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Cisco Catalyst 4500E Supervisor Engine 9-E

Overview

The Cisco[®] Digital Network Architecture (Cisco DNA[™]) with Software-Defined Access (SD-Access) is the most advanced network fabric to power customer business. Cisco DNA 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

The Cisco Catalyst[®] 4500E Supervisor Engine 9-E (Figure 1) is the next generation of enterprise-class switching engine. The Cisco Unified Access[™] Data Plane (UADP) Application-Specific Integrated Circuit (ASIC) powers fabric-enabled wireless and helps enable uniform wired and wireless policy enforcement, application visibility, flexibility, and application optimization.

The Cisco Catalyst 4500E Supervisor Engine 9-E is an enterprise-class access and aggregation supervisor engine designed to provide up to 928 Gbps of wired access per system with an E-Series chassis. It also supports up to 20 Gbps of wireless termination. The Supervisor Engine 9-E provides 48 Gbps per slot with Flexible NetFlow (FNF), integrated Wireshark, and advanced security, combined with reduced Total Cost of Ownership (TCO) and excellent investment protection. These capabilities, along with four 10 Gigabit Ethernet and two 40 Gigabit Ethernet uplink ports and 384 10/100/1000 access ports with Power over Ethernet (PoE), PoE Plus (PoE+), and Cisco Universal PoE (Cisco UPOE[®]), make this supervisor engine the leading Cisco access supervisor engine in the Cisco Catalyst Family. Supervisor Engine 9-E facilitates user experiences for enterprise, public sector, midmarket, and commercial customer business-critical applications.

Backward and forward compatibility with most existing Cisco Catalyst 4500 and 4500E Series line cards and power supplies helps assure greater customer satisfaction with an industry-leading investment protection architecture. The Supervisor Engine 9-E is supported in Cisco Catalyst 4500E Series chassis.

Figure 1.   Cisco Catalyst 4500E Supervisor Engine 9-E
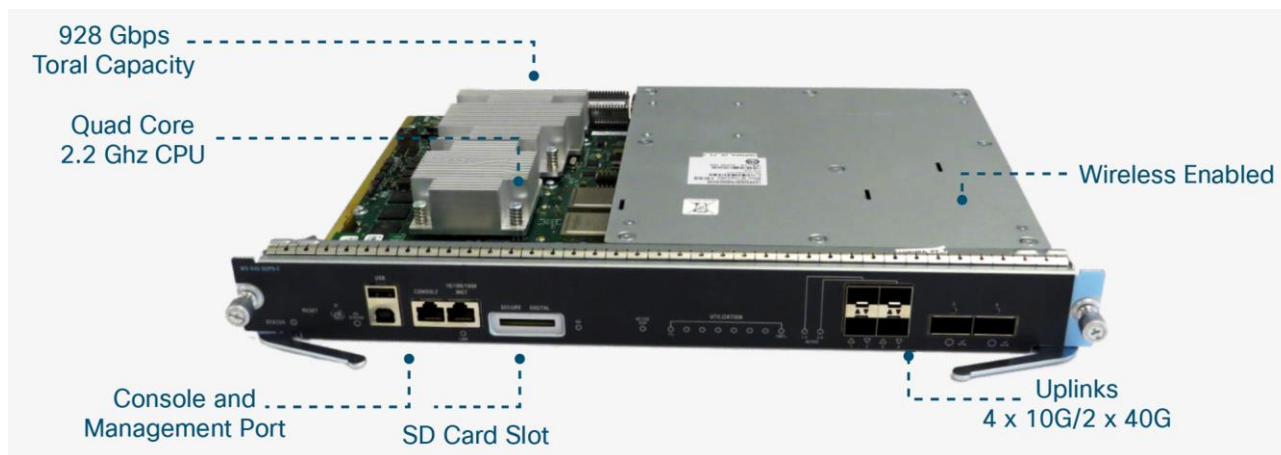
Feature highlights

The Cisco Catalyst 4500E Supervisor Engine 9-E offers the following:

- Performance and capabilities
  - Up to 928 Gbps wired switching capacity with 250 Mpps of throughput
  - Up to 20 Gbps of wireless termination capacity. Support for up to 100 access points and 2000 wireless clients on each switching entity
  - Up to two 40 Gigabit Ethernet uplinks (Quad Small Form-Factor Pluggable Plus [QSFP+])
  - Up to 4 nonblocking 10 Gigabit Ethernet uplinks (Small Form-Factor Pluggable Plus [SFP+])
  - SFP support on uplinks to offer flexibility for up to 4 Gigabit Ethernet ports
  - 384 ports of nonblocking 10/100/1000
  - PoE+ (30W) capabilities on all ports in a line card simultaneously
  - Cisco UPOE (60W) capabilities on all line card slots
  - Energy Efficient Ethernet (IEEE 802.3az)
  - 388 ports of non blocking Gigabit Ethernet SFP (4 uplink ports plus 384 line card ports)
  - 100 ports of 10 Gigabit Ethernet SFP+ (4 uplink ports plus 96 line card ports)
  - Up to 128,000 FNF entries in hardware
  - SD card support for flexible storage options
  - 256,000 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
  - Scalable routing (IPv4, IPv6, and multicast) tables and Layer 2 tables
  - Scalable and dynamic allocation of Access Control List (ACL) and Quality of Service (QoS) entries to use 8 queues per port and comprehensive security policies per port
  - SD-Access: The Supervisor Engine 9-E forms the foundational building block for SD-Access – Cisco's leading enterprise architecture, which includes:
    - 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)
- Infrastructure services
  - Cisco IOS® XE Software, the modular open application platform for virtualized borderless services
  - Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and Cisco In-Service Software Upgrade (ISSU) support
  - Network virtualization through Multi-Virtual Route Forwarding (VRF) and Easy Virtual Networking (EVN) technology for Layer 3 segmentation
  - Virtual Switching System (VSS) for simplified loop-free topologies without Spanning Tree dependencies.

- Flexible and future-ready uplinks with Field Programmable Gate Array (FPGA) to support next-generation protocols
- Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting

- Cisco Services
  - Optimized application performance through deep visibility with FNF, supporting rich Layer 2, 3, and 4 information (MAC, VLAN, and TCP flags) and synthetic traffic generation with IP Service-Level Agreement (IP SLA-VO)
  - Energy-efficient design with Cisco EnergyWise® technology to manage network, PoE+, personal computers, and laptops
- Investment protection and reduced TCO
  - Full backward compatibility with 24-Gbps, and 48-Gbps slot line cards with no performance degradation
  - The Supervisor Engine 9-E is compatible with classic Cisco Catalyst 4500 Series line cards and power supplies, providing full investment protection. It is not compatible with the classic Cisco Catalyst 4500 Series chassis. When you deploy the Supervisor Engine 9-E with classic line cards, all of the new features except the 24- and 48-Gbps per slot switching capacity are inherited

Predictable performance and scalability

Table 1 highlights the performance and scalability enhancements of the Cisco Catalyst 4500E Supervisor Engine 9-E.

Table 1.   Performance and Scalability Features

Features	Performance and Scalability
Centralized wired switching capacity	Up to 928 Gbps
Wireless termination capacity	Up to 20 Gbps
Per-slot switching capacity	48 Gbps
Throughput	250 Mpps for IPv4 125 Mpps for IPv6
IPv4 routing entries	256,000
IPv6 routing entries	128,000
Multicast routes	32,000
CPU	Quad core; 2.2 GHz
CPU queues	64
Synchronous Dynamic RAM (SDRAM)	4 GB
Nonvolatile RAM (NVRAM)	2 GB
Security and QoS hardware entries	128,000
Dynamic Host Configuration Protocol (DHCP) Snooping entries	12,000
MAC addresses	55,000
Active VLANs	4094
Address Resolution Protocol (ARP) entries	47,000
Spanning Tree Protocol instances	10,000
Switched Virtual Interfaces (SVIs)	4094
Switched Port Analyzer (SPAN)	Maximum of 8 bidirectional sessions

SD-Access architecture

Enterprises are embarking on a transformation to digital capabilities for such processes as service delivery and asset management. Cisco SD-Access provides a transformational approach to building and managing networks. It supports faster, easier, and improved business efficiency with investment protection. Implementing Cisco SD-Access helps produce real business outcomes. By decoupling network functions from hardware, SD-Access helps you ensure policy compliance, launch new business services faster, and improve issue resolution times significantly. It is open and extensible and can significantly reduce your operational expenses.

