Cisco Catalyst 9500 Series Switches

Built for Security, IoT, and Cloud

The Cisco® Catalyst® 9500 Series Switches are the next generation of enterprise-class core and aggregation layer switches, supporting full programmability and serviceability. Based on an x86 CPU, the Catalyst 9500 Series is Cisco's lead purpose-built fixed core and aggregation enterprise switching platform, built for security, IoT, and cloud. The switches come with a 4-core, 2.4-GHz CPU, 16-GB DDR4 memory, and 16-GB internal storage.

The Catalyst 9500 Series is the industry's first purpose-built 40 Gigabit Ethernet line of switches targeted for the enterprise campus. These switches deliver unmatched table scale (MAC/route/ACL) and buffering for enterprise applications. The Catalyst 9500 Series includes nonblocking 40G Quad Small Form-factor Pluggable (QSFP+) and 1G/10G Small Form-factor Pluggable Plus (SFP/SFP+) switches with granular port densities that fit diverse campus needs. The switches support advanced routing and infrastructure services (such as Multiprotocol Label Switching [MPLS] Layer 2 and Layer 3 VPNs, Multicast VPN [MVPN], and Network Address Translation [NAT]); software-defined access border capabilities (such as a host tracking database, cross-domain connectivity, and VPN Routing and Forwarding [VRF]-aware Locator/ID Separation Protocol [LISP]); and network system virtualization with Cisco StackWise® virtual technology that are critical for their placement in the campus core. The platform also supports all the foundational high-availability capabilities such as patching, Graceful Insertion and Removal (GIR), Cisco Nonstop Forwarding with Stateful Switchover (NSF/SSO), redundant platinum-rated power supplies, and fans.

The foundation of Software-Defined Access
Advanced persistent security threats. The exponential growth of Internet of Things (IoT) devices. Mobility everywhere. Cloud adoption. All of these require a network fabric that integrates advanced hardware and software innovations to automate, secure, and simplify customer networks. The goal of this network fabric is to enable customer revenue growth by accelerating the rollout of business services.

The Cisco Digital Network Architecture (Cisco DNA™) with Software-Defined Access (SD-Access) is the network fabric that powers business. It is an open and extensible, software-driven architecture that accelerates and simplifies your enterprise network operations. The programmable architecture frees your IT staff from time-consuming, repetitive network configuration tasks so they can focus instead on innovation that positively transforms your business. SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include:

- Simplified device deployment
- Unified management of wired and wireless networks
- Network virtualization and segmentation
- Group-based policies
- Context-based analytics

The Cisco® Catalyst® 9500 Series switches form the foundational building block for Software-Defined Access—Cisco's leading enterprise architecture.

Cisco ONE Software

Cisco ONE™ Software offers a valuable and flexible way to buy software for the access, WAN, and data center domains. At each stage in the product lifecycle, Cisco ONE Software helps make buying, managing, and upgrading your network and infrastructure software easier. Cisco ONE Software provides:

- Flexible licensing models to smoothly distribute customers' software spending over time
- Investment protection for software purchases through software services–enabled license portability
- Access to updates, upgrades, and new technology from Cisco through Cisco® Software Support Services (SWSS)
- Lower cost of entry with the new Cisco ONE Subscription for Switching model

Cisco ONE for Access lets you manage your entire switching structure as a single, converged component. With one management system and one policy for wired and wireless networks, it offers an efficient way to provide more secure access.

Product overview: features

Product highlights

- Cisco Unified Access™ Data Plane (UADP) 2.0 Application-Specific Integrated Circuit (ASIC) ready for next-generation technologies with its programmable pipeline, microengine capabilities, and template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and QoS entries
- Intel® 2.4-GHz x86 CPU with up to 120 GB of USB 3.0 SSD storage for container-based application hosting
- Up to 960-Gbps switching capacity (IPv4) with up to 1440 Mpps of throughput
- Up to 24 nonblocking 40 Gigabit Ethernet QSFP ports
- Platinum-rated AC power supplies
- Up to 512,000 Flexible NetFlow (FNF) entries in hardware
- Up to 32 MB of shared buffer per ASIC
- Up to 64,000 routing entries for high-end campus access and aggregation deployments
- IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
- Dual-stack support for IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration
- Support for both static and dynamic NAT and Port Address Translation (PAT)
- Scalable routing (IPv4, IPv6, and multicast) tables and Layer 2 tables
- Open IOS-XE, a modern operating system for the enterprise with support for model-driven programmability, on-box Python scripting, streaming telemetry, container-based application hosting, and patching for critical bug fixes. The OS also has built-in defenses to protect against runtime attacks
- StackWise virtual technology, a network system virtualization technology that increases operational efficiency and boosts nonstop communications and scaled system bandwidth

- **SD-Access:** With the Catalyst 9500 Series, you can be part of the future of networking with features that include:
  - Policy-based automation from edge to cloud
  - Segmentation and micro-segmentation made easy, with predictable performance and scalability
  - Automation through the Cisco Application Policy Infrastructure Controller Enterprise Module (APIC-EM)
  - Policy through the Cisco Identity Services Engine (ISE)
  - Network assurance through the Network Data Platform
  - Faster launch of new business services and significantly improved issue resolution time
- **Plug and Play (PnP) enabled:** A simple, secure, unified, and integrated offering to ease new branch or campus device rollouts or updates to an existing network
- **Advanced security:**
  - Encrypted Traffic Analytics (ETA): You benefit from the power of machine learning to identify and take actions toward threats or anomalies in your network, including malware detection in encrypted traffic and distributed anomaly detection. Additionally, ETA is able detect vulnerable implementations in encrypted traffic
  - Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models
  - Trustworthy systems: Secure Unique Device Identification (SUDI) support for Plug and Play, enabling tamper-proof device identity capability, which secures zero-touch provisioning by allowing your device to show a certificate to the server to be able to get onto your network

Platform details

Switch models and configurations

All switches ship with the 950W AC power supply. Figure 1 shows the Cisco Catalyst 9500 Series Switches.

