

Cisco Nexus 6001 Switch

Cisco Nexus 6000 Series Switches Product Overview

In today's data centers, virtualization deployments have become common place, and this trend is increasing rapidly with the availability of 10 Gigabit Ethernet servers at attractive prices. The combination of increased adoption of 10 Gigabit Ethernet servers and applications with higher bandwidth requirements is increasing the need for dense 10 and 40 Gigabit Ethernet switching. Moreover, data center architecture is evolving as customers seek to build large-scale nonblocking fabrics to accommodate different applications, creating patterns of heavy east-west and north-south traffic. Leaf and spine layer designs using high-density and low-latency switches lead to a flatter network architecture, allowing connections scaling from hundreds to 10,000 or more servers with high bidirectional bandwidth, and helping ensure a low-latency fabric with a low hop count.

Cisco Nexus[®] 6000 Series Switches, part of the Cisco[®] Unified Fabric offering, expands architectural flexibility and scalability, enabling agile virtualized and cloud deployments. It runs the industry-leading Cisco NX-OS Software operating system, providing customers with features and capabilities that are widely deployed worldwide.

The new Cisco Nexus 6000 Series provides high 10 and 40 Gigabit Ethernet density in energy-efficient switches with a compact form factor. With a robust integrated Layer 2 and 3 feature set, the Cisco Nexus 6000 Series provides a versatile platform that can be deployed in multiple scenarios to build scalable Cisco Unified Fabric in the data center: direct-attach 10 and 40 Gigabit Ethernet access and high-density fabric extender aggregation deployments, leaf and spine designs, and compact aggregation. Cisco Nexus 6000 Series designs can adapt to increasing bandwidth demands with a low power and compact space profile, saving capital expenditures (CapEx) and operating expenses (OpEx).

Cisco Nexus 6000 Series products use the same set of Cisco ASICs and a single software image across the product family, thereby offering feature consistency and operation simplicity. Cisco Nexus 6000 Series Switches support robust Layer 2 and 3 functions, industry-leading fabric extender architecture with Cisco Nexus 2000 Series Fabric Extenders and Cisco Nexus B22 Blade Fabric Extender, In-Service Software Upgrade (ISSU), and Cisco FabricPath. Operation efficiency and programmability are enhanced on the Cisco Nexus 6000 Series through advanced analytics, power-on autoprovisioning, and Python and TCL scripting. In addition, the hardware is capable of supporting the Cisco Open Network Environment Platform Kit (onePK).

Cisco Nexus 6001 Switch Product Overview

The Cisco Nexus 6001 Switch is an important component of the Cisco Unified Data Center architecture, complementing the existing Cisco Nexus Family switches. The Cisco Nexus 6001 extends the industry-leading innovations and versatility of the Cisco Nexus 5000 Series Switches, which are purpose-built 10 Gigabit Ethernet data center-class switches. The Cisco Nexus 6001 is an energy-efficient switch that offers high port density in one rack unit (1RU), supports 10 and 40 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE), provides integrated Layer 2 and 3 features at wire speed, and offers low latency of approximately 1 microsecond for any packet size. With a choice of front-to-back and back-to-front airflow options, the switch is designed for a broad range of traditional data center and large-scale virtualized cloud deployments.

The Cisco Nexus 6001 is a 1RU 10 and 40 Gigabit Ethernet switch offering wire-speed performance for up to sixty-four 10 Gigabit Ethernet ports (using Quad Small Form-Factor Pluggable [QSFP] breakout cables) for Ethernet and FCoE traffic, with an overall throughput of 1.28 terabits per second (Tbps). The Cisco Nexus 6001 offers 48 fixed 10 Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) ports and four 40 Gigabit Ethernet QSFP+ ports. Each 40 Gigabit Ethernet port can be split into four 10 Gigabit Ethernet ports using a QSFP breakout cable. The Cisco Nexus 6001 delivers low port-to-port latency of approximately 1 microsecond and low jitter independent of packet size using cut-through switching architecture and with features enabled.

The Cisco Nexus 6001 can be deployed in multiple scenarios - direct-attach 10 and 40 Gigabit Ethernet server-access and high-density fabric extender aggregation deployments, leaf and spine designs, and compact aggregation - to build scalable Cisco Unified Fabric across a diverse set of physical and virtual server environments in the data center.

The Cisco Nexus 6001 (Figure 1), part of the Cisco Nexus 6000 Series Switches, is a top-of-rack (ToR) switch.

Figure 1. Cisco Nexus 6001 Switch



Cisco Nexus 6001 Transceiver and Cabling Options

The Cisco Nexus 6001 supports a wide variety of 1, 10, and 40 Gigabit Ethernet connectivity options. Table 1 lists the transceivers supported for 1 and 10 Gigabit Ethernet connectivity, and Table 2 lists the 40 Gigabit Ethernet QSFP+ transceivers supported.

