperature or less; for other optics or higher ambient temperatures, 930W-DC is supported with 2 PSU's in nonredundancy mode only.



Cisco NX-OS: Industry Leading Data Center Operating System



Specifications

Table 3 lists the performance and scalability specifications for the Cisco Nexus 9300 Switches. (Check the software release notes for feature support information.)

Table 3. Hardware performance and scalability specifications*

Item	Cisco Nexus 9300-FX Series	Cisco Nexus 9300-FX2 Series	Cisco Nexus 9364C Switch
Maximum number of Longest Prefix Match (LPM) routes**	1,792,000	896,000	262,000
Maximum number of IP host entries**	1,792,000	896,000	262,000
Maximum number of MAC address entries**	512,000	256,000	92,000
Maximum number of multicast routes	32,000	32,000	32,000
Number of Interior Gateway Management Protocol (IGMP) snooping groups	Shipping: 8,000 Maximum: 32,000	Shipping: 8,000 Maximum: 32,000	Shipping: 8,000 Maximum: 32,000
Maximum number of Cisco Nexus 2000 Series Fabric Extenders per switch	16	16	NA
Maximum number of Access Control List (ACL) entries	Single-slice forwarding engine: 5000 ingress 2000 egress	Per slice of the forwarding engine: 5000 ingress 2000 egress	Per slice of the forwarding engine: 4000 ingress 2000 egress
Maximum number of VLANs	3,967	3,967	3,967
Number of Virtual Routing and Forwarding (VRF) instances	Shipping: 1,000 Maximum: 16,000	Shipping: 1,000 Maximum: 16,000	Shipping: 1,000 Maximum: 16,000



Cisco NX-OS: Industry Leading Data Center Operating System



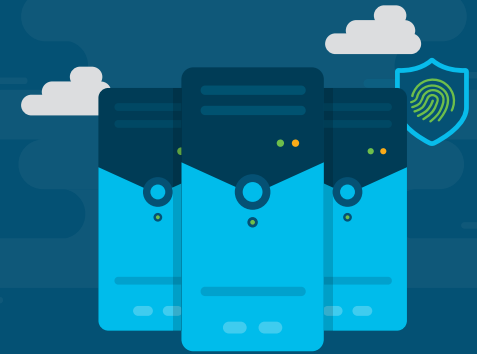
Item	Cisco Nexus 9300-FX Series	Cisco Nexus 9300-FX2 Series	Cisco Nexus 9364C Switch
Maximum number of ECMP paths	64	64	64
Maximum number of port channels	512	512	1,024
Maximum number of links in a port channel	32	32	32
Number of active SPAN sessions	4	4	4
Maximum number of VLAN's in Rapid Per-VLAN Spanning Tree (RPVST) instances	3,967	3,967	3,967
Maximum number of Hot-Standby Router Protocol (HSRP) groups	490	490	490
Number of Network Address Translation (NAT) entries	1,023	1,023	1,023
Maximum number of Multiple Spanning Tree (MST) instances	64	64	64
Flow-table size used for Cisco Tetration platform	32,000	64,000	-

* More templates and greater scalability are on the roadmap. Refer to the [Cisco Nexus 9000 Series Verified Scalability Guide](#) documentation for the latest exact scalability values validated for specific software.

** Raw capacity of flow table.



Cisco NX-OS: Industry Leading Data Center Operating System



Service and support

Cisco offers a range of professional, solution, and product support services for each stage of your Cisco Nexus 9000 platform deployment:

- Cisco Data Center Quick Start Service for Cisco Nexus 9000 Series Switches: This offering provides consulting services that include technical advice and assistance to help deploy Cisco Nexus 9000 Series Switches
- Cisco Data Center Accelerated Deployment Service for Cisco Nexus 9000 Series Switches: This service delivers planning, design, and implementation expertise to bring your project into production. The service also provides recommended next steps, an architectural high-level design, and operation-readiness guidelines to scale the implementation to your environment
- Cisco Migration Service for Cisco Nexus 9000 Series Switches: This service helps you migrate from Cisco Catalyst® 6000 Series Switches to Cisco Nexus 9000 Series Switches
- Cisco Product Support: Support service is available globally 24 hours a day, 7 days a week, for Cisco software and hardware products and technologies associated with Cisco Nexus 9000 Series Switches. Enhanced support options delivered by Cisco also include solution support for Cisco ACI, Cisco SMARTnet™ Service, and Cisco Smart Net Total Care® service

For more information, visit <https://www.cisco.com/go/services>.

