Cisco Catalyst 9300 Series Switches

Contents

Built to reimage connection, reinforce security, and redefine experience

Cisco Catalyst™ 9300 Series Switches are Cisco's lead stackable enterprise access switching platform and, as part of the Catalyst 9000 family, are built to transform your network to handle a hybrid world where the workplace is anywhere, endpoints could be anything, and applications are hosted all over the place.

The Catalyst 9300 Series, including the Catalyst 9300X models, continues to shape the future with continued innovation that helps you reimagine connections, reinforce security and redefine the experience for your hybrid workforce, big or small. With Catalyst 9300 Series switches, you choose how you want to manage your network – on-premises, virtual, or from the cloud.

The many industry firsts of the Catalyst 9300 Series include:

- **Up to 1 TB of stacking bandwidth:** With Cisco StackWise-1T, Catalyst 9300 Series switches are the industry's highest-density stacking bandwidth solution with the most flexible uplink architecture.
- **Flexible and dense uplink offerings** with 100 Gigabit Ethernet (G), 40G, 25G, Multigigabit, 10G, and 1G modular uplinks.
- **Mixed stacking with backward compatibility**: Stack your Catalyst 9300X fiber switches with Catalyst 9300 and Catalyst 9300X Multigigabit switches, bringing stackable high-speed fiber to the access layer.
- **Highest number of Multigigabit ports:** With standalone and StackWise-1T, Catalyst 9300X models enable 48 Multigigabit ports in standalone mode and 448 Multigigabit ports with an 8-member stack.
- **Highest 90W UPOE+ density:** Enable your OT/IT needs with up to 48 ports of 90W Cisco UPOE+ in standalone mode or 384 ports of 90W UPOE+ with an 8-member stack.
- **StackPower with backward compatibility:** Enable power resiliency with higher power budgets in a mixed Catalyst 9300 and Catalyst 9300X stack.
- **100G IPsec in hardware:** Built on the Cisco® Unified Access Data Plane (UADP) 2.0sec application-specific integrated circuit (ASIC), the Catalyst 9300X models come with 100G line-rate IPsec to enable various options for new edge connectivity.
- **Secure tunnel connectivity:** With the new edge, the Catalyst 9300X enables secure connections to secure internet gateways, cloud service providers, and site-to-site connectivity using IPsec tunnels with 256-bit Advanced Encryption Standard encryption (AES-256) and speeds up to 100G.
- **Enhanced application hosting:** With twice the capacity and additional RAM, Intel® QuickAssist Technology (QAT), and 2x 10G AppGig ports, the Catalyst 9300X models can host multiple Cisco Signed performance-savvy applications.
- **ThousandEyes enabled:** Enable end-to-end visualization of the path from campus/branch to clouds/data center with Cisco ThousandEyes® Network and Application Synthetics (included with Cisco DNA Advantage licenses).
- **Cisco ASAc firewall enabled:** Using application hosting, Cisco Adaptive Security Virtual Appliance (ASAc) and stateful inspection of traffic can be seamlessly added to existing networks without any additional hardware.

- **Cloud management:** Migrate Catalyst 9300 Series switches to the Cisco Meraki® dashboard to unlock centralized management and monitoring of devices while retaining advanced features like a cloud-hosted command-line interface terminal. Learn more.
- **Investment protection:** Catalyst 9300X redundant fans and power supplies, data stack, and StackPower cables are backward compatible with the Catalyst 9300 Series.

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 Networking Cloud 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 that include:

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

Cisco Catalyst, Cisco DNA, and Meraki software

Cisco Catalyst, Cisco DNA, and Meraki software subscriptions offer a valuable and flexible way to buy software for the access layer, WAN, and data center domains. At each stage in the product lifecycle, Cisco Catalyst, Cisco DNA, and Meraki software helps make buying, managing, and upgrading your network and infrastructure software easier. Cisco 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 Service (SWSS).
- Lower cost of entry with the new Cisco Catalyst Software Subscription for Switching support model.
- Choose what management model works best for you – on-premises, virtual, or in the cloud.
- Access to end-to-end network visibility with Cisco Spaces, service assurance through Cisco ThousandEyes Network and Application Synthetics, and Cisco ASAc firewall (with Cisco Catalyst and Cisco DNA Advantage licenses).

Cisco Catalyst 9300 Series Switches let you manage your entire switching structure as a single, converged component. With one management system, whether on-premises or in the cloud, and one policy for wired and wireless networks, they offer an efficient way to provide more secure access.

Product overview

Product highlights

- Highest wireless scale for Wi-Fi 6 and 802.11ac Wave 2 access points supported on a single switch with select models.
- Catalyst 9300 and Catalyst 9300L/LM models are based on the Cisco UADP 2.0 ASIC with programmable pipeline and micro-engine capabilities, along with template-based, configurable allocation of Layer 2 and Layer 3 forwarding, access control lists (ACLs), and quality-of-service (QoS) entries.
- Catalyst 9300X models are based on UADP 2.0sec ASIC, which adds line-rate support for crypto, including 100G hardware-based IPsec.
- x86 CPU complex with 8 GB memory, 16 GB of flash, and an external USB 3.0 SSD pluggable storage slot (delivering up to 240 GB of storage with an optional SSD drive) to host containers. Catalyst 9300X models support 16 GB of memory.
- USB 2.0 slot to load system images and set configurations.
- Up to 1 Tbps of local stackable switching bandwidth with the Catalyst 9300X models.
- Deeper buffer and higher scale model options for rich multimedia content delivery applications.
- Flexible and dense uplink offerings with 100G, 40G, 25G, Multigigabit, 10G, and 1G as fixed or modular uplinks.
- Easy transition from 40G to 100G and 10G to 25G with dual-rate optics.
- Flexible downlink options with 25G, 10G and 1G copper and fiber as well as the densest Multigigabit links.
- With a mix of copper (1G up to 10G) and fiber (1G up to 25G) supported in a single stack, multiple flexible deployment scenarios are enabled, including 2-tier, 3-tier, and hybrid architectures.
- Leading Power over Ethernet (PoE) capabilities with up to 384 ports of PoE per stack, PoE+, and 288 ports of high-density IEEE 802.3bt-90W UPOE+ and 60W Cisco UPOE®.
- Intelligent power management with Cisco StackPower technology, providing power stacking among members for power redundancy. StackPower pools the power supplies across the stack to be used for redundancy and supplemental power purposes.
- Line-rate, hardware-based Flexible NetFlow (FNF), delivering flow collection of up to 128,000 flows with select models.
- 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 Network Address Translation (NAT) and Port Address Translation (PAT).
- IEEE 802.1ba Audio Video Bridging (AVB) built in to provide a better audio and video experience through improved time synchronization and QoS.
- Precision Time Protocol (PTP; IEEE 1588v2) provides accurate clock synchronization with sub-microsecond accuracy, making it suitable for distribution and synchronization of time and frequency over the network.
- Cisco IOS® XE, a modern operating system for the enterprise with support for model-driven programmability, including NETCONF, RESTCONF, YANG, 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.
- End-to-end visualization of the path from campus/branch to clouds/data center with Cisco ThousandEyes Network and Application Synthetics (included with a Cisco Catalyst and Cisco DNA Advantage license).
- Fully managed Meraki cloud customers can take advantage of the power of Catalyst 9300 switching in their Meraki cloud through the cloud-management service.
- **SD-Access:** Cisco Catalyst 9300 Series Switches form the foundational building block for SD-Access, Cisco's lead enterprise architecture:
  - Policy-based automation from edge to cloud.
  - Simplified segmentation and micro-segmentation, with predictable performance and scalability.
  - Automation through Cisco Catalyst Center and Meraki dashboard.
  - Policy handled through the Cisco Identity Services Engine (ISE).
  - Network assurance provided through Cisco Catalyst Center and Meraki dashboard.
  - 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):** Uses the power of machine learning to identify and take action against threats or anomalies in your network, including malware detection in encrypted traffic (without decryption) and distributed anomaly detection.
  - Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models.
  - **Trustworthy solutions:** Hardware-anchored Secure Boot and Secure Unique Device Identification (SUDI) support for PnP, to verify the identity of the hardware and software.

Platform details

Switch models and configurations

Table 1. Product family configurations

Model	Modular uplinks and speeds	Stacking bandwidth support	Multigigabit density	Cisco StackPower	Hardware-based IPsec	App hosting capacity
Catalyst 9300X	10G, 25G, 40G, Multigigabit, and 100G	Stackwise-1T (480G when stacking with a Catalyst 9300 model)	48x 10G	✓ (larger power budget)	Up to 100G IPsec*	✓ (2x hosting resources compared to Catalyst 9300 models)
Catalyst 9300	10G, 25G, 40G and Multigigabit	Stackwise-480	48x 5G and 24x 10G	✓	✗	✓
Catalyst 9300L	✗	Stackwise-320	12x 10G	✗	✗	✓
Catalyst 9300LM	✗	Stackwise-320	8x 10G	✗	✗	✓

*** Need to order HSEC key for IPsec feature.**

The Cisco Catalyst 9300 Series consists of 19 modular uplink switch models and 14 fixed uplink switch models.