Table 1. Cisco Nexus 6001 1 and 10 Gigabit Ethernet SFP+ Transceiver Support Matrix

Cisco SFP	Description
FET-10G	10-Gbps SFP+ module for Cisco Nexus 2000 Series to Cisco Nexus 5000 Series connectivity
Cisco SFP-10G-SR	10GBASE-SR SFP+ module (multimode fiber [MMF])
Cisco SFP-10G-LR	10GBASE-LR SFP+ module (single-mode fiber [SMF])
Cisco SFP-10G-ER	10GBASE-ER-SFP+ module (SMF)
Cisco SFP-H10GB-CU1M	10GBASE-CU SFP+ cable 1m (Twinax cable)
Cisco SFP-H10GB-CU3M	10GBASE-CU SFP+ cable 3m (Twinax cable)
Cisco SFP-H10GB-CU5M	10GBASE-CU SFP+ cable 5m (Twinax cable)
Cisco SFP-H10GB-ACU7M	10GBASE-CU SFP+ cable 7m (active Twinax cable)
Cisco SFP-H10GB-ACU10M	10GBASE-CU SFP+ cable 10m (active Twinax cable)
Cisco GLC-T	1000BASE-T SFP
GLC-ZX-SM	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, dual LC/PC connector
Cisco GLC-SX-MM	Gigabit Ethernet SFP, LC connector SX transceiver (MMF)
Cisco GLC-SX-MMD	Gigabit Ethernet SFP, LC connector SX transceiver (MMF), extended temperature range and digital optical monitoring (DOM)
Cisco GLC-LH-SM	Gigabit Ethernet SFP, LC connector LX/LH transceiver (SMF)
Cisco GLC-LH-SMD	Gigabit Ethernet SFP, LC connector LX/LH transceiver (SMF), extended temperature range and digital optical monitoring (DOM)
Cisco SFP-GE-T	1000BASE-T SFP, extended temperature range

Cisco SFP	Description
Cisco SFP-GE-S	Gigabit Ethernet SFP, LC connector SX transceiver (MMF), extended temperature range and digital optical monitoring (DOM)
Cisco SFP-GE-L	Gigabit Ethernet SFP, LC connector LX/LH transceiver (SMF), extended temperature range and DOM

Table 2. Cisco Nexus 6001 40 Gigabit Ethernet QSFP+ Transceiver Support Matrix

Cisco SFP	Description
QSFP-40G-SR4	40GBASE-SR4 QSFP module, (multi-mode fiber, MMF at 100m)
QSFP-40G-CSR4	40GBASE Extended CSR4 QSFP module, (multi-mode fiber, MMF at 300m)
QSFP-4x10G-AC7M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 7-meter, active
QSFP-4x10G-AC10M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 10-meter, active
QSFP-H40G-CU1M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 1-meter, passive
QSFP-H40G-CU3M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 3-meter, passive
QSFP-H40G-CU5M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 5-meter, passive
QSFP-H40G-ACU7M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 7-meter, active
QSFP-H40G-ACU10M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 10-meter, active

The platform supports an innovative Twinax copper cabling solution that connects to standard QSFP connectors for in-rack use, and optical cabling for longer cable runs (Table 3).

- For in-rack or adjacent-rack cabling, the Cisco Nexus 6001 supports QSFP+ direct-attach 40 Gigabit Ethernet copper cables, an innovative solution that integrates transceivers with Twinax cables into an energy-efficient, low-cost, and low-latency solution. QSFP+ direct-attach 40 Gigabit Twinax copper cables use only 1.5 watt (W) of power per transceiver and introduce approximately 0.1 microsecond of latency per link.
- For longer cable runs, the Cisco Nexus 6001 supports multimode, short-reach optical QSFP transceivers. These optical transceivers use approximately 1.5W per transceiver and have a latency of approximately 0.1 microsecond.

Table 3. Cisco Nexus 6001 Cabling Support Matrix

Connector (Media)	Cable	Distance	Maximum Power Consumption	Transceiver Latency
QSFP CU copper	Twinax	1m 3m 5m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP ACU copper	Active Twinax	7m 10m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP SR4 MMF	MMF (OM3) MMF (OM4)	100m 150m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP CSR4 MMF	MMF (OM3) MMF (OM4)	300m 400m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP LR4 SMF	SMF	10 km	Approximately 3.5W	Approximately 0.1 microsecond

Features and Benefits

The comprehensive feature sets of the Cisco Nexus 6001 platform make it well suited to meet the challenging demands of virtualized and cloud-based deployments. The Cisco Nexus 6001 is designed with the Cisco high-performance ASICs and is an excellent switch for integrating and connecting a virtual environment to the high-performance servers in the data center. The Cisco Nexus 6001 is excellent for ToR deployments such as direct-attach 10 Gigabit Ethernet server-access and fabric extender aggregation deployments and leaf and spine designs to build scalable Cisco Unified Fabric in data centers. This platform can be deployed in the middle of the row (MoR; in server racks) or at the end of the row (EoR; in network racks) in the data center.

The Cisco Nexus 6001 provides investment protection by allowing the same ports to be used as either Ethernet or FCoE. The switch also provides a high-density option in a 1RU form factor for ToR, MoR, and EoR deployment options. The combination of high port density, lossless Ethernet, wire-speed performance, and very low latency makes the switch well suited to meet the growing demands in the data center with a common Ethernet-based fabric in physical and virtual data center deployments. The Cisco Nexus 6001 delivers scalable performance, intelligence, and a broad set of features to address the needs of data center networks.