Figure 1.   Cisco Catalyst 9500 Series Switches – 24 x 40 Gigabit Ethernet

Figure 2.   Cisco Catalyst 9500 Series Switches – 12 x 40 Gigabit Ethernet

Figure 3.   Cisco Catalyst 9500 Series Switches – 40 x 1/10 Gigabit Ethernet

Table 1 shows the Cisco Catalyst 9500 Series configurations.

Table 1. Cisco Catalyst 9500 Series configurations

Model	Description	Total QSFP or SFP+ Ports
C9500-24Q	Cisco Catalyst 9500 Series 24-port 40 Gigabit Ethernet with QSFP+	24 QSFP+ (or up to 24 SFP+ with QSA adapter)
C9500-12Q	Cisco Catalyst 9500 Series 12-port 40 Gigabit Ethernet with QSFP+	12 QSFP+ (or up to 12 SFP+ with QSA adapter)
C9500-40X	Cisco Catalyst 9500 Series 40-port 1/10 Gigabit Ethernet with SFP/SFP+	40 SFP/SFP+

Network modules

The Cisco Catalyst 9500 Series Switches support optional network modules for uplink ports only on the 40-port 10 Gigabit Ethernet switch. The default switch configuration does not include the network module. When you purchase the switch, you can choose from the network modules described in Table 2.

Figure 4 shows the available network modules.

Figure 4. Cisco Catalyst 9500 Series network module 8-port 10 Gigabit Ethernet with SFP+

Figure 5. Cisco Catalyst 9500 Series network module 2-port 40 Gigabit Ethernet with QSFP+

Table 2. Network module numbers and descriptions

Network Module	Description
C9500-NM-8X	Cisco Catalyst 9500 Series Network Module 8-port 1/10 Gigabit Ethernet with SFP/SFP+
C9500-NM-2Q	Cisco Catalyst 9500 Series Network Module 2-port 40 Gigabit Ethernet with QSFP+

Power supplies

The Cisco Catalyst 9500 Series Switches support dual 1+1 redundant power supplies. The switches ship with one power supply by default. The second power supply can be purchased at the time the switch is ordered or at a later time. If only one power supply is installed, it should always be in power supply bay #1. The switches also ship with five field-replaceable variable-speed fans. These have front-to-back airflow and can operate with up to one individual fan failure. The fan trays support fan-tray Online Insertion and Removal (OIR) for up to 120 seconds and can support a maximum fan speed of 2400 RPM.

Figure 6.   Shows the 950W AC power supply.

Table 3 provides more details on the Catalyst 9500 Series power supply.

Table 3.   Power supply specifications

Power Supply Feature	Support in the Catalyst 9500 Series
AC power max rating	950W
System power consumption	850W max
Input-voltage range and frequency	AC 115 to 230 VAC, 50 to 60 Hz
Power supply efficiency	94%
Total output BTU (Note: 1000 BTU/hr = 293W)	2901 BTU/hr (850W) max
Input current	AC 10A at 115VAC, 5 A at 230VAC
Output ratings	12V at 79A, 12V at 3A
Output holdup time	AC = 10 ms at maximum load
Power-supply input receptacles	AC IEC 60320 C16
Power cord rating	AC 15A

Table 4 shows the different power supplies available in these switches.

Table 4.   Power supply models

Models	Default Power Supply
Cisco Catalyst 9500 Series 12-port 40 Gigabit Ethernet with QSFP	PWR-C4-950WAC-R
Cisco Catalyst 9500 Series 24-port 40 Gigabit Ethernet with QSFP+	PWR-C4-950WAC-R
Cisco Catalyst 9500 Series 40-port 1/10 Gigabit Ethernet with SFP/SFP+	PWR-C4-950WAC-R

Switch performance

Table 5 shows performance specifications for the Cisco Catalyst 9500 Series switches.

Table 5.   Performance specifications

Performance Numbers for All Switch Models	C9500-12Q	C9500-24Q	C9500-40X
Switching capacity	Up to 960 Gbps full duplex	Up to 1920 Gbps full duplex	Up to 960 Gbps full duplex
Forwarding rate	Up to 720 Mpps	Up to 1440 Mpps	Up to 720 Mpps
Total number of MAC addresses	Up to 64,000[*]		
Total number of IPv4 routes (Address Resolution Protocol [ARP] plus learned routes)	Up to 64,000 indirect[*] Up to 32,000 host[*]		
Total number of IPv6 routes	Up to 32,000 indirect[*] Up to 16,000 host[*]		
Multicast scale	Up to 48,000[*]		

Performance Numbers for All Switch Models	C9500-12Q	C9500-24Q	C9500-40X
QoS ACL scale	Up to 18000[*]		
Security ACL scale	Up to 18000[*]		
FNF entries	Up to 512,000[*]		
DRAM	16 GB		
Flash	16 GB		
VLAN IDs	4000		
Total Switched Virtual Interfaces (SVIs)	4000		
Jumbo frame	9198 bytes		

[*] Varies based on selected flexible ASIC template.

Flexible ASIC templates

Flexible ASIC templates enable universal deployments by leveraging the UADP 2.0 XL's ability to create resources to optimize table sizes for different places in the network. Based on how the switch is used in the network, an appropriate flexible ASIC template may be selected to configure the switch for specific features.