Figure 1. Cisco Catalyst 9300 Series Switches

Table 2 lists port scale and power details for the Cisco Catalyst 9300 Series models.

Table 2. Cisco Catalyst 9300 Series switch configurations

Model	Total 10/100/1000, Multigigabit copper or SFP fiber	Uplink configuration	Default AC power supply
Modular uplink models			
C9300X-48HX	48 ports Cisco UPOE+, 48x 10G Multigigabit (10G/5G/2.5G/1G/100M) with 90W UPOE+	Modular uplinks	1100W AC
C9300X-48TX	48 ports data, 48x 10G Multigigabit (10G/5G/2.5G/1G/100M)	Modular uplinks	715W AC

Model	Total 10/100/1000, Multigigabit copper or SFP fiber	Uplink configuration	Default AC power supply
C9300X-48HXN	48 ports Cisco UPOE+, 8x 10G Multigigabit (10G/5G/2.5G/1G/100M) + 40x 5G Multigigabit (5G/2.5G/1G/100M)	Modular uplinks	1100W AC
C9300X-24HX	24 ports Cisco UPOE+, 24x 10G Multigigabit (10G/5G/2.5G/1G/100M)	Modular uplinks	1100W AC
C9300X-12Y	12 ports 25G/10G/1G SFP28	Modular uplinks	715W AC
C9300X-24Y	24 ports 25G/10G/1G SFP28	Modular uplinks	715W AC
C9300-24T	24 ports data	Modular uplinks	350W AC
C9300-48T	48 ports data	Modular uplinks	350W AC
C9300-24P	24 ports PoE+	Modular uplinks	715W AC
C9300-48P2	48 ports PoE+ ENERGY STAR certified	Modular uplinks	715W AC
C9300-24U	24 ports Cisco UPOE	Modular uplinks	1100W AC
C9300-48U	48 ports Cisco UPOE	Modular uplinks	1100W AC
C9300-24UX	24 ports Multigigabit Cisco UPOE (10G/5G/2.5G/1G/100M)	Modular uplinks	1100W AC
C9300-48UXM2	48 ports Cisco UPOE, 36 ports 100M/1G/2.5G + 12 ports Multigigabit (10G/5G/2.5G/1G/100M) ENERGY STAR® certified	Modular uplinks	1100W AC
C9300-48UN	48 port 5Gbps Multigigabit UPOE ports (5G/2.5G/1G/100M)	Modular uplinks	1100W AC
C9300-24UB	24 port Cisco UPOE	Modular uplinks	1100W AC
C9300-24UXB	24 ports Multigigabit Cisco UPOE (10G/5G/2.5G/1G/100M)	Modular uplinks	1100W AC
C9300-48UB	48 ports Cisco UPOE	Modular uplinks	1100W AC
C9300-24H	24 ports Cisco UPOE+	Modular uplinks	1100W AC
C9300-48H	48 ports Cisco UPOE+	Modular uplinks	1100W AC
C9300-24S	24 ports 1G SFP	Modular uplinks	715W AC
C9300-48S	48 ports 1G SFP	Modular uplinks	715W AC

Model	Total 10/100/1000, Multigigabit copper or SFP fiber	Uplink configuration	Default AC power supply
Fixed uplink models			
C9300L-24T-4G	24 ports data	4x 1G fixed uplinks	350W AC
C9300L-24T-4X	24 ports data	4x 10G/1G fixed uplinks	350W AC
C9300L-48T-4G	48 ports data	4x 1G fixed uplinks	350W AC
C9300L-48T-4X	48 ports data	4x 10G/1G fixed uplinks	350W AC
C9300L-24P-4G	24 ports PoE+	4x 1G fixed uplinks	715W AC
C9300L-24P-4X	24 ports PoE+	4x 10G/1G fixed uplinks	715W AC
C9300L-48P-4G	48 ports PoE+	4x 1G fixed uplinks	715W AC
C9300L-48P-4X	48 ports PoE+	4x 10G/1G fixed uplinks	715W AC
C9300L-48PF-4G	48 ports PoE+	4x 1G fixed uplinks	1100W AC
C9300L-48PF-4X	48 ports PoE+	4x 10G/1G fixed uplinks	1100W AC
C9300L-24UXG-4X	24 ports Cisco UPOE, 8 ports Multigigabit (10G/5G/2.5G/1G/100M) + 16 ports 1G (1G/100M/10M)	4x 10G/1G fixed uplinks	1100W AC
C9300L-24UXG-2Q	24 ports Cisco UPOE, 8 ports Multigigabit (10G/5G/2.5G/1G/100M) + 16 ports 1G (1G/100M/10M)	2x 40G fixed uplinks	1100W AC
C9300L-48UXG-4X	48 ports Cisco UPOE, 12 ports Multigigabit (10G/5G/2.5G/1G/100M) + 36 ports 1G (1G/100M/10)	4x 10G/1G fixed uplinks	1100W AC
C9300L-48UXG-2Q	48 ports Cisco UPOE, 12 ports Multigigabit (10G/5G/2.5G/1G/100M) + 36 ports 1G (1G/100M/10M)	2x 40G fixed uplinks	1100W AC

Model	Total 10/100/1000, Multigigabit copper or SFP fiber	Uplink configuration	Default AC power supply
C9300LM-48UX-4Y	48 port Cisco UPOE, 8 port 10G Multigigabit (10G/5G/2.5G/1G/100M) + 40 port 1G (1G/100M/10M)	4x 25G fixed uplinks	1000W AC[1]
C9300LM-48U-4Y	48 ports 1G (1G/100M/10M) with Cisco UPOE	4x 25G fixed uplinks	1000W AC[1]
C9300LM-24U-4Y	24 ports 1G (1G/100M/10M) with Cisco UPOE	4x 25G fixed uplinks	600W AC[1]
C9300LM-48T-4Y	48 ports 1G (1G/100M/10M) Data	4x 25G fixed uplinks	600W AC[1]

[1] C9300LM models use different power supplies compared to the Catalyst 9300, 9300X, and 9300L models.

[2] ENERGY STAR certified model.

Network modules

Cisco Catalyst 9300 Series Switches (C9300X and C9300 SKUs) support optional network modules for uplink ports (Figures 2 and 3). These field-replaceable network modules with 25G and 40G speeds in the Cisco Catalyst 9300 Series enable greater architectural flexibility and infrastructure investment protection by allowing a nondisruptive migration from 10G to 25G and beyond. 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 3.