Here are some of the primary features of the Cisco Nexus 6001:

- **Optimized for virtualization and cloud deployments:** The data center today must meet the demands of virtualization and cloud-based computing. High-performance servers deployed in the cloud can support many more virtual machines and workloads than ever before. The requirement to deploy new servers on demand puts additional strain on the network fabric. The Cisco Nexus 6001 addresses this challenge by providing scalability and performance, making it an excellent platform for meeting current and future needs.
- **Density and resilience:** Built for today's data centers, the switches are designed just like the servers they support. Ports and power connections are at the rear, close to server ports, helping keep cable lengths as short and efficient as possible and delivering to rack servers benefits traditionally offered only on blade servers. Hot-swappable power and fan modules can be accessed from the front panel, where status lights offer an at-a-glance view of switch operation. Front-to-back or back-to-front cooling is consistent with server designs, supporting efficient data center hot- and cold-aisle designs. Serviceability is enhanced with all customer-replaceable units accessible from the front panel.
- **Energy efficiency:** The Cisco Nexus 6001 helps data centers operate within their space, power, and cooling parameters while reducing their carbon footprints. The switch power supplies are also capable of maintaining 90 percent efficiency at load conditions of as low as 25 percent utilization. This capability allows the switch to make efficient use of power while still being appropriately sized to support the conditions of a full system load.
- **Low latency:** The Cisco Nexus 6001 with cut-through switching supports approximately 1 microsecond of port-to-port latency for any packet size with features enabled.
- **Intelligent Cisco Switched Port Analyzer (SPAN) and Encapsulated SPAN (ERSPAN):** SPAN and ERSPAN can be used for troubleshooting and robust monitoring of traffic. The SPAN and ERSPAN capabilities in the Cisco Nexus 6001 are nondisruptive, with only extra bandwidth capacity used for SPAN and ERSPAN traffic. SPAN and ERSPAN traffic is categorized as best effort, and in the event of link congestion, SPAN and ERSPAN traffic is dropped first. Enhancements include more efficient allocation of bandwidth to SPAN and ERSPAN traffic whereby any fabric bandwidth not used for data traffic can be allocated to SPAN or ERSPAN traffic. The switch can support up to 31 line-rate SPAN and ERSPAN sessions.

- Flexible buffer management: The Cisco Nexus 6001 supports a 25-MB packet buffer shared by every 3 ports of 40 Gigabit Ethernet or every 12 ports of 10 Gigabit Ethernet. Of the 25-MB buffer, 16 MB are used for ingress and 9 MB are used for egress buffering. The Cisco Nexus 6001 supports allocation of the buffer as shared or dedicated or shared plus dedicated. The flexible buffer management capability on the Cisco Nexus 6001 allows dynamic tuning of the shared and dedicated buffer size in the event of congestion.
- Multicast enhancements: The Cisco Nexus 6001 supports line-rate Layer 2 and 3 multicast throughput for all frame sizes. The Cisco Nexus 6001 offers optimized multicast replication through the fabric and at the egress point. The large buffers allow absorption of bursty traffic. Support is provided for 32,000 multicast routes and for Internet Group Management Protocol (IGMP) snooping tables. Multicast enhancements include flow-based hashing for multicast traffic over a PortChannel and enhanced Bidirectional Protocol-Independent Multicast (Bidir-PIM) support. The switch also supports IP-based forwarding for IGMP snooping.

Applications

The Cisco Nexus 6001 supports a number of application scenarios, making the switches a versatile data center option.

Fabric Extender Architecture: High-Density Fabric Extender Aggregator

- Cisco Fabric Extender Technology (FEX Technology) enables customers to build a single, modular fabric that extends from Cisco Nexus switches, to Cisco Unified Computing System™ (Cisco UCS®) servers, to adapters (Cisco Adapter FEX), and to virtual machines (Cisco Data Center VM-FEX). The Cisco FEX technology is based on the emerging standard IEEE 802.1br. Designing the network using Cisco FEX technology provides flexibility, reduced cabling infrastructure, and a single point of management, helping customers scale their networks. Cisco Nexus 2200 platform fabric extenders can be single or dual connected (using enhanced virtual PortChannel [vPC+] technology) to two upstream Cisco Nexus 6001 Switches. Servers or end hosts can connect to single or dual Cisco Nexus 2200 platform fabric extenders using network interface card (NIC) teaming when the parent Cisco Nexus 6001 has vPC+ enabled.

Following are some common Cisco Nexus 2000 and 6000 Series deployment options.

- Rack servers with 100 Megabit Ethernet, Gigabit Ethernet, or 10 Gigabit Ethernet NICs; the fabric extender can be physically located at the top of the rack, and the Cisco Nexus 6000 Series Switch can reside in the middle or at the end of the row, or the fabric extender and the Cisco Nexus 6000 Series Switch can both reside in the middle or at the end of the row.
- Mixed Gigabit Ethernet and 10 Gigabit Ethernet environments in which rack servers are running at either speed in the same rack or in adjacent racks.
- 10 Gigabit Ethernet and FCoE deployments using servers with converged network adapters (CNAs) for unified fabric environments with the Cisco Nexus 2232PP 10GE Fabric Extender.
- 1/10GBASE-T server connectivity with ease of migration from 1 to 10GBASE-T and effective reuse of structured cabling.
- Gigabit Ethernet and 10 Gigabit Ethernet blade servers with pass-through blades.
- Low-latency, high-performance computing environments.
- Virtualized access.

In addition to the fabric extender deployment options already mentioned, the Cisco Nexus 6001 with high-density 10 and 40 Gigabit Ethernet support provides unique value as a high-density fabric extender aggregation platform. Some sample scenarios are listed here:

- In conjunction with the Cisco Nexus 2248PQ 10GE Fabric Extender, the Cisco Nexus 6001 can be used as a high-density 10 Gigabit Ethernet switching system, consolidating more than 576 10 Gigabit Ethernet connections in a single management plane.
- In conjunction with the Cisco Nexus 2232PP 10GE Fabric Extender, the Cisco Nexus 6001 can be used as a high-density 10 Gigabit Ethernet switching system, consolidating up to 1536 10 Gigabit Ethernet connections in a single management plane.
- A variety of blade fabric extender options can be aggregated into a Cisco Nexus 6001 using 10 Gigabit Ethernet, providing a single point of management for blade server deployments.
- In conjunction with the Cisco Nexus 2248TP GE Fabric Extender, the Cisco Nexus 6001 can be used as a high-density 1 Gigabit Ethernet switching system, consolidating more than 1152 Gigabit Ethernet connections in a single management plane.