The following flexible ASIC templates are supported on the Cisco Catalyst 9500 Series.

- Access-edge for switches deployed in the access layer or fabric edge (ASIC resources are optimized for client scale)
- Core-border for switches deployed in the core layer or fabric border (ASIC resources are optimized for Layer 3 and cross-domain policies)
- Aggregation for switches deployed in the distribution and aggregation layer (ASIC resources are optimized for a mixture of Layer 2 and Layer 3 capabilities)
- Collapsed-core-WAN for switches deployed in a collapsed core and WAN edge (ASIC resources are optimized for Layer 3 and NAT)

Table 6 describes the ASIC templates.

Table 6.   ASIC template descriptions

Template Numbers for C9500 Models	Aggregation Template	NAT Template	Core Template	Border Template
IPv4/IPv6 LPM	0-64K / 0-32K	0-64K / 0-32K	0-64K / 0-32K	0-64K / 0-32K
IPv4/IPv6 host	48K-112K / 24K-56K	48K-112K / 24K-56K	32K-96K / 16K-48K	80K-144K / 40K -72K
Multicast route	16K (IPv4) 8K (IPv6)	16K (IPv4) 8K (IPv6)	16K (IPv4) 8K (IPv6)	16K (IPv4) 8K (IPv6)
IGMP/MLD snooping	16K	16K	16K	16K
MAC address	64K	16K	16K	16K
SGT label	8K	8K	8K	8K
NetFlow	128K/ASIC	128K/ASIC	128K/ASIC	128K/ASIC
Security ACL	18K	18K	18K	18K
QoS ACL	18K	3K	18K	18K
PBR/NAT	2K	16K	2K	2K
Tunnel	1K	1K	1K	1K
LISP	1K	1K	1K	1K
MACsec	1K	1K	1K	1K

Template Numbers for C9500 Models	Aggregation Template	NAT Template	Core Template	Border Template
SPAN	1K	1K	1K	1K
CoPP	1K	1K	1K	1K
NetFlow	1K ingress, 2K Egress	1K ingress, 2K Egress	1K ingress, 2K Egress	1K ingress, 2K Egress
Microflow policer	0.5K Input, 1K output	0.5K Input, 1K output	0.5K Input, 1K output	0.5K Input, 1K output

SD-Access architecture

Enterprises are in search of ways to transform their operations to add digital capabilities that enhance service delivery and asset management. Cisco SD-Access provides this transformational shift in building and managing networks. It provides faster, easier, and improved business efficiency with investment protection for enhanced business outcomes. By decoupling network functions from hardware, SD-Access helps ensure policy compliance, allows you to launch new business services faster, and improves issue resolution times significantly. At the same time, it is open and extensible and can significantly reduce your operational expenses.

Cisco SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include simplified device deployment, unified management of wired and wireless networks, network virtualization and segmentation, group-based policies, and context-based analytics. With these fundamental features in place, key use cases can now be orchestrated. These use cases include user mobility, secure segmentation, user onboarding and policies, IoT integration, guest access, context-based troubleshooting, and data center and cloud integration.

Cisco StackWise Virtual

StackWise Virtual is an advanced stacking technology that supports both access and distribution deployments through multiple topologies (such as two nodes or a ring). It provides higher scale for system virtualization at the network layer. The Catalyst 9500 Series supports StackWise Virtual with a 2-node topology. StackWise Virtual in the distribution layer of the network interacts with the access and core layer switches as if it were a single logical switch. An access/core switch connects to both switches of the StackWise Virtual switch using one logical port channel called a Multichassis EtherChannel (MEC). The MEC enables the StackWise Virtual switches to provide redundancy and load balancing on the port channel.

This capability enables a loop-free Layer 2 network topology, since the StackWise Virtual switches are treated as one logical switch for both access and core switches. The StackWise Virtual switch also simplifies the Layer 3 network topology by presenting itself as one logical switch, thus reducing the number of routing peers in the network.

Model	Description	StackWise Virtual
C9500-24Q	Cisco Catalyst 9500 Series 24-port 40 Gigabit Ethernet with QSFP+	Supported
C9500-12Q	Cisco Catalyst 9500 Series 12-port 40 Gigabit Ethernet with QSFP+	Not Supported Yet
C9500-40X	Cisco Catalyst 9500 Series 40-port 1/10 Gigabit Ethernet with SFP/SFP+	Not Supported Yet

Platform benefits

Open IOS-XE

The Cisco Catalyst 9500 Series opens a completely new paradigm in network configuration, operation, and monitoring through network automation. Cisco's automation solution is open, standards-based, and extensible across the entire lifecycle of a network device. The various mechanisms that bring about network automation are outlined below, based on a device lifecycle.