For more information

For more information about the Cisco Nexus 9000 Series and latest software release information and recommendations, visit <https://www.cisco.com/go/nexus9000>.

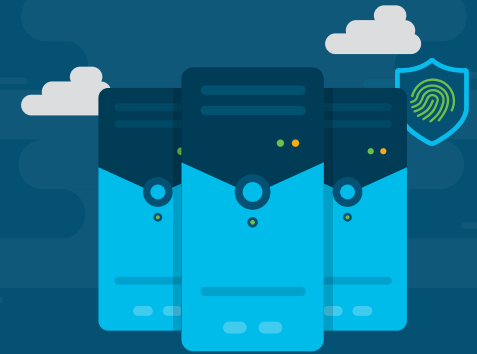
Cisco Nexus 3000 Switches

Based on industry-leading merchant silicon elements, Cisco Nexus 3000 has a comprehensive portfolio of fixed switches. The Cisco Nexus 34180YC and 3464C programmable switches are high-speed, low-power, high-density fixed data center switches. The Cisco Nexus 3400-S is the first 400G programmable switch series in the Cisco Nexus 3000 portfolio with 50 Gbps PAM4 Serial-Deserializers (SerDes), and is designed for data centers with industry-leading performance-per-watt power efficiency at low latency and offers leading analytics. The main benefits of the Cisco Nexus 3400-S switches are as follows:

- With the 12.8-Tbps ASIC, the Cisco Nexus 3432D-S provides 32 ports of 400G, allowing customers to grow at scale with fewer numbers of switches in their fabric, simplifying management, and reducing the cost and number of hops. At 400G, the Cisco Nexus 3400-S offers the lowest latency in the industry, of 370 nanoseconds at high-power efficiency
- The Cisco Nexus 3400-S offers a programmable pipeline translated to flexible profiles, whether Longest-Prefix-Matching (LPM)-optimized or Layer 3 host-optimized. Customers can choose the profile to match their deployment needs
- The Cisco Nexus 3400-S supports comprehensive encapsulation and tunneling technologies, Virtual Extensible LAN (VXLAN), VXLAN routing, MPLS, Generic Protocol Extension (GPE), and Geneve Network Virtualization using Generic Routing Encapsulation (NVGRE)
- Cisco Nexus 3400-S switches enable deep network analytics, offering per-flow monitoring, queue forensics, and drop-packet forensics to help monitor customer networks



Cisco NX-OS: Industry Leading Data Center Operating System



Switch models

Table 4. Cisco Nexus 3000 Switch specifications

Feature	1/10/25G SFP28	40/100G QSFP28	40/100/400G QSFPDD
	Cisco Nexus 34180YC	Cisco Nexus 3464C	Cisco Nexus 3432D-S
Ports	48 x 10/25-Gbps and 6 x 40/100-Gbps QSFP28 ports	64 x QSFP+/QSFP28 ports and 2 x SFP ports	32 x 40/100/400-Gbps QSFPDD ports and 2 x 100M/1G SFP ports
CPU	4 cores	4 cores	4 cores
System memory	16 GB	16 GB	16 GB
SSD drive	128 GB	128 GB	128 GB
System buffer	20 MB	22 MB	70 MB
Management ports	2 ports: 1 RJ-45 and 1 SFP	2 ports: 1 RJ-45 and 1 SFP	2 ports: 1 RJ-45 and 1 SFP+
USB ports	1	1	1
RS-232 serial ports	1	1	1
Power supplies (up to 2)	500W AC, 930W DC, or 1200W HVAC/HVDC	1200W AC, 930W DC, or 1200W HVAC/HVDC	1100W AC
Typical power (AC/DC)	190W	460W	626W
Maximum power (AC/DC)	350W	1000W	1240W
Fans	4	3	6
Physical dimensions (H x W x D)	1.72 x 17.3 x 22.5 in. (4.4 x 43.9 x 57.1 cm)	3.38 x 17.4 x 22.5 in. (8.6 x 44.1 x 57.1 cm)	1.75 x 17.29 x 25.4 in. (4.44 x 43.91 x 64.51cm)