SD-Access enables policy-based automation from edge to cloud with foundational capabilities including 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, including:

- User mobility
- Secure segmentation
- User onboarding and policies
- Internet of Things (IoT) integration
- Guest access
- Context-based troubleshooting
- Data center integration
- Cloud integration

For more information, please refer to https://www.cisco.com/c/en/us/solutions/enterprise-networks/software-defined-access/index.html

Best-in-class resiliency

The Cisco Catalyst 4500E Series is designed for excellent nonstop communications with uninterrupted hardware switching. With Cisco IOS XE Software, customers continue to reap the benefit of this best-in-class resiliency in various ways.

ISSU allows you to upgrade or downgrade complete Cisco IOS Software images with minimal (less than 200 ms) to no disruption to the network when using a redundant Cisco Catalyst 4500E Series system with dual Supervisor Engines 9-E. Facilitating rapid, nondisruptive software upgrades for new line cards, new power supplies, new features, or bug fixes, ISSU offers continuous packet forwarding during the supervisor engine switchover running different Cisco IOS Software releases.

NSF/SSO offers continuous packet forwarding during supervisor engine switchover. Information is fully synchronized between supervisor engines to allow the standby supervisor engine to immediately take over in subsecond time if the primary engine fails.

NSF/SSO and ISSU dramatically improve network reliability and availability in a Layer 2 or Layer 3 environment. They are essential for business-critical applications such as Voice over IP (VoIP). These features help ensure that VoIP calls are not dropped.

In addition to redundant power supplies, fans, and clock modules, the Cisco Catalyst 4510R+E and 4507R+E chassis models support 1+1 supervisor engine redundancy, using the Supervisor Engine 9-E. The primary supervisor engine is active and is responsible for normal system operation. The secondary supervisor engine serves as a standby, monitoring the operation of the primary supervisor engine. The resiliency features of the Cisco Catalyst 4500E help prevent network outages that could result in lost business and revenue.

Apart from the features previously mentioned, the Supervisor Engine 9-E has resiliency built into its uplinks. Table 2 shows the uplink options and associated bandwidth allocation on the Supervisor Engine 9-E.

Table 2.   High Availability, Uplink, and Wireless Options

Supervisor Configurations	Uplink Ports	Wireless Termination	Line Card/Chassis Considerations
Single supervisor	4x 10 GE	–	10-slot chassis: **None**
			3-, 6-, and 7-slot chassis: **None**
Single supervisor	4x 10 GE	20x GE	10-slot chassis: **Last slot restricted to 4700-level line cards**
			3-, 6-, and 7-slot chassis: **None**
Single supervisor	2x 40 GE	–	10-slot chassis: **Last slot restricted to 4700-level line cards**
			3-, 6-, and 7-slot chassis: **None**
Single supervisor	2x 40 GE	20 GE	10-slot chassis: **10th slot disabled**
			3-,6-, and 7-slot chassis: **No restriction**
Dual supervisor	Active supervisor: 2x 10 GE	–	10-slot chassis: **None**
	Standby supervisor: 2x 10 GE		7-slot chassis: **None**
Dual supervisor	Active supervisor: 2x 10 GE	20 GE	10-slot chassis: **Last slot restricted to 4700-level line cards**
	Standby supervisor: 2x 10 GE		7-slot chassis: **None**
Dual supervisor	Active supervisor: 1x 40 GE	–	10-slot chassis: **Last slot restricted to 4700-level line cards**
	Standby supervisor: 1x 40 GE		7-slot chassis: **No restriction**
Dual supervisor	Active supervisor: 1x 40 GE	20 GE	10-slot chassis: **10th slot disabled**
	Standby supervisor: 1x 40 GE		7-slot chassis: **None**

Programmability

The traditional way of configuring and managing Cisco networking devices has been manual configuration through the Command-Line Interface (CLI). As deployments become more complex, programmability of devices has enabled a shift from manual to automatic network provisioning and configuration. Managing device configuration programmatically enables you to:

- Configure and control at scale
- Check to make sure that dependencies are satisfied before committing a change, and also easily roll back changes when they are not consistently compatible across the network

Programmability is the capability to configure and manage networking devices using protocols that are specifically designed to be consumed by software. Supervisor Engine 9-E provides support for:

- YANG data modeling
- NETCONF Protocol
- Representational State Transfer Configuration Protocol (RESTCONF)

For more details, please refer to https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4500/XE3-9-0E/15-25E/configuration/guide/xe-390-configuration/prgrmblty.html.