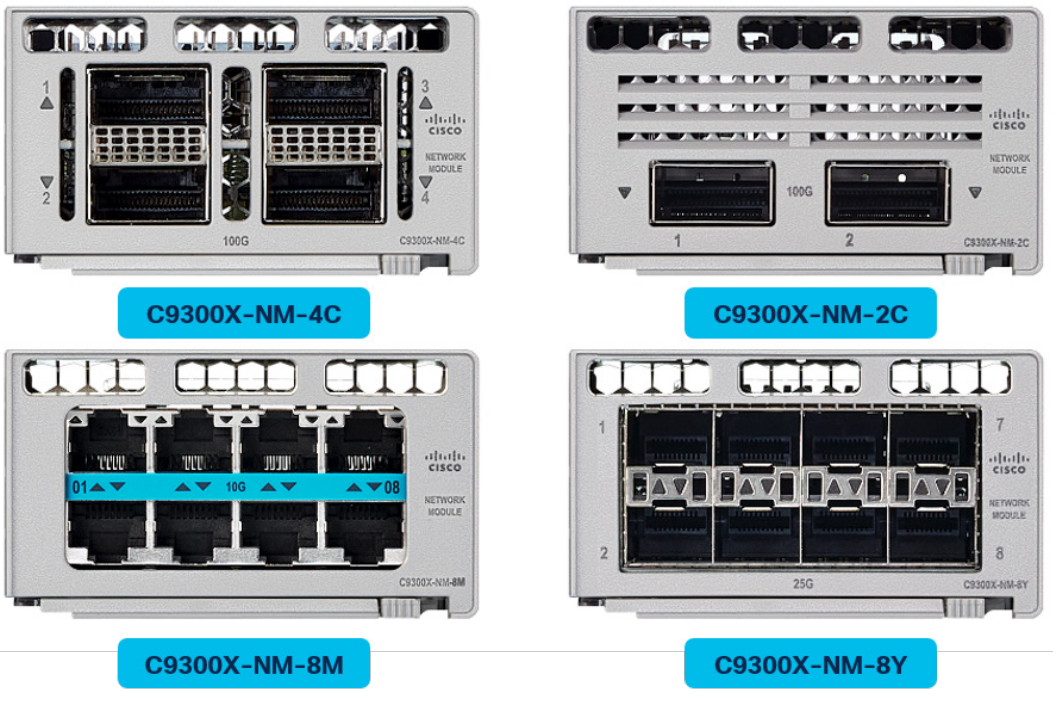

Figure 2. Cisco Catalyst 9300X network modules

Figure 3. Cisco Catalyst 9300 Series network modules

Table 3. Network module numbers and descriptions

Network module	Description
C9300X-NM-8M**	Catalyst 9300X 8x 10G/1G Multigigabit Network Module
C9300X-NM-8Y**	Catalyst 9300X 8x 25G/10G/1G Network Module
C9300X-NM-2C**	Catalyst 9300X 2x 100G/40G Network Module
C9300X-NM-4C*	Catalyst 9300X 4x 100G/40G Network Module
C9300-NM-4G	Catalyst 9300 Series 4x 1G Network Module
C9300-NM-4M	Catalyst 9300 Series 4x Multigigabit Network Module
C9300-NM-8X	Catalyst 9300 Series 8x 10G/1G Network Module
C9300-NM-2Q	Catalyst 9300 Series 2x 40G Network Module
C9300-NM-2Y	Catalyst 9300 Series 2x 25G/10G/1G Network Module

* C9300X-NM-4C is compatible only with the C9300X-48HX, C9300X-48TX, and C9300X-24Y models.

** The number of network module ports is limited when a C9300X-NM-xx is used with the C9300X-48HXN models.

Please note: Catalyst 3850 and Catalyst 9300 network modules are supported on the Catalyst 9300 models. Catalyst 9300X network modules are supported only on the Catalyst 9300X models.

For additional details, please read the Cisco Catalyst 9000 Switching Platform FAQ: https://www.cisco.com/c/dam/en/us/products/collateral/switches/catalyst-9300-series-switches/nb-09-cat-9k-faq-cte-en.pdf.

Power supplies

Cisco Catalyst 9300 Series Switches support dual redundant power supplies. The switches ship with one power supply by default, and the second power supply can be purchased when 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 three field-replaceable fans. Power supplies are common across the Catalyst 9300 Series.

Figure 4. Cisco Catalyst 9300 Series dual redundant power supplies

Table 4 lists the different power supplies available in these switches and available PoE power.

Table 4. Power supply models

Model	Primary power supply	Default or upgrade	Available PoE	With 350W secondary PS	With 715W secondary PS	With 1100W secondary PS	With 1900W secondary PS
C9300X-48HX	PWR-C1-1900WAC-P	Upgrade	1390W	1740W	2105W	2490W	3290W
	PWR-C1-1100WAC-P	Default	590W	940W	1305W	1690W	2490W
C9300X-48TX	PWR-C1-715WAC-P	Default	No PoE	No PoE	No PoE	No PoE	No PoE
C9300X-48HXN	PWR-C1-1900WAC-P	Upgrade	1490W	1840W	2205W	2590W	3390W
	PWR-C1-1100WAC-P	Default	690W	1040W	1405W	1790W	2590W
C9300X-24HX	PWR-C1-1900WAC-P	Upgrade	1535W	1885W	2160W*	2160W*	2160W*
	PWR-C1-1100WAC-P	Default	735W	1085W	1450W	1835W	2160W*
C9300X-24Y	PWR-C1-715WAC-P	Default	No POE	No PoE	No PoE	No PoE	No PoE
C9300X-12Y	PWR-C1-715WAC-P	Default	No PoE	No PoE	No PoE	No PoE	No PoE
C9300-48H	PWR-C1-1900WAC-P	Upgrade	1622W	1972W	2337W	2722W	2880W
	PWR-C1-1100WAC-P	Default	822W	1172W	1537W	1922W	2722W
C9300-24H	PWR-C1-1900WAC-P	Upgrade	1630W	1980W	2160W*	2160W*	2160W*
	PWR-C1-1100WAC-P	Default	830W	1180W	1545W	1930W	2160W
C9300-48UN	PWR-C1-1900WAC-P	Upgrade	1445W	1795W	2160W	2545W	2880W*
	PWR-C1-1100WAC-P	Default	645W	995W	1360W	1745W	2545W

Model	Primary power supply	Default or upgrade	Available PoE	With 350W secondary PS	With 715W secondary PS	With 1100W secondary PS	With 1900W secondary PS
C9300-48UXM	PWR-C1-1900WAC-P	Upgrade	1290W	1640W	2005W	2880W*	2880W*
	PWR-C1-1100WAC-P	Default	490W	840W	1205W	1590W	2390W
C9300-24UX	PWR-C1-1900WAC-P	Upgrade	1360W	1440W*	1440W*	1440W*	1440W*
	PWR-C1-1100WAC-P	Default	560W	910W	1275W	1440W*	1440W*
C9300-48U	PWR-C1-1900WAC-P	Upgrade	1622W	1800W**	1800W**	1800W**	1800W**
	PWR-C1-1100WAC-P	Default	822W	1172W	1537W	1800W**	1800W**
C9300-24U	PWR-C1-1900WAC-P	Upgrade	1440W*	1440W*	1440W*	1440W*	1440W*
	PWR-C1-1100WAC-P	Default	830W	1180W	1152W	1440W*	1440W*
C9300-48P	PWR-C1-1100WAC-P	Upgrade	822W	1172W	1440W*	1440W*	1440W*
	PWR-C1-715WAC-P	Default	437W	787W	1152W	1440W*	1440W*
C9300-24P	PWR-C1-1100WAC-P	Upgrade	720W*	720W*	720W*	720W*	720W*
	PWR-C1-715WAC-P	Default	445W	720W*	720W*	720W*	720W*
C9300-48T	PWR-C1-350WAC-P***	Default	No PoE	No PoE	No PoE	No PoE	No PoE
C9300-24T	PWR-C1-350WAC-P***	Default	No PoE	No PoE	No PoE	No PoE	No PoE
C9300-48S	PWR-C1-715WAC-P	Default	No PoE	No PoE	No PoE	No PoE	No PoE
C9300-24S	PWR-C1-715WAC-P	Default	No POE	No POE	No PoE	No PoE	No PoE
C9300-48UB	PWR-C1-1100WAC-P	Default	822W	1172W	1537W	1800W**	1800W**
C9300-24UB	PWR-C1-1100WAC-P	Default	830W	1180W	1440W*	1440W*	1440W*
C9300-24UXB	PWR-C1-1100WAC-P	Default	560W	910W	1275W	1440W*	1440W*

Model	Primary power supply	Default or upgrade	Available PoE power	With 350W secondary PS	With 715W secondary PS	With 1100W secondary PS
C9300L-24T-4G	PWR-C1-350WAC-P	Default	No PoE	No PoE	No PoE	No PoE
C9300L-24T-4X	PWR-C1-350WAC-P	Default	No PoE	No PoE	No PoE	No PoE
C9300L-48T-4G	PWR-C1-350WAC-P	Default	No PoE	No PoE	No PoE	No PoE

Model	Primary power supply	Default or upgrade	Available PoE power	With 350W secondary PS	With 715W secondary PS	With 1100W secondary PS
C9300L-48T-4X	PWR-C1-350WAC-P	Default	No PoE	No PoE	No PoE	No PoE
C9300L-24P-4G	PWR-C1-715WAC-P	Default	505W	720W*	720W*	720W*
C9300L-24P-4X	PWR-C1-715WAC-P	Default	505W	720W*	720W*	720W*
C9300L-48P-4G	PWR-C1-715WAC-P	Default	505W	855W	1220W	1440W*
C9300L-48P-4X	PWR-C1-715WAC-P	Default	505W	855W	1220W	1440W*
C9300L-48PF-4G	PWR-C1-1100WAC-P	Default	890W	1240W	1440W	1440W*
C9300L-48PF-4X	PWR-C1-1100WAC-P	Default	890W	1240W	1440W	1440W*
C9300L-24UXG-4X	PWR-C1-1100WAC-P	Default	880W	1230W	1440W	1440W*
C9300L-24UXG-2Q	PWR-C1-1100WAC-P	Default	722W	1072W	1440W	1440W*
C9300L-48UXG-4X	PWR-C1-1100WAC-P	Default	675W	1025W	1390W	1775W
C9300L-48UXG-2Q	PWR-C1-1100WAC-P	Default	675W	1025W	1390W	1775W

*** Limited by port number and port rating (e.g., 24 PoE+ 30W ports = 720W).**

**** Limited by design.**

***** Upgrade options for 715W and 1100W PSUs are available.**

Model	Primary power supply	Default or upgrade	Available PoE power	With 600W AC secondary PS	With 715W DC secondary PS	With 1000W AC secondary PS
C9300LM-48UX-4Y	PWR-C6-1KWAC	Default	790W	1390W	1505W	1790W
C9300LM-48U-4Y	PWR-C6-1KWAC	Default	790W	1390W	1505W	1790W*
C9300LM-24U-4Y	PWR-C6-1KWAC	Upgrade	820W	1420W	1440W*	1440W*
	PWR-C6-600WAC	Default	420W	1020W	1135W	1420W
C9300LM-48T-4Y	PWR-C6-600WAC	Default	No PoE	No PoE	No PoE	No PoE

*** Limited by port number and port rating (e.g. 24x 60W UPOE ports = 1440W).**

Stacking

Cisco Catalyst 9300 Series Switch models are designed for stacking as a single virtual switch, enabling customers to have a single management plane and control plane for up to 448 access ports.