- **Automated device provisioning:** This is the ability to automate the process of upgrading software images and installing configuration files on Cisco Catalyst switches when they are being deployed in the network for the first time. Cisco provides both turnkey solutions such as Plug and Play and off-the-shelf tools such as Zero-Touch Provisioning (ZTP) and Preboot Execution Environment (PXE) that enable an effortless and automated deployment

- **API-driven configuration:** Modern network switches such the Catalyst 9500 Series support a wide range of automation features and provide robust open APIs over Network Configuration Protocol (NETCONF) and RESTCONF using YANG data models for external tools, both off-the-shelf and custom built, to automatically provision network resources

- **Granular visibility:** Model-driven telemetry provides a mechanism to stream data from a switch to a destination. The data to be streamed is driven through subscription to a data set in a YANG model. The subscribed data set is streamed out to the destination at configured intervals. Additionally, Open IOS-XE enables the push model, which provides near-real-time monitoring of the network, leading to quick detection and rectification of failures

- **Seamless software upgrades and patching:** To enhance OS resilience, Open IOS-XE supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This support allows customers to add patches without having to wait for the next maintenance release

Security

- **Encrypted Traffic Analytics (ETA):** ETA is a unique capability for identifying malware in encrypted traffic coming from the access layer. Since more and more traffic is becoming encrypted, the visibility this feature provides related to threat detection is critical for keeping your network secure at different layers

- **Advanced Encryption Standard (AES)-256 MACsec encryption:** AES is the IEEE 802.1AE standard for authenticating and encrypting packets between switches and endpoints. The Catalyst 9500 Series switches support 256-bit and 128-bit AES on all ports at all speeds, providing the most secure link encryption

- **Trustworthy systems:** Cisco Trust Anchor Technologies provide a highly secure foundation for Cisco products. With the Catalyst 9500 Series, these trustworthy systems enable hardware and software authenticity assurance for supply chain trust and strong mitigation against man-in-the-middle attacks on software and firmware. Trust Anchor capabilities include:

- **Image signing:** Cryptographically signed images provide assurance that the firmware, BIOS, and other software are authentic and unmodified. As the system boots, the system's software signatures are checked for integrity

- **Secure Boot:** Cisco Secure Boot technology anchors the boot sequence chain of trust to immutable hardware, mitigating threats against a system's foundational state and the software that is to be loaded, regardless of a user's privilege level. It provides layered protection against the persistence of illicitly modified firmware

- **Cisco Trust Anchor module:** A tamper-resistant, strong cryptographic, single-chip solution provides hardware authenticity assurance to uniquely identify the product so that its origin can be confirmed to Cisco, providing assurance that the product is genuine

Resiliency and high availability

- **Front-panel stacking:** The Catalyst 9500 Series is the only switching platform in the industry with support for front-panel stacking. This enables the switch to be optimized for a variety of deployments

- **High availability:** The Cisco Catalyst 9500 Series supports high-availability features, including the following:

  ◦ Cross-stack EtherChannel provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency

  ◦ IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) provides rapid spanning tree convergence independent of spanning tree timers and also offers the benefit of Layer 2 load balancing and distributed processing

  ◦ Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning tree (IEEE 802.1w) reconvergence on a per-VLAN spanning tree basis, providing simpler configuration than MSTP. In both MSTP and PVRST+ modes, stacked units behave as a single spanning tree node

  ◦ Switch-port autorecovery ("err-disable" recovery) automatically attempts to reactivate a link that is disabled because of a network error

Flexible NetFlow

- **Flexible NetFlow (FNF):** Cisco IOS® Software FNF is the next generation in flow visibility technology, allowing optimization of the network infrastructure, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Catalyst 9500 Series is capable of up to 512,000 flow entries

Application visibility and control

- **Next-Generation Network Based Application Recognition (NBAR2):** NBAR2 enables advanced application classification techniques, accuracy with up to 1400 predefined and well-known application signatures and up to 150 encrypted applications on the Cisco Catalyst 9000 Series. Some of the most popular applications included are Skype, Office 365, Microsoft Lync, Cisco WebEx®, and Facebook. Many others are already predefined and easy to configure. NBAR2 provides the network administrator with an important tool to identify, control, and monitor end-user application usage while helping ensure a quality user experience and securing the network from malicious attacks. It uses FNF to report application performance and activities within the network to any supported NetFlow collector, such as Cisco Prime®, Cisco Stealthwatch®, or any compliant third-party tool

QoS

- **Superior QoS:** The Cisco Catalyst 9500 Series offers Gigabit Ethernet speed with intelligent services that keep traffic flowing smoothly, even at 10 times the normal network speed. Industry-leading mechanisms for cross-stack marking, classification, and scheduling deliver superior performance for data, voice, and video traffic—all at wire speed. This includes granular wireless bandwidth management and fair sharing, 802.1p Class of Service (CoS) and Differentiated Services Code Point (DSCP) field classification, Shaped Round Robin (SRR) scheduling, and Committed Information Rate (CIR)

Service discovery

- **Constrained Application Protocol (CoAP):** This Internet application protocol enables constrained devices (including IoT devices with limited processing and storage such as smart lights and IP phones) to communicate efficiently with each other and also with the Internet through translation to HTTP. The simple and lean protocol also provides multicast support, an important aspect in IoT management
- **Multicast DNS (mDNS) gateway:** This service discovery gateway capability facilitates the sharing of services advertised using the Apple mDNS (Bonjour) protocol (such as printers, Apple TVs and file services across the network). Additionally, the administrator can create policies defining which services can be seen and accessed by the users in the network. This capability facilitates a Bring-Your-Own-Device (BYOD) rollout

Smart operation

- **Bluetooth ready:** The Catalyst 9500 Series has hardware support to connect a Bluetooth dongle to your switch, enabling you to use this wireless interface as a management port. This port functions as an IP management interface and can be used for configuration and troubleshooting using the WebUI or the Command-Line Interface (CLI), and to transfer images and configurations
- **WebUI:** WebUI is an embedded GUI-based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability and to enhance the user experience. WebUI comes with the default image. There is no need to enable anything or install any license on the device. You can use WebUI to build a day-1 configuration and from then on monitor and troubleshoot the device without having to know how to use the CLI
- **RFID tags:** The Catalyst 9500 Series switches have an embedded RFID tag that facilitates easy asset and inventory management using commercial RFID readers
- **Blue beacon:** The Catalyst 9500 Series switches support a blue beacon LED for easy identification of the switch being accessed

High-performance IP routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in the Cisco Catalyst 9500 Series Switches, based on.