Table 4 lists the fabric extenders that are supported with the Cisco Nexus 6001. Please refer to the Cisco Nexus 2200 platform data sheets and release notes for more information about the products.

Table 4. Supported Fabric Extenders

Fabric Extender	Description
Cisco Nexus 2248PQ	48x 1/10GE SFP+ host interface and 4x 40G (16 x 10G SFP+) network interfaces
Cisco Nexus 2224TP	24x 100/1000BASE-T host interfaces and 2x 10 Gigabit Ethernet fabric interfaces (SFP+)
Cisco Nexus 2248TP	48x 100/1000BASE-T host interfaces and 4x 10 Gigabit Ethernet fabric interfaces (SFP+)
Cisco Nexus 2248TP-E	48x 100/1000BASE-T host interfaces and 4x 10 Gigabit Ethernet fabric interfaces (SFP+; 32 MB shared buffer)
Cisco Nexus 2232PP	32x 1/10 Gigabit Ethernet and FCoE host interfaces (SFP+) and 8x 10 Gigabit Ethernet and FCoE fabric interfaces (SFP+)
Cisco Nexus 2232TM	32x 1/10GBASE-T host interfaces and 8x 10 Gigabit Ethernet (SFP+) uplink modules
Cisco Nexus 2232TM-E	32x 1/10GBASE-T host interfaces and 8x 10 Gigabit Ethernet (SFP+) uplink modules (lower power consumption and improved bit error rate [BER])
Cisco Nexus B22HP	16x 1/10GBASE-KR internal host interfaces and 8x 10 Gigabit Ethernet fabric interfaces (SFP+; network interfaces)
Cisco Nexus B22F	16x 10GBASE-KR internal host interfaces and 8x 10 Gigabit Ethernet fabric interfaces (SFP+; network interfaces)

Large-Scale Fabric (Layer 2 and 3): Leaf and Spine Architecture

Data center designs are evolving, with customers seeking to build large-scale nonblocking fabrics to accommodate different applications, creating patterns of heavy east-west and north-south traffic. The Cisco Nexus 6001 is well suited as a leaf or spine node in a Layer 2 or 3 fabric design. Leaf and spine layer designs using high-density and low-latency switches lead to flatter network architecture, allowing connections scaling from hundreds to more than 10,000 servers with high bidirectional bandwidth, and helping ensure low-latency fabric with a low hop count. The spine switches create a nonblocking, low-latency fabric, forwarding packets between leaves. The leaf switches provide connectivity to servers. Use of a highly meshed architecture helps ensure the highest possible network availability with little impact on customer traffic in the event of a failure. The Cisco Nexus 6001 can be deployed as a Layer 2 or Layer 3 spine or leaf switch, providing a high degree of design flexibility.

Multihop FCoE

Cisco Unified Fabric combines data center and storage networks to deliver a single high-performance, highly available, and scalable network. With the Cisco Nexus 6001, Cisco can support end-to-end data center convergence, from the server to storage, by delivering multihop FCoE capability in the data center. The FCoE capability complements the existing FCoE function on the Cisco Nexus 5500 switch platform. With this broad selection of standards-based FCoE switches, Cisco provides unified fabric support to both the access and core network layers, supporting all storage traffic (FCoE, Small Computer System Interface over IP [iSCSI], and network-attached storage [NAS]) over simplified infrastructure based on lossless 10 and 40 Gigabit Ethernet. The Cisco Nexus 6000 Series Switches are the industry's first to provide 40-Gbps FCoE support, surpassing the 16-Gbps Fibre Channel capability.

High-Performance Computing

The Cisco Nexus 6001 can be deployed as a high-density Small Form-Factor (SFF) access-layer switch to consolidate a large number of 10 Gigabit Ethernet servers in deployments that call for only a small number of hops from the server to the upstream network to reduce latency. The Cisco Nexus 6001 has a high density of 10 Gigabit Ethernet ports per rack unit, approximately 1 microsecond of latency port to port for any packet size, integrated line-rate Layer 2 and 3 features, scalability, and integrated data analytics with programmability. It addresses the needs of high-performance computing (HPC) and high-frequency trading (HFT) environments, for which InfiniBand solutions lack management visibility and high performance of bulk data transfers across traditional applications.

The capability of the Cisco Nexus 6001 to function in all these capacities helps protect investments in the data center with a deployment model in which additional features can be enabled as they are needed.

Cisco NX-OS Software Overview

Cisco NX-OS Software is a purpose-built data center operating system designed for performance, resiliency, scalability, manageability, and programmability. Cisco NX-OS meets Ethernet and storage networking requirements, providing a robust and comprehensive feature set that can meet the demanding requirements of virtualization and automation in present and future data centers. Cisco's enhanced fabric solution allows the transparent integration of the virtual and physical devices on a unified network. In addition, users can use the comprehensive Cisco NX-OS service set to create unique innovations for customized solutions. With its MIBs, native XML interface, and command-line interface (CLI) like that of Cisco IOS[®] Software, Cisco NX-OS provides drastically simplified management for the devices in which it runs.

Cisco NX-OS Software Features and Benefits

- Software compatibility: Cisco NX-OS Software Release 6.0 interoperates with Cisco products running any variant of the Cisco IOS Software operating system. Cisco NX-OS 6.0 also interoperates with any networking OS that conforms to the networking standards listed as supported in this data sheet.
- Common software throughout the data center: Cisco NX-OS simplifies the data center operating environment and provides a unified OS designed to run all areas of the data center network, including the LAN, SAN, and Layer 4 to 7 network services.