Simplified operations through automation

As campus switching has grown to support increasing enterprise demands, so has the need to deploy and manage new and evolving technologies. Simplified operations are critical in meeting these challenges and achieving increased operational efficiency through proactive management and reduction in unplanned network downtime.

The Cisco Catalyst 4500E Supervisor Engine 9-E offers the following rich set of capabilities for simplified operations:

- Auto-install and AutoQoS for fast deployment
- Configuration rollback for improved configuration management
- EEM, Smart Call Home, Generic On-Line Diagnostics (GOLD), and Time Domain Reflectometry (TDR) for simplified operations
- FNF and IP SLA for enhanced visibility
- Cisco EnergyWise technology for simplified power management
- ISSU for simplified change management

Application Visibility and Control (AVC) with DNS as an Authoritative Source (DNS-AS)

AVC with DNS-AS provides a centralized means of controlling the identification and classification of trusted network traffic in an organization. It accomplishes this by using network metadata stored in a DNS server that is authoritative to the domain in question to identify applications, Modular QoS CLI (MQC) to classify the corresponding traffic and apply suitable policies, and FNF to monitor and export application information to an external collector.

AVC with DNS-AS has the following benefits:

- Application visibility: Helps ensure unambiguous visibility of applications
- Metadata driven: Uses information about applications
- Centralized control: Uses a cross-domain application-intent policy controller
- Control without administrative access: Provides alternatives to controller-based approaches

Modular open application platform – Cisco IOS XE Software
Cisco IOS XE Software is the next-generation operating system for Cisco Catalyst 4500E supervisor engines. Cisco continues to evolve Cisco IOS Software to support next-generation switching hardware and provide increased architectural flexibility to deliver quick adoption of future Cisco Enterprise network services, while increasing customer investment protection in Cisco IOS Software.

Cisco IOS XE Software provides the following customer benefits:

- A modern operating system that can take advantage of the multicore CPU architecture of the next-generation Cisco Catalyst 4500E system with Supervisor 9-E.
- Service virtualization capabilities that allow the Cisco Catalyst 4500E Series to host applications other than Cisco IOS Software, such as customer-written applications or third-party applications in parallel with Cisco IOS Software. The hosted application can communicate with Cisco IOS Software to use its rich feature sets. This benefit allows a customer to quickly adopt new technologies using proven code, while keeping Cisco IOS Software simple and robust. Cisco IOS XE Software helps the Cisco Catalyst 4500E to be an open service platform and is a primary anchor to support future Cisco Enterprise Networks innovations.

IPv6 support

IPv6 is important for the future of IP networking and is critical for the expansion of IP address space. IPv6 capability is required by many companies and is being mandated by governments worldwide. The Cisco Catalyst 4500 Supervisor Engine 9-E supports IPv6 unicast and

multicast in hardware for full line-rate forwarding performance of up to 125 Mpps. The Supervisor Engine 9-E also dynamically allocates hardware table space between IPv4 and IPv6 routes to increase table-space usage for optimal IPv4-to-IPv6 migration It supports Multicast Listener Discovery (MLD) snooping for IPv6, enhancing performance and reducing network traffic by allowing a switch to dynamically add and remove hosts from a multicast group.

Table 3 highlights the IPv6 capabilities of the Supervisor Engine 9-E.