- IP unicast routing protocols (including static, Routing Information Protocol Version 1 [RIPv1], RIPv2, RIPng, and Open Shortest Path First [OSPF] routed access) are supported for small network routing applications with the Network Essentials stack. Equal-cost routing facilitates Layer 3 load balancing and redundancy across the stack
- Advanced IP unicast routing protocols (such as OSPF, Enhanced Interior Gateway Routing Protocol [EIGRP], Border Gateway Protocol Version 4 [BGPv4], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and for constructing scalable LANs. IPv6 routing (using OSPFv3 and EIGRPv6) is supported in hardware for maximum performance
- Protocol-Independent Multicast (PIM) for IP multicast routing is supported, including PIM Sparse Mode (PIM SM), and Source-Specific Multicast (SSM)
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting

Software requirements

- The Cisco Catalyst 9500 Series Switches run on Open IOS-XE version 16.5.1 or later. This software release includes all the features listed earlier in the Platform Benefits section

Packaging

The Cisco Catalyst 9300, 9400, and 9500 Series introduce new packaging that includes vastly simplified base network packages (Network Essentials and Network Advantage) and term-based software packages (Cisco DNA Essentials, Cisco DNA Advantage) as add-ons. The Cisco DNA packages, in addition to on-box capabilities, also unlock additional functionality in Cisco DNA Center, enabling controller-based software-defined automation in your network.

License consumption is further simplified to following two combinations:

Essentials: This consists of Perpetual Network Essentials and a term-based (3-, 5-, or 7-year) Cisco DNA Essentials package.

Advantage: This consists of Perpetual Network Advantage and a term-based (3-, 5-, or 7-year) Cisco DNA Advantage package.

Note that it is not required to deploy Cisco DNA Center just to use one of the above packages. Refer to https://switching.cisco.com/faqs for additional details about the Essentials and Advantage packages.

Tables 7 and 8 show functionalities included in the two packages.

Table 7.   Network Essentials and Network Advantage packages

Features	Network Essentials	Network Advantage
Switch fundamentals STP, Trunking, Private VLAN (PVLAN), Q-in-Q, IPv6, OSPF, RIP, Policy-Based Routing (PBR), Virtual Router Redundancy Protocol (VRRP), Internet Group Management Protocol (IGMP), PIM Stub, Weighted Random Early Detection (WRED), Cisco UPOE®, First Hop Security (FHS), 802.1X, MACsec-128, Control Plane Policing (CoPP), SSO	✓	✓
Advanced switch capabilities and scale BGP, EIGRP, Hot Standby Router Protocol (HSRP), IS-IS, Bootstrap Router (BSR), Multicast Source Discovery Protocol (MSDP), Class-Based Weighted Fair Queuing (CBWFQ), MACsec-256		✓
Management automation NETCONF/YANG, PnP, ZTP/Open PnP	✓	✓
Capacity planning, performance monitoring, and troubleshooting Streaming telemetry, sampled NetFlow, Switched Port Analyzer (SPAN), Remote SPAN (RSPAN)	✓	✓
Flexible network segmentation for isolation VPN Routing and Forwarding (VRF), MPLS VPNs – Layer 3 VPN (L3VPN), Ethernet over MPLS (EoMPLS), Hierarchical Virtual Private LAN Services (H-VPLS), IPv6 Provider Edge (6PE), IPv6 on Virtual Provider Edge (6VPE), Multicast VPN (MVPN)		✓
High availability and resiliency Nonstop Routing (NSR), GIR, Stackwise Virtual		✓
Enhanced security controls MACsec-256, CoPP		✓
IoT integration CoAP		✓

Table 8.   Cisco DNA Essentials and DNA Advantage packages

Features	Cisco DNA Essentials	Cisco DNA Advantage
Add-on for Network Essentials	✓	
Add-on for Network Advantage		✓
Subscription based (3, 5, 7, or 10 years) with ongoing updates	✓	✓
On-Box Features		
Flexible automation	✓	✓
Containers, Python, Embedded Event Manager (EEM), Autonomic Networking Infrastructure (ANI)		
Advanced telemetry and visibility	✓	✓
Flexible NetFlow, MPLS, Multicast, CoPP, shared NetFlow policers, NetFlow with EEM, Wireshark		
Advanced telemetry and visibility		✓
Encapsulated Remote SPAN (ERSPAN), Application Visibility and Control (AVC), NBAR2		
Optimized network deployments		✓
LISP with Virtual Extensible LAN (VXLAN), Cisco TrustSec®, Security Group Tag (SGT) caching, Security Group Access Control List (SGACL), FEW, Dynamic Host Configuration Protocol (DHCP), DNS; mDNS gateway, NAT and Port Address Translation (PAT)		
Comprehensive security		✓
ETA		
Cisco DNA Center Features		
Day 0 network bring-up automation	✓	✓
Cisco network PnP application, network settings, device credentials		
Element management	✓	✓
Discovery, inventory, topology, software image, patch, licensing, and configuration management		
Network monitoring	✓	✓
Product Security Incident Response Team (PSIRT) compliance; end of life/end of sale reporting; telemetry quotient; Client 360; Device 360; top talkers/application reporting; syslog, Simple Network Management Protocol (SNMP), NetFlow, streaming telemetry collection and correlation		
QoS configuration and monitoring	✓	✓
EasyQoS application		
Policy-based automation		✓
SD-Access, group-based policy for access, app prioritization, monitoring, and path selection		
SD-Access with integrated wireless, IoT, Bonjour, Stealthwatch, firewalls, IT Service Management (ITSM) integration, third-party IP Address Management (IPAM) integration		
Network assurance and analytics		✓
Regulatory and config compliance		
Application visibility and performance monitoring		
Network issue and trends visualization and correlation with contextual graphs, time machine, and topology and site-based views		
API and firehose-based data integration with Splunk and ServiceNow		
Collector for syslog, SNMP, NetFlow, and streaming telemetry		

Dimensions, physical specifications, weight, and Mean Time Between Failures (MTBF)

Table 9 lists the dimensions, physical specifications, weight, and MTBF for the Cisco Catalyst 9500 Series Switches.