Figure 5. Cisco Catalyst 9300 Series modular uplink models stack (C9300/C9300X SKUs) and fixed uplink models stack (C9300L SKUs).

Table 5 lists the supported stacking options.

Table 5. Supported stacking options

Model	Stacking support	Stacking bandwidth support	Optional stacking hardware	Number of members	Supported stack members
C9300X SKUs	StackWise-1T	1 Tbps	StackWise cable	8	Stacks with other Catalyst 9300X models at StackWise-1T speeds with same license level Stacks with C9300 SKUs at StackWise-480 speeds with same license level
C9300 SKUs	StackWise-480	480 Gbps	StackWise cable	8	Other C9300 SKUs with same license level C9300 higher-scale SKUs only stack with other like higher-scale models
C9300L SKUs	StackWise-320	320 Gbps	C9300L-STACK-KIT Or C9300L-STACK-KIT2	8	Stacks with other Catalyst 9300L and 9300LM models with same license level
C9300LM SKUs	StackWise-320	320 Gbps	C9300L-STACK-KIT2	8	Stacks with other Catalyst 9300L and 9300LM models with same license level

Mixed stacking between Catalyst 9300X and Catalyst 9300 models are supported at StackWise-480 speeds.

Mixed stacking between Catalyst 9300 and Catalyst 9300X and Catalyst 9300 higher-scale models (C9300-24UB, C9300-24UXB, C9300-48UB) is **not supported**. You cannot stack fixed uplink models (C9300L SKUs) with modular uplink models (C9300 SKUs) or other Catalyst switches, such as the Cisco Catalyst 3850 and 3650 Series. Any combination of Catalyst 9300 Series models can form a stack. Separately, any combination of Catalyst 9300L models can form a stack.

Catalyst 9300 Series higher-scale SKUs (C9300-24UB, C9300-24UXB, C9300-48UB) need to be stacked with other higher-scale models.

StackWise cables that are available to configure stacking with Catalyst 9300 Series modular uplink models (C9300X and C9300 SKUs) come in lengths of 0.5m, 1m, and 3m.

The optional StackWise-320 kit for Catalyst 9300 Series fixed uplink models (C9300L and 9300LM SKUs) consists of two stack adapters and a stacking cable. The default stacking cable is 0.5m, but options of 1m and 3m are also available. Table 6 lists the stacking accessories.

Table 6. Stacking accessories

Model	Description
STACK-T1-50CM	Data stack 50 cm (cable option with C9300 and C9300X SKUs)
STACK-T1-1M	Data stack 1m (cable option with C9300 and C9300X SKUs)
STACK-T1-3M	Data stack 3m (cable option with C9300 and C9300X SKUs)
C9300L-STACK-KIT	Stack kit for C9300L SKUs only: Two data stack adapters and one data stack cable
STACK-T3-50CM	Data stack 50cm cable (default cable with C9300L Stack Kit)
STACK-T3-1M	Data stack 1m cable (cable option with C9300L Stack Kit)
STACK T3-3M	Data stack 3m cable (cable option with C9300L Stack Kit)
C9300L-STACK-KIT2	Stack kit for C9300LM and C9300L SKUs: Two data stack adapters and one data stack cable
STACK-T3A-50CM	Data stack 50cm cable (default cable with C9300L Stack Kit2)
STACK-T3A-1M	Data stack 1m cable (cable option with C9300L Stack Kit2)
STACK T3A-3M	Data stack 3m cable (cable option with C9300L Stack Kit2)

Figure 6. Cisco Catalyst 9300 Series fixed uplink models with optional stack kit

Fan

Cisco Catalyst 9300 Series Switches also come with three field-replaceable fans and support (N+1) redundancy. Table 7 lists the fan module part number.

Table 7. Fan module

Model	Description
FAN-T2=	Fan module

Performance and scalability

Performance and scalability metrics for the Cisco Catalyst 9300 Series are provided in Table 8.

Performance specifications

Table 8. Performance specifications

Description	Catalyst 9300X modular uplink models	Catalyst 9300 modular uplink models	Catalyst 9300 higher-scale models	Catalyst 9300L/LM fixed uplink models
Total number of MAC addresses	32,000	32,000	64,000	32,000
Total number of IPv4 routes (ARP plus learned routes)	39,000 (24,000 direct routes and 15,000 indirect routes)	32,000 (24,000 direct routes and 8000 indirect routes)	112,000 (48,000 direct routes and 64,000 indirect routes)	32,000 (24,000 direct routes and 8000 indirect routes)
IPv6 routing entries	19,500	16,000	56,000	16,000
Multicast routing scale	8,000	8,000	16,000	8,000
QoS scale entries	4,000	5,120	18,000	5,120
ACL scale entries	8,000	5,120	18,000	5,120

Description	Catalyst 9300X modular uplink models	Catalyst 9300 modular uplink models	Catalyst 9300 higher-scale models	Catalyst 9300L/LM fixed uplink models
Packet buffer per SKU	16-MB buffer for 48-port 5G Multigigabit, 24-port 10G Multigigabit and 12-port fiber 32-MB buffer for 48-port 10G Multigigabit and 24-port fiber	16-MB buffer for 24- or 48-port Gigabit Ethernet models 32-MB buffer for 24- and 48-port Multigigabit	32-MB buffer for 24-and 48-port Gigabit Ethernet models 64-MB buffer for 24-port Multigigabit model (24UXB)	16-MB buffer for 24- and 48-port Gigabit Ethernet models
FNF entries	64,000 flows on 48-port 5G Multigigabit and 24-port 10G Multigigabit and 12-port fiber 128,000 flows on 48-port 10G Multigigabit and 24-port fiber	64,000 flows on 24-and 48-port Gigabit Ethernet models 128,000 flows on 24-port Multigigabit	128,000 flows on 24-and 48-port Gigabit Ethernet models 256,000 flows on 24-port Multigigabit	64,000 flows on 24-and 48-port Gigabit Ethernet models
DRAM	16 GB	8 GB	8 GB	8 GB
Flash	16 GB	16 GB	16 GB	16 GB
VLAN IDs	4094	4094	4094	4094
PVST Instances	300	300	300	300
STP virtual ports (port* VLANs) for PVST	13,000	13,000	13,000	13,000
STP virtual ports (port* VLANs) for MST	13,000	13,000	13,000	13,000
Total switched virtual interfaces (SVIs)	1000	1000	1000	1000
Jumbo frames	9198 bytes	9198 bytes	9198 bytes	9198 bytes
Total routed ports per Catalyst 9300 Series stack	448	448	448	416

Bandwidth specifications

Table 9. Bandwidth specifications

SKU	Switching capacity	Switching capacity with stacking	Forwarding rate	Forwarding rate with stacking
C9300X-48TX	1,760 Gbps	2,760 Gbps	1309 Mpps	2232 Mpps
C9300X-48HX	1,760 Gbps	2,760 Gbps	1309 Mpps	2232 Mpps
C9300X-48HXN	960 Gbps	1960 Gbps	714.24 Mpps	1458.24 Mpps
C9300X-24HX	800 Gbps	1,880 Gbps	654.72 Mpps	1398.72 Mpps
C9300X-12Y	1000G	2000G	744Mpps	1488mpps
C9300X-24Y	2,000 Gbps	3,000 Gbps	1488 Mpps	2232 Mpps
C9300-24T	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48T	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps
C9300-24P	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48P	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps
C9300-24U	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48U	256 Gbps	736 Gbps	190.48 Mpps	547.62 Mpps
C9300-24UX	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-48UXM	580 Gbps	1060 Gbps	431.54 Mpps	788.69 Mpps
C9300-48UN	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-24UB	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48UB	256 Gbps	736 Gbps	190.48 Mpps	547.62 Mpps
C9300-24UXB	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-24H	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48H	256 Gbps	736 Gbps	190.48 Mpps	547.62 Mpps
C9300-24S	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48S	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps

SKU	Switching capacity	Switching capacity with stacking	Forwarding rate	Forwarding rate with stacking
C9300X-12Y	1,000 Gbps	2,000 Gbps	744.04 Mpps	1488 Mpps
C9300X-24Y	2,000 Gbps	3,000 Gbps	1488 Mpps	2232 Mpps
C9300LM-48UX-4Y	440 Gbps	760 Gbps	327.36 Mpps	565.44 Mpps
C9300LM-48U-4Y	296 Gbps	616 Gbps	220.22 Mpps	458.30 Mpps
C9300LM-24U-4Y	248 Gbps	568 Gbps	184.51 Mpps	422.59 Mpps
C9300LM-48T-4Y	296 Gbps	616 Gbps	220.22 Mpps	458.30 Mpps
C9300L-24T-4G	56 Gbps	376 Gbps	41.66 Mpps	279.76 Mpps
C9300L-24T-4X	128 Gbps	448 Gbps	95.23 Mpps	333.33 Mpps
C9300L-48T-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48T-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-24P-4G	56 Gbps	376 Gbps	41.66 Mpps	279.76 Mpps
C9300L-24P-4X	128 Gbps	448 Gbps	95.23 Mpps	333.33 Mpps
C9300L-48P-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48P-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-48PF-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48PF-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-24UXG-4X	272 Gbps	592 Gbps	202.38 Mpps	440.47 Mpps
C9300L-24UXG-2Q	352 Gbps	672 Gbps	261.90 Mpps	500.00 Mpps
C9300L-48UXG-4X	392 Gbps	712 Gbps	291.66 Mpps	529.76 Mpps
C9300L-48UXG-2Q	472 Gbps	792 Gbps	351.19 Mpps	589.28 Mpps

All models are at wire-speed nonblocking performance for both IPv4 and IPv6. The forwarding rates in the table above are measured with 64-byte IPv4 packet sizes.

SD-Access architecture

What if you could give time back to IT? Provide network access in minutes for any user or device to any application – without compromise? SD-Access provides the industry's first policy-based automation from network edge to cloud. Your foundation for your digital network, Cisco SD-Access. Built on the principles of Cisco DNA, SD-Access provides end-to-end segmentation to keep user, device, and application traffic separate without a redesign of the network. It automates user access policy so organizations can make sure the right policies are set for any user or device with any application across the network. This is accomplished with a single network fabric across LAN and WLAN, which creates a consistent user experience anywhere without compromising on security.

There are many challenges today in managing the network to drive business outcomes. These limitations are due to manual configuration and fragmented tool offerings. SD-Access provides:

- A transformational management solution that reduces operational expenses and enhances business agility
- Consistent management of wired and wireless network provisioning and policy
- Automated network segmentation and group-based policy
- Contextual insights for fast issue resolution and capacity planning
- Open and programmable interfaces for integration with third-party solutions

For an overview of the key use cases SD-Access addresses, refer to the SD-Access Solution Overview.

Platform benefits

Cisco IOS XE 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 automation mechanisms are outlined below.

- **Automated device provisioning** 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 PnP 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** is available with modern network switches such as the Cisco Catalyst 9300 Series. It supports a wide range of automation features and provides robust open APIs over NETCONF, RESTCONF, and GNMI using YANG data models for external tools, both off-the-shelf and custom built, to automatically provision network resources.
- **Granular visibility** enables model-driven telemetry to stream data from a switch to a destination. The data to be streamed is identified through subscription to a data set in a YANG model. The subscribed data set is streamed to the destination at specified intervals. Additionally, Cisco IOS XE enables the push model. It provides near-real-time monitoring of the network, leading to quick detection and rectification of failures.
- **Seamless software upgrades and patching** supports OS resilience. Cisco IOS XE supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This support lets you add patches without having to wait for the next maintenance release.

Security

- **Encrypted Traffic Analytics (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 affords for threat detection is critical for keeping your network secure at different layers.
- **AES-256 MACsec encryption** is the IEEE 802.1AE standard for authenticating and encrypting packets between switches. The Cisco Catalyst 9300 Series Switches support 256-bit and 128-bit AES, providing the most secure link encryption.
- **IPsec encryption** delivers secure end-to-end encrypted traffic between sites and connectivity to the Cloud. Catalyst 9300X models support line-rate IPsec up to 100 Gbps, delivering uncompromised secure connectivity.
- **Trustworthy solutions built with Cisco Trust Anchor technology** provide a highly secure foundation for Cisco products. With the Catalyst 9300 Series, this technology enables hardware and software authenticity assurance for supply chain trust and strong mitigation against man-in-the-middle attacks that compromise 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. This provides assurance that the product is genuine.

Cloud Security

- **Cisco Umbrella® DNS integration:**

  Small to midsize networks reliant on managed service providers can now host the Cisco Umbrella agent directly on their Catalyst 9300 Series Switches. This allows the business to easily customize its DNS filtering policies granularly at the user or group level to prevent bring-your-own-device (BYOD) or IoT guest or corporate users from accessing malicious or inappropriate websites, without having to rely on the service provider to push the policies out. It also lets the business optimize use of bandwidth by allowing direct cloud access for trusted apps. Requires a Cisco Catalyst and Cisco DNA Advantage license and Cisco Umbrella license per device.

- **Cisco ASAc app hosting integration:**

  The integration of ASAc on Cisco Catalyst 9000 switches simplifies the network design by providing the flexibility to plug small-form-factor firewalls into the network closer to the source. It also avoids complex tunnels to centralized firewalls. This design lowers the total cost of ownership by reducing the number of physical firewall appliances in the network.

  The ASAc Firewall App hosting solution hosts a virtual firewall or ASAc on Cisco Catalyst 9300 Series Switches. All the physical firewalls next to a switch can be virtualized and deployed on the switch itself. As in a traditional network, the SecOps team manages the ASAc firewalls deployed on the Catalyst switches, and the NetOps team instantiates the application and performs lifecycle management using Cisco Catalyst Center. The SecOps team controls policy management using Cisco Defense Orchestrator. Both the SecOps and NetOps teams can seamlessly manage the network without any disruptions.

  The container version of Cisco ASAc provides full firewall functionality to secure IT, OT, and IoT converged networks. ASAc uses Layer 3 firewall policies and does a stateful inspection of the traffic.

  The ASAc firewall runs on a 240-GB external SSD that is mounted on a Cisco Catalyst 9300 Series Switch. Cisco Catalyst Center deploys the ASAc on these Catalyst switches, and ASAc is then onboarded to Cisco Defense Orchestrator.

Service assurance

- **Cisco ThousandEyes integration:**

Deliver a superior network and service experience for your users, employees, and partners with groundbreaking observability from network to app. Cisco ThousandEyes network tests are now integrated into Cisco Catalyst 9300 Series Switches with Cisco Catalyst and Cisco DNA Advantage licenses, giving you visibility beyond your campus

perimeter so you can resolve issues faster. The Cisco ThousandEyes Network and Application Synthetics license is included by default upon the selection of a Cisco Catalyst and Cisco DNA Advantage option with a 3-year, 5-year, or 7-year subscription. Please see Cisco Catalyst and DNA Advantage Use Right to ThousandEyes for more information about the free Cisco ThousandEyes entitlements that come with your Cisco Catalyst 9300 or 9400 Series switch's Cisco DNA Advantage subscription.

Resiliency and high availability

- **StackWise-1T:** Cisco Catalyst 9300 Series modular uplink models (C9300X SKUs) support the industry's highest back-panel stacking bandwidth solution (1 Tbps) with StackWise-1T. Up to eight switches can be configured in a StackWise-1T with the special connector at the back of the switch, using dedicated stack cables.
- **StackWise-480:** Cisco Catalyst 9300 Series modular uplink models (C9300 SKUs) support a high-speed back-panel stacking bandwidth solution (480 Gbps) with StackWise-480. Up to eight switches can be configured in a StackWise-480 with the special connector at the back of the switch, using dedicated stack cables.
- **StackWise-320:** Cisco Catalyst 9300 Series fixed uplink models (C9300L and C9300LM SKUs) support a stacking bandwidth solution (320 Gbps) with StackWise-320. Up to eight switches can be optionally configured in a StackWise-320 with the special stack kit at the back of the switch, using dedicated stack cables.
- **Cisco StackPower:** Cisco StackPower is an innovative power interconnect system that allows the power supplies in a stack to be shared as a common resource among all the switches. This allows you to simply add one extra power supply in any switch of the stack and either provide power redundancy for any of the stack members or simply add more power to the shared pool. Up to four switches can be configured in a StackPower stack with the special connector at the back of the switch. However, with the use of the XPS-2200 appliance, up to eight switches can be configured in the StackPower stack. **Cisco StackPower is supported only on the models with a modular uplink stack – C9300 and C9300X SKUs. Catalyst 9300X models support StackPower+, delivering more power over StackPower cables compared to the Catalyst 9300 models.**

Figure 7. Cisco Catalyst 9300 Series StackPower

- **High availability:** The Catalyst 9300 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.