Table 3. Summary of Supervisor Engine 9-E IPv6 Capabilities

Feature and Description	Capabilities
IPv6 support	Unicast and multicast forwarding done in hardware
IPv6 performance	125 Mpps
IPv6 routing entries	128,000
Dynamic hardware route table allocations	Yes
MLD snooping for IPv6	Yes, in hardware
Unicast Reverse Path Forwarding Version 6 (URPFv6): Strict mode	Yes, in hardware

Investment protection with chassis and line card support

Previously installed Cisco Catalyst 4500E Series chassis with classic and E-Series line cards can take advantage of the new features and functions of the Supervisor Engine 9-E on all ports with a simple supervisor engine upgrade. However, to take advantage of the switching capacity of 48 Gbps per slot, the Cisco Catalyst 4500E Series chassis (including R+E chassis) and select new E-Series line cards are required. You can mix and match Cisco Catalyst 4500E Series line cards and classic line cards in an E-Series chassis with no performance degradation to either line card type. Table 4 shows the supervisor engine and line card slot assignment options in the Cisco Catalyst 4500E Series chassis.

Table 4. Chassis slot assignment options

Chassis	Single Supervisor Engine 9-E Slot Assignments	Redundant Supervisor Engine 9-E Slot Assignments	E-Series Line Card Slot Options	Classic Line Card Slot Options
Cisco Catalyst 4503-E	Slot 1	–	Slots 2 and 3	Slots 2 and 3
Cisco Catalyst 4506-E	Slot 1	–	Slots 2 through 6	Slots 2 through 6
Cisco Catalyst 4507R+E	Slot 3 or 4	Slots 3 or 4	Slots 1, 2, and 5 to 7	Slots 1, 2, and 5 to 7
Cisco Catalyst 4510R+E	Slots 5 or 6	Slots 5 or 6	Slots 1 to 4, and 7 to 10	Slots 1 to 4, and 7 to 10

Table 5 summarizes the performance capacities of the Supervisor Engine 9-E on a per-chassis basis.

Table 5. Bandwidth per slot for different chassis

	Cisco Catalyst 4503-E Chassis	Cisco Catalyst 4506-E Chassis	Cisco Catalyst 4507R+E Chassis	Cisco Catalyst 4510R+E Chassis
Supervisor Engine 9-E (WS-X45-Sup9-E)	48 Gbps per slot	48 Gbps per slot	48 Gbps per slot	48 Gbps per slot

Features at a glance

Cisco IOS XE Software LAN Base: This feature set provides Layer 2 features for access.

Cisco IOS XE Software IP Base: This feature set is upgradable with a Software Activation License (SAL). It includes all Layer 2 features and some basic Layer 3 features. ISSU/SSO is supported in this package.

Cisco IOS XE Software Enterprise Services: This feature set is upgradable with a SAL; it supports full Layer 3 protocols and advanced features such as complete routing scalability (256,000), BGP, VRF, Policy-Based Routing (PBR), and so on.

These features can be enabled using the software licensing mechanism. For details about software licensing, refer to the "Licensing" section later in this document or visit https://www.cisco.com/go/sa.

Industry standards

- Ethernet: IEEE 802.3

- 10 Gigabit Ethernet: IEEE 802.3ae

- IEEE 802.1D Spanning Tree Protocol

- IEEE 802.1w Rapid Reconfiguration of Spanning Tree

- IEEE 802.1s Multiple VLAN Instances of Spanning Tree

- IEEE 802.3ad Link Aggregation Control Protocol (LACP)

- IEEE 802.1p CoS Prioritization

- IEEE 802.1Q VLAN

- IEEE 802.1X User Authentication

- RMON I and II standards

Supported line cards

Cisco Catalyst 4500E Series line cards and modules

- WS-X4748-12X48U+E: Cisco Catalyst 4500E Series 48-port (RJ-45) line card with 12 Multigigabit ports and 36 10/100/1000 ports with 802.3af PoE, 802.3at PoE+, and Cisco UPOE

- WS-X4748-UPOE+E: Cisco Catalyst 4500E Series, 48-port 802.3af PoE, 802.3at PoE+, and Cisco UPOE 10/100/1000

- WS-X4748-RJ45-E: Cisco Catalyst 4500E Series, 48-port 10/100/1000 (RJ-45)

- WS-X4748-RJ45V+E: Cisco Catalyst 4500E Series, 48-port PoE 802.3at 10/100/1000 (RJ-45)