Table 9.   Dimensions, physical specifications, weight, and MTBF

Description	Specifications		
Dimensions (H x W x D)	1.73 x 17.5 x 21.52 in		
Rack units (RU)	1 RU		
Chassis with 2 power supplies and built-In fan	25.75 lb (11.68 kg)		
Input voltage	90 to 264 VAC		
Operating temperature	32°F to 104°F (0° to 40°C)		
Storage temperature	-4° to 149°F (-20° to 65°C)		
Relative humidity operating and nonoperating noncondensing	Ambient (noncondensing) operating: 5% to 90% Ambient (noncondensing) nonoperating and storage: 5% to 95%		
Altitude	Operation up to 6000 ft		
MTBF (hours)	C9500-12Q	C9500-24Q	C9500-40X
	179,660	127,660	180,640

Connectors

Table 10 shows the supported connectors for the Catalyst 9500 Series.

Table 10.   Connectors

Connectors and cabling	• 10GBASE-SR, LR, LRM, ER, ZR, DWDM SFP+ transceivers: LC fiber connectors (single-mode or multimode fiber) • QSFP • CX1 cable assemblies: SFP+ connector

For the latest Cisco transceiver module compatibility information, refer to
https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html.

Management and standards support

Table 11 shows management and standards support for the Cisco Catalyst 9500 Series.

Table 11.   Management and standards support[*]

Description	Specification	
Management	BRIDGE-MIB	CISCO-SNMP-TARGET-EXT-MIB
	CISCO-AUTH-FRAMEWORK-MIB	CISCO-STACKMAKER-MIB
	CISCO-BGP4-MIB, BGP4-MIB	CISCO-MEMORY-POOL-MIB
	CISCO-BRIDGE-EXT-MIB	CISCO-STP-EXTENSIONS-MIB
	CISCO-BULK-FILE-MIB	CISCO-SYSLOG-MIB
	CISCO-CABLE-DIAG-MIB	CISCO-TCP-MIB
	CISCO-CALLHOME-MIB	CISCO-UDLDP-MIB
	CISCO-CEF-MIB	CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
	CISCO-CIRCUIT-INTERFACE-MIB	CISCO-VLAN-MEMBERSHIP-MIB
	CISCO-ENTITY-VENDORTYPE-OID-MIB	CISCO-VTP-MIB

Description	Specification	
	CISCO-CONTEXT-MAPPING-MIB	EtherLike-MIB
	CISCO-DEVICE-LOCATION-MIB	HC-RMON-MIB
	CISCO-DHCP-SNOOPING-MIB	IEEE8021-PAE-MIB
	CISCO-EIGRP-MIB	IEEE8023-LAG-MIB
	CISCO-EMBEDDED-EVENT-MGR-MIB	IF-MIB
	CISCO-ENTITY-FRU-CONTROL-MIB	IGMP-MIB
	CISCO-ENTITY-SENSOR-MIB	IGMP-STD-MIB
	ENTITY-MIB	IP-FORWARD-MIB
	CISCO-ERR-DISABLE-MIB	IP-MIB
	CISCO-CONFIG-COPY-MIB	IPMROUTE-STD-MIB
	CISCO-FLOW-MONITOR-MIB	LLDP-EXT-MED-MIB
	CISCO-FTP-CLIENT-MIB	LLDP-MIB
	CISCO-HSRP-EXT-MIB	NOTIFICATION-LOG-MIB
	CISCO-HSRP-MIB	OLD-CISCO-MEMORY-MIB
	CISCO-IETF-ISIS-MIB	CISCO-CDP-MIB
	CISCO-IF-EXTENSION-MIB	POWER-ETHERNET-MIB
	CISCO-IGMP-FILTER-MIB	RMON2-MIB
	CISCO-CONFIG-MAN-MIB	RMON-MIB
	CISCO-IP-CBR-METRICS-MIB	SNMP-COMMUNITY-MIB
	CISCO-IPMROUTE-MIB	SNMP-FRAMEWORK-MIB
	CISCO-IP-STAT-MIB	SNMP-MPD-MIB
	CISCO-IP-URPF-MIB	SNMP-NOTIFICATION-MIB
	CISCO-L2L3-INTERFACE-CONFIG-MIB	SNMP-PROXY-MIB
	CISCO-LAG-MIB	SNMP-TARGET-MIB
	CISCO-LICENSE-MGMT-MIB	SNMP-USM-MIB
	CISCO-MAC-AUTH-BYPASS-MIB	SNMPv2-MIB
	CISCO-MAC-NOTIFICATION-MIB	SNMP-VIEW-BASED-ACM-MIB
	CISCO-MDI-METRICS-MIB	TCP-MIB
	CISCO-FLASH-MIB	UDP-MIB
	CISCO-OSPF-MIB	CISCO-IMAGE-MIB
	CISCO-OSPF-TRAP-MIB	CISCO-STACKWISE-MIB
	CISCO-PAE-MIB	CISCO-ENVMON-MIB
	CISCO-PAGP-MIB	
	CISCO-PIM-MIB	
	CISCO-PING-MIB	
	CISCO-PORT-QOS-MIB	
	CISCO-PORT-SECURITY-MIB	
	CISCO-PORT-STORM-CONTROL-MIB	
	CISCO-POWER-ETHERNET-EXT-MIB	
	CISCO-PRIVATE-VLAN-MIB	
	CISCO-PROCESS-MIB	
	CISCO-PRODUCTS-MIB	
	CISCO-RF-MIB	
	CISCO-RTP-METRICS-MIB	
	CISCO-RTTMON-MIB	
Standards	IEEE 802.1s	RMON I and II standards
	IEEE 802.1w	SNMPv1, SNMPv2c, and SNMPv3
	IEEE 802.1x	
	IEEE 802.3ae for 10G SKU	
	IEEE 802.3ae, IEEE 802.3ba on the 40G SKU	
	IEEE 802.1x-Rev	
	IEEE 802.3ad	
	IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports	