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- **Modular software design:** Cisco NX-OS is designed to support distributed multithreaded processing on symmetric multiprocessors (SMPs), multicore CPUs, and distributed line-card processors. Computationally intensive tasks, such as hardware table programming, can be offloaded to dedicated processors distributed across the line cards. Cisco NX-OS modular processes are instantiated on demand, each in a separate protected memory space. Thus, processes are started and system resources allocated only when a feature is enabled. The modular processes are governed by a real-time preemptive scheduler that helps ensure the timely processing of critical functions.
 - **Enhanced virtual PortChannel:** The vPC feature allows one end of a PortChannel to be split across a pair of Cisco Nexus 6000 Series Switches. vPC provides Layer 2 multipathing through the elimination of Spanning Tree Protocol blocked ports in dual-homed connections. vPC enables fully used bisectonal bandwidth and simplified Layer 2 logical topologies without the need to change the existing management and deployment models. The vPC feature has been enhanced so that edge devices can connect to the Cisco Nexus 2000 Series using vPC, and the Cisco Nexus 2000 Series can connect to the Cisco Nexus 6000 Series using vPC at same time.
 - **Cisco FabricPath:** Cisco FabricPath provides the simplicity and fabric efficiency to easily deploy new virtualized services in a cloud-based environment. New virtual and physical servers can be added to the network with the simplicity and mobility of the Layer 2 network without the deficiencies of traditional Spanning Tree Protocol.

Cisco FabricPath is a set of multipath Ethernet technologies that combines the reliability and scalability benefits of Layer 3 routing with the flexibility of Layer 2 networks, enabling IT to build massively scalable data centers. Cisco FabricPath offers a topology-based Layer 2 routing mechanism that provides an equal-cost multipath (ECMP) forwarding model. Cisco FabricPath implements an enhancement that solves the MAC address table scalability problem characteristic of switched Layer 2 networks. Furthermore, Cisco FabricPath supports vPC+, a technology similar to vPC that allows redundant interconnection of the existing Ethernet infrastructure to Cisco FabricPath without using Spanning Tree Protocol. Benefits introduced by the Cisco FabricPath technology include:

- **Operation simplicity:** Cisco FabricPath embeds an autodiscovery mechanism that does not require any additional platform configuration. By offering Layer 2 connectivity, the “VLAN anywhere” characteristic simplifies provisioning and offers workload flexibility across the network.
 - **High resiliency and performance:** Because Cisco FabricPath is a Layer 2 routed protocol, it offers stability, scalability, and optimized resiliency along with network failure containment.
 - **Massively scalable fabric:** By building a forwarding model on 16-way ECMP routing, Cisco FabricPath helps prevent bandwidth bottlenecks and allows organizations to add capacity dynamically, without network disruption.
 - **Multiple-topology support.** Cisco FabricPath supports two distinct topologies that provide VLAN localization and reuse in the network.
- **Automation:** Cisco NX-OS provides the intelligence and flexibility to support device-aware power-on provisioning, enabling transparent autoconfiguration of devices. Users can create custom Python scripts that are specific to their environments.
 - **Programmability:** Cisco NX-OS enables users to innovate using Cisco onePK. Customers can create host-based applications using the comprehensive service set available in Cisco NX-OS.

- **Programmatic XML interface:** Based on the NETCONF industry standard, the Cisco NX-OS XML interface provides a consistent API for devices, enabling rapid development and creation of tools to enhance the network.
- **Simple Network Management Protocol (SNMP):** Cisco NX-OS complies with SNMP Versions 1, 2, and 3. An extensive collection of MIBs is supported.
- **Role-based access control (RBAC):** With RBAC, Cisco NX-OS enables administrators to limit access to switch operations by assigning roles to users. Administrators can customize access and restrict it to the users who require it.

Cisco Prime Data Center Network Manager

Cisco Prime Data Center Network Manager (DCNM) provides LAN and SAN management capabilities for the Cisco Nexus and Cisco MDS 9500 Families. Cisco DCNM provides a GUI that reduces OpEx compared to traditional CLI methods and allows efficient operation control, monitoring, provisioning, and troubleshooting for your Cisco NX-OS devices. The main features include:

- Unified fabric visibility and topology display with VMware vSphere integration shows connectivity from the virtual machine to the VMware ESX host and to the switch and the storage array.
- Event aggregation and filtering helps you quickly find the information you need and identify network problems.
- Deployment wizards and user-modifiable templates help implement best practices.
- RBAC secures devices and provides appropriate delegation.
- Integrated domain dashboards, health monitoring, reporting, change tracking, and user auditing provides comprehensive management capabilities.
- Trend monitoring of ports and traffic allow you to optimize your existing resources and anticipate new resource requirements.

Specifications

Table 5 lists the specifications for the Cisco Nexus 6001. Please check software release notes for feature support information.