- **Flexlink+:** Flexlink+ allows you to set up active and backup interfaces or port channels, which can provide Layer 2 failover redundancy without the use of Spanning Tree Protocol (STP).
- **Extended fast software upgrade** provides the ability to upgrade the platform software or to reload the system in under 30 seconds of traffic impact, in both standalone and stack configurations.
- 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 auto-recovery ("err-disable" recovery) automatically attempts to reactivate a link that is disabled because of a network error.
- The Catalyst 9300 Series platform delivers an industry-leading non-stop forwarding (NSF)/stateful switchover (SSO) resiliency architecture in a stackable solution with sub-50-ms failover.
- Always-on wireless network with stateful switchover when wireless functionality is enabled on stack of Catalyst 9300 Series Switches.

Deep buffer technology

The Catalyst 9300 Series higher-scale models have a deeper buffer to address the requirements of rich multimedia lossless content delivery and large routing tables in a fixed access solution with a wide range of uplink choices for deployment flexibility.

Flexible NetFlow

- Cisco IOS Software FNF is the next generation in flow visibility technology. It enables optimization of the network infrastructure, reduces operating costs, and improves capacity planning and security incident detection with increased flexibility and scalability. The Catalyst 9300 Series is capable of up to 64,000 flow entries on 48-port, 24-port, and 12-port models and up to 128,000 flow entries on Multigigabit models.

Application visibility and control

- Next-Generation Network-Based Application Recognition (NBAR2) enables advanced application classification techniques, up to 1400 predefined and well-known application signatures, and up to 150 encrypted applications on the Cisco Catalyst 9000 switches. Some of the most popular applications included are Skype, Office 365, Microsoft Lync, Webex, and Facebook, among many others that are 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. NBAR2 leverages FNF to report application performance and activities within the network to any supported NetFlow collector, such as Cisco Prime®, Cisco Secure Network Analytics, or any compliant third-party tool.

QoS

- **Superior QoS:** The Cisco Catalyst 9300 Series offers Gigabit Ethernet speeds 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 at wire speed. Superior QoS 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, Committed Information Rate (CIR), and eight egress queues per port.

Service discovery

- **Multicast DNS (mDNS) gateway:** This service discovery gateway capability facilitates 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 BYOD rollout.

Smart operation

- **Simplified Campus Automation** is designed to optimize the discovery and configuration of devices in your network with a more streamlined simple and easy-to-use automation tool. With features such as simplified discovery, IT can discover devices within the network with just a few steps. Also available is a more streamlined GUI that provides a simplified view of switch configurations and software details on a port-by-port basis.

  Cloud management with IOS XE: Cloud management with IOS XE simplifies network operations by providing a centralized, intuitive dashboard that enables IT teams to manage, configure, and monitor all devices in real time. With features like zero-touch provisioning, automated firmware updates, and port-level visibility, cloud management reduces manual effort, minimizes errors, and delivers end-to-end visibility across the network.

  The Cisco Catalyst 9300 Series Switches provide flexibility in cloud management by offering the ability to choose the configuration source of each device managed from the Meraki dashboard.

  Configuration Source: Cloud: This operating mode offers the full cloud management experience. Device configurations are managed via the Meraki user interface and delivered entirely from the cloud. This capability also offers a read-only Cloud CLI terminal to view the entire running configuration or perform advanced troubleshooting using IOS XE show commands.

  Configuration Source: Device: This capability is an evolution of Cloud Monitoring. With device configuration, users can onboard their device to the cloud to access central monitoring and troubleshooting tools, as well as a Cloud CLI terminal to execute read/write commands. Configurations are managed via local console, Secure Shell (SSH), or CLI and remain local to the device.

  To learn more about cloud management with IOS XE, see Cloud Management with IOS XE.

- **Meraki dashboard monitoring and management:** Catalyst 9300 Series Switches can be ordered or migrated to be Meraki dashboard managed, combining the simplicity of the Meraki dashboard with the power of Catalyst 9000 switching. All configuration and monitoring is performed natively in the dashboard.

- **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. It comes with the default image, so there is no need to enable anything or install any license on the device. You can use WebUI to build configurations, and to monitor and troubleshoot the device without having CLI expertise.
- **Efficient switch operation*:** Cisco Catalyst 9300 Series Switches provide optimum power saving with Energy Efficient Ethernet (EEE) on the RJ-45 ports and low-power operations for industry best-in-class power management and power consumption capabilities. The ports support reduced power modes so that ports not in use can move into a lower power utilization state. Other efficient switch operation features are as follows:
  - Per-port power consumption command allows customers to specify a maximum power setting on an individual port.
  - Per-port PoE power sensing measures actual power being drawn, enabling more intelligent control of powered devices. The PoE MIB provides proactive visibility into power usage and allows you to set different power-level thresholds.
- **RFID tags:** Catalyst 9300 Series Switches have an embedded RFID tag that facilitates easy asset and inventory management using commercial RFID readers.
- **Blue beacon:** Catalyst 9300 Series Switches support a blue beacon LED for easy identification of the switch being accessed.

Open standards-based fabric

The Cisco Catalyst 9300 Series Switches support modern fabric technologies such as VXLAN with Border Gateway Protocol Ethernet VPN (BGP-EVPN) control plane, with open APIs. This technology provides the flexibility to build open standards-based fabrics to secure infrastructure, users, and data. This fabric architecture provides rich unicast and multicast protocol support to optimally route or bridge traffic as well as support for integrated campus services, all of which can be automated via open APIs to effectively configure and monitor the network.

Programmability

Cisco IOS XE provides open standards-based APIs such as NETCONF, RESTCONF, and gNMI to simplify provisioning and configuration, allowing network administrators to save time when provisioning new network devices and to prevent the human errors that often are a byproduct of manual configuration. Integrating ZTP with various DevOps toolkits allows network administrators to drastically reduce the time and resources needed to onboard a device to their network. The ability to collect real-time statistics through model-driven telemetry through gRPC and gNMI allows administrators to integrate with many health monitoring tools to optimize their environments and to troubleshoot and provide alerts about any potential problems.

High-performance IP routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in the Cisco Catalyst 9300 Series Switches, based on:

- IP unicast routing protocols (including static, Routing Information Protocol version 1 [RIPv1], RIPv2, RIPng, and Open Shortest Path First [OSPF]) 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 (including full OSPF, Enhanced Interior Gateway Routing Protocol [EIGRP], 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 BGPv6) 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.

Audio Video Bridging

Starting with Cisco IOS XE Software Release 16.8, the Cisco Catalyst 9300 Series supports the IEEE 802.1 AVB standard. This standard provided the means for highly reliable delivery of low-latency, time-synchronized audio and video streaming services through Layer 2 Ethernet networks. The standard also makes it easier to integrate new services and for AV equipment from different vendors to interoperate.

Benefits

- Improves quality of experience by lowering jitter and latency for time-synchronized delivery of high-quality AV.
- Provides scalability of applications across networked deployments, including expansive and complex AV infrastructure.
- Lowers total cost of ownership (TCO) with reduced cabling (lowers CapEx) and no license fees (lowers OpEx).

For more details about AVB and specific models supported, see https://www.cisco.com/go/avb.

Multigigabit Ethernet technology

Cisco Multigigabit Ethernet technology allows you to achieve bandwidth speeds from 1 Gbps to 10 Gbps over traditional Category 5e/6 cabling or above. This technology addresses the need for exponential increases in bandwidth with the enormous growth of 802.11ac Wave 2, to be eclipsed by the growth of Wi-Fi 6 and new wireless applications without having to replace current cabling infrastructure.

Multiprotocol Label Switching

The Cisco Catalyst 9300 Series Switches support Multiprotocol Label Switching (MPLS), which combines the performance and capabilities of Layer 2 (data link layer) switching with the proven scalability of Layer 3 (network layer) routing. MPLS enables explosive growth in network utilization while providing the opportunity to differentiate services without sacrificing the existing network infrastructure. MPLS support includes:

- **MPLS Layer 3 VPN:** An MPLS VPN consists of a set of sites that are interconnected by means of an MPLS provider core network. At each customer site, one or more customer edge (CE) devices attach to one or more provider edge (PE) devices.
- **VPLS:** Virtual Private LAN Service (VPLS) enables enterprises to link together their Ethernet-based LANs from multiple sites via the infrastructure provided by their service provider.
- **EoMPLS:** Ethernet over MPLS (EoMPLS) is a category of Any Transport over MPLS (AToM) to transport Layer 2 packets over an MPLS backbone.
- **MPLS over GRE:** L3VPN over Generic Routing Encapsulation (GRE) and VPLS over GRE are supported to tunnel MPLS/VPLS packets over non-MPLS networks using GRE tunneling.