Description	Specification
	IEEE 802.1D Spanning Tree Protocol
	IEEE 802.1p CoS prioritization
	IEEE 802.1Q VLAN
	IEEE 802.3 10BASE-T specification
	IEEE 802.3u 100BASE-TX specification
	IEEE 802.3ab 1000BASE-T specification
	IEEE 802.3z 1000BASE-X specification

*Pending final verification.

Safety and compliance

Table 12 lists the safety and compliance information for the Cisco Catalyst 9500 Series.

Table 12.   Safety and compliance information

Description	Specification
Safety certifications	UL 60950-1
	CAN/CSA-C22.2 No. 60950-1
	EN 60950-1
	IEC 60950-1
	AS/NZS 60950-1
	GB4943
EMI and EMC compliance	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
	EN50082-1
	EN61000-6-1
	EN55024
	CISPR24
	EN300386
	KN 24
	KN 61000-4 series

Cisco enhanced limited lifetime hardware warranty

The Cisco Catalyst 9500 Series Switches come with an enhanced limited Lifetime Warranty (E-LLW) that includes Next-Business-Day (NBD) delivery of replacement hardware where available and 90 days of 8x5 Cisco Technical Assistance Center (TAC) support. Your formal warranty statement, including the warranty applicable to Cisco software, appears in the information packet that accompanies your Cisco product. We encourage you to carefully review the warranty statement shipped with your specific product before use. Cisco reserves the right to refund the purchase price as its exclusive warranty remedy. For further information about warranty terms, visit https://www.cisco.com/go/warranty.

Table 13 provides information about the E-LLW.

Table 13.   E-LLW Details

	Cisco E-LLW
Devices covered	Applies to Cisco Catalyst 9500 Series Switches.
Warranty duration	As long as the original customer owns the product.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the Return Materials Authorization (RMA) request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week, basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 9500 Series product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Cisco and partner services for next-generation Cisco catalyst fixed switches

Cisco and partner services offer various personalized services to enable IoT, cloud and secure networks. You can purchase advanced services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. Please refer to Table 14 for more information on Cisco's Technical Services available for the Cisco Catalyst 9500 Series Switches.

Table 14.   Technical services

Cisco Technical Services
Cisco Smart Net Total Care™ Service • Around-the-clock, global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com knowledge base and tools • NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement and onsite parts replacement and installation available • Ongoing operating system software updates within the licensed feature set[1] • Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
Cisco Smart Foundation Service • NBD advance hardware replacement as available • Access during business hours to Small and Medium-sized Business (SMB) TAC (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation portal • Operating system software bug fixes and patches
Cisco SP Base Service • Around-the-clock, global access to the Cisco TAC • Registered access to Cisco.com • NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement; return to factory option available[2] • Ongoing operating system software updates[1]

Cisco Focused Technical Support Services
• Three levels of premium, high-touch services are available:
  ◦ Cisco High-Touch Operations Management Service
  ◦ Cisco High-Touch Technical Support Service
  ◦ Cisco High-Touch Engineering Service
• Valid Cisco Smart Net Total Care or SP Base contracts are required on all network equipment

[1] Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

Learn more about available services.

Software policy for Cisco Catalyst 9500 Series Switches

Cisco ONE Software for Access Switching is available for the Cisco Catalyst 9500.

Cisco ONE Software for Access Switching offers comprehensive solutions for the enterprise campus and branch offices. Cisco ONE for Access Switching introduces a simpler and more economical way to deploy access, aggregation, and core switches across enterprise campus and branch locations.

The Cisco ONE Subscription for Switching offer delivers an unbound network on an open and extensible architecture to help you navigate the digital journey. This subscription offer simplifies the buying process and includes lower initiation costs and flexible terms. It includes: Cisco ONE Advantage with full Cisco Digital Network Architecture (DNA) capabilities and Cisco Software-Defined Access (SD-Access).

For ordering information for Cisco ONE Software for the Cisco Catalyst 9500, go to https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html.

Software policy for network stack components

Customers with the Network Essential Stack and Network Advantage Stack software feature sets will be provided with maintenance updates and bug fixes. These are designed to maintain compliance of the software with published specifications, release notes, and industry standards as long as the original end user continues to own or use the product or for up to one year from the end-of-sale date for the product, whichever occurs earlier.

Cisco Embedded Support for Cisco DNA term components

Cisco Embedded Support delivers the right support for Cisco software products and suites. It will keep your business applications performing as expected and protect your investment. Cisco Embedded Support for the DNA Essentials and DNA Advantage term components is included as part of the switch value. Embedded Support provides access to TAC support, major software updates, maintenance and minor software releases, and the Cisco Software Support site, for increased productivity with anytime access.