Table 5. Product Specifications

Performance
<ul style="list-style-type: none"> • Cisco Nexus 6001: Layer 2 and 3 hardware forwarding at 7.68 Tbps • Support for up to 256,000 combined entries of MAC addresses and APR entries • Low-latency of approximately 1 microsecond using cut-through forwarding for predictable, consistent traffic latency regardless of packet size, traffic pattern, or features enabled on 40 and 10 Gigabit Ethernet interfaces • 25-MB buffer per 3x 40 Gigabit Ethernet QSFP interfaces • Line-rate traffic throughput on all ports
Interfaces
<ul style="list-style-type: none"> • Cisco Nexus 6001: 48 fixed 10 Gigabit Ethernet SFP+ and 4 fixed 40 Gigabit Ethernet QSFP+ ports, with 10 and 40 Gigabit Ethernet FCoE support on all respective ports • 40 Gigabit Ethernet ports can be converted to 10 Gigabit Ethernet interfaces through QSFP breakout cable • Fabric extension through the Cisco Nexus 2200 platform

Layer 2 Features

- Layer 2 switch ports and VLAN trunks
- IEEE 802.1Q VLAN encapsulation
- Support for up to 4000 VLANs
- Support for up to 4000 access control list (ACL) entries
- Rapid Per-VLAN Spanning Tree Plus (PVRST+) (IEEE 802.1w compatible)
- Multiple Spanning Tree Protocol (MSTP) (IEEE 802.1s): 64 instances
- Spanning Tree PortFast
- Spanning Tree root guard
- Spanning Tree Bridge Assurance
- Cisco EtherChannel technology (up to 16 ports per EtherChannel)
- Cisco vPC technology
- vPC configuration synchronization
- Link Aggregation Control Protocol (LACP): IEEE 802.3ad
- Advanced PortChannel hashing based on Layer 2, 3, and 4 information
- Jumbo frames on all ports (up to 9216 bytes)
- Pause frames (IEEE 802.3x)
- Storm control (unicast, multicast, and broadcast)
- Private VLANs
- Private VLAN over trunks (isolated and promiscuous)
- Private VLANs over vPC and EtherChannels
- VLAN remapping
- Cisco FabricPath
- EvPC and vPC+with Cisco FabricPath
- Cisco Adapter FEX
- Cisco Data Center VM-FEX
- Support for up to 24 fabric extenders (Layer 2) with each switch

Layer 3 Features

- Layer 3 interfaces: Routed ports, switch virtual interface (SVI), PortChannels, subinterfaces, and PortChannel subinterfaces
- Support for up to 32,000 IPv4 and 8000 IPv6 host prefixes
- Support for up to 8000 multicast routes (IPv4)
- Support for up to 8000 IGMP snooping groups
- Support for 4000 Virtual Routing and Forwarding (VRF) entries
- Support for up to 4096 VLANs
- Support for VLAN translation (16,000 ingress and 16,000 egress)
- 16-way ECMP
- 4000 flexible ACL entries
- Routing protocols: Static, Routing Information Protocol Version 2 (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First Version 2 (OSPFv2), and Border Gateway Protocol (BGP)
- IPv6 routing protocols: Static, OPFv3, BGPv6, and EIGRPv6
- IPv6 VRF-lite
- Hot-Standby Router Protocol (HSRP) and Virtual Router Redundancy Protocol (VRRP)
- ACL: Routed ACL with Layer 3 and 4 options to match ingress and egress ACL
- Multicast: Protocol Independent Multicast Version 2 (PIMv2) sparse mode, Source-Specific Multicast (SSM), Bidir-PIM, Multicast Source Discovery Protocol (MSDP), IGMPv2 and v3, and Multicast VLAN Registration (MVR)
- VRF: VRF-lite (IP VPN); VRF-aware unicast; and BGP-, OSPF-, RIP-, and VRF-aware multicast
- Unicast Reverse Path Forwarding (uRPF) with ACL; strict and loose modes
- Jumbo frame support (up to 9216 bytes)
- Support for up to 24 fabric extenders on each Cisco Nexus 6001

Quality of Service (QoS)

- Layer 2 IEEE 802.1p (class of service [CoS])
- 8 unicast queues and 8 multicast queues per port
- Per-port QoS configuration
- CoS trust
- Port-based CoS assignment
- Modular QoS CLI (MQC) compliance: IPv4 and IPv6
- ACL-based QoS classification (Layers 2, 3, and 4)
- MQC CoS marking
- Per-port virtual output queuing
- CoS-based egress queuing
- Egress strict-priority queuing
- Egress port-based scheduling: Weighted Round-Robin (WRR)
- Control Plan Policing (CoPP): IPv4 and IPv6

Security

- Ingress ACLs (standard and extended) on Ethernet and virtual Ethernet ports
- Standard and extended Layer 2 ACLs: MAC addresses, protocol type, etc.
- Standard and extended Layer 3 and 4 ACLs: IPv4 and IPv6, Internet Control Message Protocol (ICMP and ICMPv6), TCP, User Datagram Protocol (UDP), etc.
- VLAN-based ACLs (VACLs)
- Port-based ACLs (PACLs)
- Named ACLs
- Optimized ACL distribution
- ACLs on virtual terminals (VTYs)
- ACL logging
- Dynamic Host Configuration Protocol (DHCP) snooping with Option 82
- Dynamic Address Resolution Protocol (ARP) Inspection
- IP source guard
- DHCP relay
- Ethernet Port Security
- IPv6 RAACL, PACL, and VACL

High-Availability Features

- ISSU for Layer 2
- Hot-swappable field-replaceable power supplies, fan modules, and expansion modules
- N+1 and N+N power redundancy
- N:1 fan module redundancy

Management

- Switch management using 10/100/1000-Mbps management or console ports
- CLI-based console to provide detailed out-of-band management
- In-band switch management
- Port-based locator and beacon LEDs
- Configuration synchronization
- Module preprovisioning
- Configuration rollback
- Secure Shell Version 2 (SSHv2)
- Telnet
- Authentication, authorization, and accounting (AAA)
- AAA with RBAC
- RADIUS
- TACACS+
- Syslog (8 servers)
- Embedded packet analyzer
- SNMPv1, v2, and v3 (IPv4 and IPv6)
- Enhanced SNMP MIB support
- XML (NETCONF) support