Power over Ethernet leadership

Cisco UPOE and UPOE+: PoE removes the need for wall sockets to power each PoE-enabled device and eliminates the cost of additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. Cisco UPOE extends the IEEE PoE+ standard to double the power per port to 60 watts. This facilitates delivery of network power to a broad range of devices requiring higher power, including virtual desktop terminals, IP turrets, compact switches, building management gateways, LED lights, wireless access points, and IP phones. For even higher-powered devices such as those in smart building and IoT applications, Cisco Catalyst 9300 UPOE+ switches can deliver PoE power up to 90W and. UPOE+ ports provide data and power over a single cable to power devices like wireless access points, digital signage, security cameras, thermal cameras with pan-tilt-zoom features, LED lighting fixtures, and large display screens. UPOE+ offers reduced cabling and installation costs without need for permits, device daisy-chaining, real-time device information, centralized management and remote control, and fast, flexible device installation, enabling devices to be positioned in a practical location instead of Catalyst 9300 Series modular uplink (C9300 and C9300X SKUs) models support Cisco UPOE, PoE+, and PoE, thereby addressing the largest range of network power needs.

Catalyst 9300 Series fixed uplink (C9300L and C9300LM SKUs) models support Cisco UPOE, PoE+, and PoE.

Tables 10 through 13 show the power supply combinations required for different PoE needs.

Table 10. Power supply requirements for Catalyst 9300 Series modular uplink PoE/PoE+ models (C9300-xxP SKUs)

	24-port PoE switch	48-port PoE switch
PoE on all ports (15.4W per port)	1 PWR-C1-715WAC/ PWR-C1-715WAC-P/ PWR-C1-715WDC	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 2 PWR-C1-715WAC/ PWR-C1-715WAC-P/PWR-C1-715WDC

	24-port PoE switch	48-port PoE switch
PoE+ on all ports (30W per port)	1 PWR-C1-1100WAC/ PWR-C1-1100WAC-P or 2 PWR-C1-715WAC/ PWR-C1-715WAC-P/ PWR-C1-715WDC	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 1 PWR-C1-1100WAC/ PWR-C1-1100WAC-P and 1 PWR-C1-715WAC/PWR-C1-715WAC-P/ PWR-C1-715WDC

Table 11. Power supply requirements for Catalyst 9300 Series UPOE models (C9300-xxU/UB/UXM/UN, C9300L-xxUXG-xx SKUs)

	24-port Cisco UPOE switch	48-port Cisco UPOE switch	48- and 24-port Multigigabit Cisco UPOE switch*
Cisco UPOE (60W per port) and IEEE 802.3bt Type 3 on all ports (24-port switch) or up to 30 ports (48-port switch)	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P and 1 PWR-C1-715WAC/PWR-C1-715WAC-P/ PWR-C1-715WDC	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P

Table 12. Power supply requirements for Catalyst 9300 Series UPOE+ models (C9300-xxH SKUs)

	24-port Cisco UPOE+ switch	48-port Cisco UPOE+ switch
Cisco UPOE+ (90W per port) and IEEE 802.3bt Type 4 on 21 ports (24-port and 48-port switch)	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P and 1 PWR-C1-715WAC/PWR-C1-715WAC-P/ PWR-C1-715WDC	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 2 PWR-C1-1900WAC-P

Table 13. Power supply requirements for Catalyst 9300 Series fixed uplink PoE/PoE+ models (C9300L-xxP SKUs)

	24-port PoE switch	48-port PoE switch
PoE on all ports (15.4W per port)	1 PWR-C1-715WAC-P/ PWR-C1-715WDC	1 PWR-C1-1100WAC-P or 2 PWR-C1-715WAC-P
PoE+ on all ports (30W per port)	1 PWR-C1-1100WAC-P or 2 PWR-C1-715WAC-P/ PWR-C1-715WDC	2 PWR-C1-1100WAC-P or 1 PWR-C1-1100WAC-P and 1 PWR-C1-715WAC-P/PWR-C1-715WDC

- **Perpetual PoE:** With Perpetual PoE, the PoE power is maintained during a switch reload. This is important for IoT endpoints such as PoE-powered lights, so that there is no disruption during switch reboot.
- **Fast PoE:** When power is restored to a switch, PoE starts delivering power to endpoints without waiting for the operating system to fully load, thereby speeding up the time for the endpoint to start up.

* C9300-48UN, C9300-24UX, and C9300-48UXM are available with PWR-C1-1100WAC-P, a Platinum-rated power supply. Platinum-rated power supplies are more efficient, lowering operating power costs.

* PWR-C1-1100WAC-UP and PWR-C1-715WAC-UP Platinum-rated power supply upgrade options are available to upgrade the default AC power supply to 1100W or 715W.

Software requirements

Cisco Catalyst and Cisco DNA Software for Access Switching is available for the Cisco Catalyst 9300 Series. Meraki software for cloud management is also available for certain models.

Cisco Catalyst and Cisco DNA Software for Access Switching offers comprehensive solutions for the enterprise campus and branch offices. Cisco Catalyst and Cisco DNA 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 Catalyst and Cisco DNA 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 Catalyst and Cisco DNA Advantage Software with full Cisco DNA capabilities and SD-Access, bundled with ISE Base, ISE Plus, and Secure Network Analytics.

For ordering information for Cisco Catalyst and Cisco DNA Software for the Cisco Catalyst 9300 Series, go to https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html.

Cisco Catalyst 9300 Series Switches run on Cisco IOS XE Release 16.5.1a or later with the following exceptions. Catalyst 9300 Series 1G fiber models (C9300-xxS SKUs) are supported on Cisco IOS XE Release 16.11.1a or later. Catalyst 9300 Series fixed uplink models (C9300L SKUs) are supported on Cisco IOS XE Release 16.11.1b or later. These software releases include all the features listed earlier in the Platform Benefits section.

The Meraki software option combines the simplicity of the Meraki dashboard with power of Catalyst 9000 switching hardware. To satisfy high-bandwidth applications and the deployment of high-speed 802.11ax/ Wi-Fi 6/6E access points, the Meraki software option provides Multigigabit ports, 480G stacking, and modular 10G/40G uplinks. Catalyst 9300 Series models with the Meraki software option deliver resiliency with fast stack convergence and StackPower. They provide Adaptive Policy using an over-the-wire tag that segments traffic into security groups to deliver scalable security. The Catalyst 9300 models integrated under the Meraki dashboard provide a simple, powerful solution to the most demanding wired access applications.

Catalyst 9300 Series Switches come with Adaptive Policy to provide simple and scalable security policies to segment traffic using security groups in Meraki dashboard. Security groups are created in the dashboard using natural language such as “IoT device” and “Guest.” The security policy intent (for example, Permit or Deny) is then simply provisioned between security groups, which results in the segmentation of each group’s traffic. By making security policy management intuitive and scalable relative to legacy IP address-based ACLs, Adaptive Policy empowers operators to confidently secure their network traffic independent of future network changes.

Catalyst 9300 Series Switches can be ordered directly or migrated to the Meraki software option. For model compatibility and more information, please see Getting started: Cisco Catalyst 9300 Management with Meraki Dashboard.

You can also refer to Meraki data sheets that provide details on the models orderable with the Meraki software option (Catalyst C9300-M data sheet, Catalyst C9300X-M data sheet, Catalyst C9300L-M data sheet) as well as supported optics and accessories.

Licensing packaging

The Cisco Catalyst 9000 family of switches introduces a new and simplified licensing package in the form of base and add-on licenses.

- **The perpetual licensing** package includes the Network Essentials and Network Advantage licensing options that are tied to the hardware. Between them, the base licensing packages cover switching fundamentals, management automation, troubleshooting, and advanced switching features. These network licenses are perpetual.

  The subscription licensing package includes the Cisco Catalyst and Cisco DNA Essentials, Cisco Catalyst and Cisco DNA Advantage, and Meraki Advanced and Enterprise options. In addition to on-box capabilities, the features available with this package provide Cisco innovations on the switch, as well as on Cisco Catalyst Center. and Meraki dashboard. For Catalyst 9300 models ordered with a Network Essentials and Network Advantage license, a Cisco Catalyst or Cisco DNA subscription license is mandatory at the time of configuration. For Catalyst 9300 models ordered with a Meraki SKU, the term license is ordered separately but is required for the switch to be recognized in Meraki dashboard. With Cisco Catalyst and Cisco DNA software licenses, customers receive embedded SWSS, which covers 24x7x365 Cisco Technical Assistance Center (TAC) support, software release updates, advanced support analytics, and designated service management. This is valid only for the Cisco Catalyst and Cisco DNA Software subscription stacks (Cisco Catalyst and Cisco DNA Essentials or Advantage).