Ordering information

To place an order, visit the Cisco Ordering home page at: https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 15 lists ordering information for the Cisco Catalyst 9500 Series.

Table 15.   Ordering information

Product Number	Product Description
C9500-24Q-E	Cisco Catalyst 9500 24-port 40G switch, NW Ess. License
C9500-24Q-A	Cisco Catalyst 9500 24-port 40G switch, NW Adv. License
C9500-12Q-E	Cisco Catalyst 9500 12-port 40G switch, NW Ess. License
C9500-12Q-A	Cisco Catalyst 9500 12-port 40G switch, NW Adv. License
C9500-40X-E	Cisco Catalyst 9500 40-port 1/10G switch, NW Ess. License

Product Number	Product Description
C9500-40X-A	Cisco Catalyst 9500 40-port 1/10G switch, NW Adv. License
C9500-NM-2Q	Cisco Catalyst 9500 2 x 40GE Network Module
C9500-NM-8X	Cisco Catalyst 9500 8 x 1/10GE Network Module
C9500-NM-2Q=	Cisco Catalyst 9500 2 x 40GE Network Module Spare
C9500-NM-8X=	Cisco Catalyst 9500 8 x 1/10GE Network Module Spare
C9500-48X-A	Cisco Catalyst 9500 40-port 1/10G switch, 8 x 10GE Network Module, NW Adv. License
C9500-48X-E	Cisco Catalyst 9500 40-port 1/10G switch, 8 x 10GE Network Module, NW Ess. License
C9500-40X-2Q-A	Cisco Catalyst 9500 40-port 1/10G switch, 2 x 40GE Network Module, NW Adv. License
C9500-40X-2Q-E	Cisco Catalyst 9500 40-port 1/10G switch, 2 x 40GE Network Module, NW Ess. License
DNA Term Licenses	
C9500-DNA-E-3Y	Catalyst 9500 NW & DNA Essentials. license (3Y)
C9500-DNA-E-5Y	Catalyst 9500 NW & DNA Essentials. license (5Y)
C9500-DNA-E-7Y	Catalyst 9500 NW & DNA Essentials. license (7Y)
C9500-DNA-A-3Y	Catalyst 9500 NW & DNA Advantage license (3Y)
C9500-DNA-A-5Y	Catalyst 9500 NW & DNA Advantage license (5Y)
C9500-DNA-A-7Y	Catalyst 9500 NW & DNA Advantage license (7Y)
C9500-DNA-L-E-3Y	Catalyst 9500 NW & DNA Essentials. low port density license (3Y) for 12P40G SKU
C9500-DNA-L-E-5Y	Catalyst 9500 NW & DNA Essentials. low port density license (5Y) for 12P40G SKU
C9500-DNA-L-E-7Y	Catalyst 9500 NW & DNA Essentials. low port density license (7Y) for 12P40G SKU
C9500-DNA-L-A-3Y	Catalyst 9500 NW & DNA Advantage low port density license (3Y) for 12P40G SKU
C9500-DNA-L-A-5Y	Catalyst 9500 NW & DNA Advantage low port density license (5Y) for 12P40G SKU
C9500-DNA-L-A-7Y	Catalyst 9500 NW & DNA Advantage low port density license (7Y) for 12P40G SKU
Power Supplies, Cables, and Fan for the Cisco Catalyst 9500 Series	
FAN-T4-R	Catalyst 9500 Type 4 front to back cooling Fan
PWR-C4-950WAC-R	950W AC Config 4 Power Supply front to back cooling
PWR-C4-950WAC-R/2	950W AC Config 4 Power Supply front to back cooling, Redundant
PWR-C4-BLANK	Catalyst 9500 power supply blank cover
CAB-C15-CBN-JP	Japan Cabinet Jumper Power Cord, 250 VAC 12A, C14-C15
CAB-TA-250V-JP	Japan 250V AC Type A Power Cable
CAB-TA-AP	Australia AC Type A Power Cable
CAB-TA-AR	Argentina AC Type A Power Cable
CAB-TA-DN	Denmark AC Type A Power Cable
CAB-TA-EU	Europe AC Type A Power Cable
CAB-TA-IN	India AC Type A Power Cable
CAB-TA-IS	Israel AC Type A Power Cable
CAB-TA-IT	Italy AC Type A Power Cable
CAB-TA-SW	Switzerland AC Type A Power Cable
CAB-TA-UK	United Kingdom AC Type A Power Cable
CAB-TA-NA	North America AC Type A Power Cable
CAB-C15-CBN	Cabinet Jumper Power Cord, 250 VAC 13A, C14-C15 Connectors
CAB-TA-JP	Japan AC Type A Power Cable

Product Number	Product Description
Spare Accessory and Rack Mount Kits for the Cisco Catalyst 9500 Series	
C9500-ACC-KIT-19I=	Accessory Kit for Cisco Catalyst 9500 Series - 19" rack mount
C9500-ACC-KIT-23I=	Accessory Kit for Cisco Catalyst 9500 Series - 23" rack mount
C9500-4PT-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 9500 Series
SSD-120G	Cisco pluggable USB3.0 SSD storage

For ordering information for Cisco ONE™ Software for the Cisco Catalyst 9500 Series Switches, go to https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html.

Optics support

The Cisco Catalyst 9500 Series supports a wide range of optics. Because the list of supported optics is updated on a regular basis, please consult the tables available here for the latest compatibility information: https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html.

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Printed in USA

C78-738978-04   10/17