- Remote monitoring (RMON)
- Advanced Encryption Standard (AES) for management traffic
- Unified username and passwords across CLI and SNMP
- Microsoft Challenge Handshake Authentication Protocol (MS-CHAP)
- Digital certificates for management between switch and RADIUS server
- Cisco Discovery Protocol Versions 1 and 2
- RBAC
- SPAN on physical, PortChannel and VLAN
- ERSPAN
- Ingress and egress packet counters per interface
- Network Time Protocol (NTP)
- Cisco Generic Online Diagnostics (GOLD)
- Comprehensive bootup diagnostic tests
- Cisco Call Home
- Cisco Smart Call Home
- Cisco Fabric Manager
- Cisco DCNM
- CiscoWorks LAN Management Solution (LMS)

Data Center Bridging

- CEE- and IEEE-compliant priority flow control (PFC; per-priority Pause frame support)
- PFC link distance support: 300m
- CEE-compliant Data Center Bridging Exchange (DCBX) Protocol
- CEE- and IEEE-compliant enhanced transmission selection

FCoE Features (Require Storage Services License)

- T11 standards-compliant FCoE (FC-BB-5)
- T11 FCoE Initialization Protocol (FIP) (FC-BB-5)
- Any 10 or 40 Gigabit Ethernet port configurable as FCoE
- SAN administration separate from LAN administration
- Fibre Channel forwarding (FCF)
- Fibre Channel enhanced port types: VE, TE, and VF
- Direct attachment of FCoE targets
- Up to 32 VSANs per switch
- Fabric Device Management Interface (FDML)
- Fibre Channel ID (FCID) persistence
- Distributed device alias services
- In-order delivery
- Port tracking
- Cisco FCoE N-Port Virtualization (NPV) technology
- N-port identifier virtualization (NPIV)
- Fabric services: Name server, registered state change notification (RSCN), login services, and name-server zoning
- Per-VSAN fabric services
- Cisco Fabric Services
- Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) and Fibre Channel Security Protocol (FC-SP)
- Distributed device alias services
- Host-to-switch and switch-to-switch FC-SP authentication
- Fabric Shortest Path First (FSPF)
- Standard zoning
- Enhanced zoning
- Cisco Fabric Analyzer
- Cisco Fabric Manager support
- Storage Management Initiative Specification (SMI-S)
- Boot from SAN over vPC+ and EvPC

- Any 10 Gigabit Ethernet port configurable as FCoE
- SAN administration separate from LAN administration
- Fibre Channel standard port types: E, F, and NP
- Fibre Channel enhanced port types: VE, TE, and VF
- F-port trunking
- F-port channeling
- Direct attachment of FCoE and Fibre Channel targets
- Up to 240 buffer credits per native Fibre Channel port
- Up to 32 VSANs per switch
- Fibre Channel (SAN) PortChannel
- Native Interop Mode 2
- Native Interop Mode 3
- VSAN trunking
- FDMI
- FCID persistence
- Distributed device alias services
- In-order delivery
- Port tracking
- Cisco NPV technology
- NPIV
- Fabric services: Name server, RSCN, login services, and name-server zoning
- Per-VSAN fabric services
- Cisco Fabric Services
- DH-CHAP and FC-SP
- Distributed device alias services
- Host-to-switch and switch-to-switch FC-SP authentication
- FSPF
- Fabric binding for Fibre Channel
- Standard zoning
- Port security
- Domain and port
- Enhanced zoning
- SAN PortChannels
- Cisco Fabric Analyzer
- Fibre Channel traceroute
- Fibre Channel ping
- Fibre Channel debugging
- Cisco Fabric Manager support
- SMI-S
- Boot from SAN over vPC+ and EvPC

SNMP MIBs

Generic MIBs

- SNMPv2-SMI
- CISCO-SMI
- SNMPv2-TM
- SNMPv2-TC
- IANA-ADDRESS-FAMILY-NUMBERS-MIB
- IANAifType-MIB
- IANAiprouteprotocol-MIB
- HCNUM-TC
- CISCO-TC
- SNMPv2-MIB
- SNMP-COMMUNITY-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-NOTIFICATION-MIB
- SNMP-TARGET-MIB

- SNMP-USER-BASED-SM-MIB
- SNMP-VIEW-BASED-ACM-MIB
- CISCO-SNMP-VACM-EXT-MIB

Layer 3 MIBs

- UDP-MIB
- TCP-MIB
- OSPF-MIB
- BGP4-MIB
- CISCO-HSRP-MIB

Ethernet MIBs

- CISCO-VLAN-MEMBERSHIP-MIB
- CISCO-Virtual-Interface-MIB
- CISCO-VTP-MIB

Configuration MIBs

- ENTITY-MIB
- IF-MIB
- CISCO-ENTITY-EXT-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-SENSOR-MIB
- CISCO-FLASH-MIB
- CISCO-SYSTEM-MIB
- CISCO-SYSTEM-EXT-MIB
- CISCO-IP-IF-MIB
- CISCO-IF-EXTENSION-MIB
- CISCO-SERVER-INTERFACE-MIB
- CISCO-NTP-MIB
- CISCO-IMAGE-MIB
- CISCO-IMAGE-CHECK-MIB
- CISCO-IMAGE-UPGRADE-MIB
- CISCO-CONFIG-COPY-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- CISCO-BRIDGE-MIB