  Note: For full hardware support, including the perpetual network stack, customers will require Cisco Smart Net Total Care® for 24x7x365 Cisco TAC support, proactive security and product alerts, and product lifecycle management. An additional option for hardware support is Solution Support for your multivendor Cisco solution environment.

License consumption is easily determined by the package itself. While Network Essentials and Network Advantage perpetual licenses are always permanent and without an expiration date, subscription licenses have to be purchased for a 3-, 5-, or 7-year term (and hence are also known as term-based licenses). Table 14 shows the combinations of network perpetual and Cisco Catalyst and Cisco DNA Software subscription licenses that must be purchased.

Table 14. Cisco Catalyst, Cisco DNA, and network licensing combinations

	Cisco Catalyst and Cisco DNA Essentials	Cisco Catalyst and Cisco DNA Advantage
Network Essentials	Yes**	Yes**
Network Advantage	No*	Yes

* At the time of Cisco Catalyst and Cisco DNA license renewal, the Cisco Catalyst and Cisco DNA Essentials license can be purchased to be used with Network Advantage.

** Network Advantage is inclusive of Network Essentials features.

Managing licenses with Smart Accounts

Creating Smart Accounts by using the Cisco Smart Software Manager (SSM) enables you to manage your software licenses from a centralized website. You can set up Cisco SSM to receive daily email alerts and to be notified of expiring subscription licenses that you want to renew.

You must order a Cisco Catalyst or Cisco DNA subscription term license in order to purchase a switch with Network Essentials or Network Advantage perpetual licenses. When the license term expires, you can either renew the add-on license to continue using it or deactivate the add-on license and then reload the switch to continue operating with the base license capabilities.

Both the base and add-on licenses are also available for a 90-day evaluation period. An evaluation license is activated temporarily, without purchase. An expired evaluation license cannot be reactivated after reload.

It is not required to deploy Cisco Catalyst Center just to use Cisco Catalyst, Cisco DNA, or network packages. Meraki dashboard is required to deploy a Catalyst 9300 switch with a Meraki software license.

Introduction to Smart Licensing

Cisco Smart Licensing is a flexible licensing model that provides you with an easier, faster, and more consistent way to purchase and manage software across the Cisco portfolio and across your organization. And it's secure – you control what users can access. With Smart Licensing you get:

- **Easy activation:** Smart Licensing establishes a pool of software licenses that can be used across the entire organization—no more product activation keys (PAKs).
- **Unified management:** My Cisco Entitlements provides a complete view into all of your Cisco products and services in an easy-to-use portal, so you always know what you have and what you are using.
- **License flexibility:** Your software is not node-locked to your hardware, so you can easily use and transfer licenses as needed.

To use Smart Licensing, you must first set up a Smart Account on Cisco Software Central (software.cisco.com).

For a more detailed overview of Cisco Licensing, go to cisco.com/go/licensingguide.

Table 15. Software licenses

	Cisco Catalyst Software subscription	Cisco DNA Software subscription	Cisco Meraki Software subscription	Network stack
Packages[1]	3-, 5-, or 7-year terms	3-, 5-, or 7-year terms	1-, 3-, 5-, 7-, or 10 year terms	Perpetual
Tiers	Advantage, Essentials	Advantage, Essentials	Advanced, Enterprise	Advantage, Essentials
Portability[2]	✓	✓		✓

	Cisco Catalyst Software subscription	Cisco DNA Software subscription	Cisco Meraki Software subscription	Network stack
Management options	Catalyst Center, Meraki dashboard monitoring and management	Catalyst Center, Meraki dashboard monitoring and management	Meraki dashboard management	Meraki dashboard CLI, WebUI
Included support	Base product-level support for hardware, software, and OS	SWSS	Product-level support for hardware, software, and OS	✕
Included[3] add-ons: Common ISE policy, ThousandEyes network and application assurance, Cisco Spaces	✓	✓	✕	✕

[1] For all new orders, subscription licenses are mandatory and must be of the same tier as network licenses.

[2] Portability within the same Catalyst 9000 series of hardware.

[3] Available only with the Advantage tier.

There are three choices for software subscription: Cisco DNA, Cisco Catalyst, or Cisco Meraki. They provide:

- 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 Service (SWSS).
- Base product-level support for hardware, software, and Cisco IOS (Catalyst software only).
- ISE licenses included in the Advantage tier to facilitate zero-trust network security* (Catalyst software only).
- Access to end-to-end network visibility with Cisco Spaces, service assurance through Cisco ThousandEyes Network and Application Synthetics and app hosted ASAc firewall (with the Advantage license).

Manage your entire switching structure as a single, converged component. With one management system, on-premises, virtual, or in the cloud, and one policy for wired and wireless networks, it offers an efficient way to provide more secure access.

Tables 16 and 17 show the features included in the Network Essentials and Advantage packages and in the Cisco Catalyst and Cisco DNA Essentials and Advantage packages.

Table 16. Network Essentials and Advantage package features

Features	Network Essentials	Network Advantage
Switch fundamentals Layer 2, Routed Access (RIP, EIGRP Stub, OSPF - 1000 routes), PBR, PIM Stub Multicast (1000 routes)), PVLAN, VRRP, PBR, CDP, QoS, FHS, 802.1X, MACsec-128, CoPP, SXP, IP SLA Responder, SSO	✓	✓
Advanced switch capabilities and scale BGP, EIGRP, HSRP, IS-IS, BSR, MSDP, PIM-BIDIR,* IP SLA, OSPF	✗	✓
Network segmentation VRF, VXLAN, LISP, Cisco TrustSec®, SGT, MPLS, mVPN	✗	✓
Automation NETCONF, RESTCONF, gRPC, YANG, PnP Agent, ZTP/Open PnP, GuestShell (On-Box Python)	✗	✓
Telemetry and visibility Model-driven telemetry, sampled NetFlow, SPAN, RSPAN	✓	✓
High availability and resiliency Nonstop Forwarding (NSF), Graceful Insertion and Removal (GIR), Extended Fast Software Upgrade (xFSU), Software Patching (CLI based)	✗	✓
IoT integration AVB, PTP, CoAP	✗	✓
Security MACsec-256	✗	✓

Table 17. Cisco Catalyst and Cisco DNA Essentials and Advantage package features (add a section for other software support and add Prime, ISE and Stealthwatch support)

Features	Cisco Catalyst and Cisco DNA Essentials	Cisco Catalyst and Cisco DNA Advantage
Switch features		
Optimized network deployments Cisco Catalyst Service for Bonjour	✗	✓
Advanced telemetry and visibility Full Flexible NetFlow, EEM	✓	✓
Optimized telemetry and visibility ERSPAN, AVC (NBAR2), app hosting (in containers/VMs), Wireshark	✗	✓
Advanced security Encrypted Traffic Analytics (ETA), IPsec	✗	✓
Cisco Catalyst Center features		
Simplified Campus Automation Simplified Campus Automation optimizes the discovery and configuration of devices in your network with a more streamlined simple and easy-to-use automation tool	✓	✓
Day-0 network bring-up automation Cisco Network Plug-and-Play application, network settings, device credentials, LAN automation, host onboarding	✓	✓
Element management Discovery, inventory, topology, software image, licensing, and configuration management	✓	✓
Element management Patch management	✗	✓
Basic Assurance Health dashboards – Network, Client, Application; switch and wired client health monitoring	✓	✓

Features	Cisco Catalyst and Cisco DNA Essentials	Cisco Catalyst and Cisco DNA Advantage
Cisco ThousandEyes Network and Application Synthetics Network performance metrics, dashboarding, visibility into app and service experience, end-to-end visibility across cloud and DC applications	✕	✓
App hosted Cisco ASAc firewall Stateful inspection of network traffic with Cisco Adaptive Security Virtual Appliance (ASAc) without any additional hardware	✕	✓
SD-Access Policy-based automation and assurance for wired and wireless	✕	✓
Network assurance and analytics Global insights, trends, compliance, custom reports; switch 360, wired client 360; fabric and non-fabric insights; app health, app 360, app performance (loss, latency, jitter)	✕	✓

Catalyst 9300 Series Switches can be migrated into Meraki mode (fully cloud managed). For model compatibility and more information, see Getting Started: Cisco Catalyst 9300 Management with Meraki Dashboard: https://documentation.meraki.com/MS/Deployment_Guides/Getting_started%3A_Cisco_Catalyst_9300_Management_with_Meraki_Dashboard.

Catalyst switches can also be ordered in Meraki mode by using the “-M” part numbers. For ordering information for Cisco C9300\L\X-M switches, please refer to the Meraki data sheets listing -M part numbers.

Meraki data sheets:

- Catalyst 9300-M data sheet
- Catalyst 9300X-M data sheet
- Catalyst 9300L-M data sheet
- Catalyst C9300/X/L-M Installation Guide
- SFP and Stacking Accessories for Meraki C9300/X/L-M Switches