Monitoring MIBs

- DIFFSERV-DSCP-TC
- NOTIFICATION-LOG-MIB
- DIFFSERV-MIB
- CISCO-CALLHOME-MIB
- CISCO-SYSLOG-EXT-MIB
- CISCO-PROCESS-MIB
- RMON-MIB
- CISCO-RMON-CONFIG-MIB
- CISCO-HC-ALARM-MIB

Security MIBs

- CISCO-AAA-SERVER-MIB
- CISCO-AAA-SERVER-EXT-MIB
- CISCO-COMMON-ROLES-MIB
- CISCO-COMMON-MGMT-MIB
- CISCO-RADIUS-MIB
- CISCO-SECURE-SHELL-MIB
- TCP/IP MIBs
- INET-ADDRESS-MIB
- TCP-MIB
- CISCO-TCP-MIB
- UDP-MIB

- IP-MIB
- CISCO-IP-PROTOCOL-FILTER-MIB
- CISCO-DNS-CLIENT-MIB
- CISCO-PORTSECURITY- MIB

Miscellaneous MIBs

- START-MIB
- CISCO-LICENSE-MGR-MIB
- CISCO-FEATURE-CONTROL-MIB
- CISCO-CDP-MIB
- CISCO-RF-MIB
- CISCO-ETHERNET-FABRIC-EXTENDER-MIB
- CISCO-BRIDGE-MIB
- CISCO-FCOE-MIB
- CISCO-PORTCHANNEL-MIB
- CISCO-ZS-MIB

Standards

Industry Standards

- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1p: CoS prioritization
- IEEE 802.1Q: VLAN tagging
- IEEE 802.1Qaz: Enhanced transmission selection
- IEEE 802.1Qbb: Per-priority Pause
- IEEE 802.1s: Multiple VLAN instances of Spanning Tree Protocol
- IEEE 802.1w: Rapid reconfiguration of Spanning Tree Protocol
- IEEE 802.3: Ethernet
- IEEE 802.3ad: LACP with fast timers
- IEEE 802.3ae: 10 Gigabit Ethernet
- SFF 8431 SFP+ CX1 support
- RMON
- IEEE 1588-2008: Precision Time Protocol (boundary clock)

Power Supply

Table 6 lists the power supply properties of the Cisco Nexus 6001.

Table 6. Power Supply Properties

AC Power Supply Properties	Cisco Nexus 6001
Typical operating power	750W
Maximum power	1000W
Input voltage	94 to 240 VAC
Frequency	47 to 63 Hz
Efficiency	98% (50 to 100% load)
RoHS compliance	Yes
Hot swappable	Yes
Front-to-back air flow power supply	Yes
Back-to-front air flow power supply	Yes

Environment

Table 7 lists the environment properties of the Cisco Nexus 6001.

Table 7. Environment Properties

Property	Cisco Nexus 6001
Physical (height x width x depth)	1.75 x 17.3 x 30 in. (4.4 x 43.9 x 76.2 cm)
Operating temperature	32 to 104°F (0 to 40°C)
Nonoperating (storage) temperature	-40 to 158°F (-40 to 70°C)
Humidity	5 to 95% (noncondensing)
Altitude	0 to 10,000 ft (0 to 3000m)
Weight	31.5 lbs

For the latest software release information and recommendations, please see the product bulletin at <http://www.cisco.com/go/nexus6000>.

Regulatory Standards Compliance

Table 8 summarizes regulatory standards compliance for the Cisco Nexus 6001.

Table 8. Regulatory Standards Compliance: Safety and EMC

Specification	Description
Regulatory compliance	Products should comply with CE Markings according to directives 2004/108/EC and 2006/95/EC.
Safety	<ul style="list-style-type: none">• UL 60950-1 Second Edition• CAN/CSA-C22.2 No. 60950-1 Second Edition• EN 60950-1 Second Edition• IEC 60950-1 Second Edition• AS/NZS 60950-1• GB4943
EMC: Emissions	<ul style="list-style-type: none">• 47CFR Part 15 (CFR 47) Class A• AS/NZS CISPR22 Class A• CISPR22 Class A• EN55022 Class A• ICES003 Class A• VCCI Class A• EN61000-3-2• EN61000-3-3• KN22 Class A• CNS13438 Class A
EMC: Immunity	<ul style="list-style-type: none">• EN55024• CISPR24• EN300386• KN 61000-4 series
RoHS	The product is RoHS 6 compliant with exceptions for leaded ball grid array (BGA) balls and lead press-fit connectors.

Warranty

The Cisco Nexus 6001 has a 1-year limited hardware warranty. The warranty includes hardware replacement with a 10-day turnaround from receipt of a return materials authorization (RMA).

Service and Support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco Nexus 6001 in your data center. The innovative Cisco Services are delivered through a unique combination of people, processes, tools, and partners and are focused on helping you increase operation efficiency and improve your data center network. Cisco Advanced Services uses an architecture-led approach to help you align your data center infrastructure with your business goals and achieve long-term value. Cisco SMARTnet[®] Service helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning resources. With this service, you can take advantage of the Cisco Smart Call Home service capability, which offers proactive diagnostics and real-time alerts on your Cisco Nexus 6001 Switch. Spanning the entire network lifecycle, Cisco Services offerings help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise.

For More Information

- Cisco Nexus 6000 Series Switches: <http://www.cisco.com/go/nexus6000>
- Cisco Nexus 2000 Series Fabric Extenders: <http://www.cisco.com/go/nexus2000>
- Cisco NX-OS Software: <http://www.cisco.com/go/nxos>




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