- WS-X4712-SFP+E: Cisco Catalyst 4500E Series, 12-port 10 Gigabit Ethernet (SFP+)

- WS-X4748-SFP-E: Cisco Catalyst 4500E Series 48-port Gigabit Ethernet fiber line card

- WS-X4724-SFP-E: Cisco Catalyst 4500E Series 24-port Gigabit Ethernet fiber line card

- WS-X4712-SFP-E: Cisco Catalyst 4500E Series 12-port Gigabit Ethernet fiber line card

- WS-X4648-RJ45V-E: Cisco Catalyst 4500E Series, 48-port 802.3af PoE 10/100/1000 (RJ-45)

- WS-X4648-RJ45V+E: Cisco Catalyst 4500E Series, 48-port Premium PoE 10/100/1000 (RJ-45)

- WS-X4648-RJ45-E: Cisco Catalyst 4500E Series, 48-port 10/100/1000 (RJ-45)

- WS-X4640-CSFP-E: Cisco Catalyst 4500E Series, 40- and 80-port SFP/CSFP Gigabit Ethernet line card

- WS-X4606-X2-E: Cisco Catalyst 4500E Series, 6-port 10 Gigabit Ethernet (X2)

- WS-X4624-SFP-E: Cisco Catalyst 4500E Series, 24-port Gigabit Ethernet (SFP)

- WS-X4612-SFP-E: Cisco Catalyst 4500E Series 12-port Gigabit Ethernet (SFP)

Cisco Catalyst 4500 classic line cards and modules

- WS-X4148-FX-MT: Cisco Catalyst 4500 Fast Ethernet switching module, 48-port 100BASE-FX Multimode Fiber (MMF)

- WS-X4148-RJ: Cisco Catalyst 4500 10/100 module, 48 ports (RJ-45). Not supported on VSS

- WS-X4248-FE-SFP: Cisco Catalyst 4500 Fast Ethernet switching module, 48-port 100BASE-X (SFP)

- WS-X4306-GB: Cisco Catalyst 4500 Gigabit Ethernet Module, 6 ports (GBIC)

  WS-X4448-GB-SFP: Cisco Catalyst 4500 Gigabit Ethernet module, 48 ports 1000BASE-X (optional SFPs)

Supported pluggable

For details about the different optical modules and the minimum Cisco IOS Software release required for each of the supported optical modules, visit https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html.

Software requirements

The Cisco Catalyst 4500E Series Supervisor Engine 9-E is supported only in Cisco IOS Software and is not supported in the Cisco Catalyst Operating System Software. The minimum software version is:

- Supervisor Engine 9-E, Cisco IOS XE Software Release IOS XE 3.10

Environmental conditions

- Operating temperature: 32° to 104°F (0° to 40°C)

- Storage temperature: -40° to 167°F (-40° to 75°C)

- Relative humidity: 10 to 90 percent, noncondensing

- Operating altitude: -197 to 9843 feet

Power and Mean Time Between Failures (MTBF) information

- Active supervisor power:
  - Wired mode: 311W
  - Wireless mode: 400W
- Standby supervisor power:
  - Wired mode: 220W
  - Wireless mode: 265W

This result is not indicative of the actual power draw during operation. It is the absolute maximum value recommended for facility power and cooling capacity planning. Typical power draw is about 20 percent lower than the maximum value shown.

MTBF: 320,870 hours

Regulatory standards compliance

Table 6 shows regulatory standards compliance information, and Table 7 provides ordering information.

Table 6. Cisco Catalyst 4500 Supervisor Engine 9-E Regulatory Standards Compliance

Specification	Standard
Safety certifications	• UL 60950-1 • CAN/CSA-C22.2 No. 60950-1 • EN 60950-1 • IEC 60950-1 • AS/NZS 60950.1 • IEEE 802.3
Electromagnetic emissions certifications	• 47 CFR Part 15 • CISPR22 Class A • EN 300 386 V1.6.1 • EN 55022 Class A • EN 55032 Class A • CISPR 32 Class A • EN61000-3-2 • EN61000-3-3 • ICES-003 Class A • TCVN 7189 Class A • V-3 Class A • CISPR24 • EN 300 386 • EN55024 • TCVN 7317 • V-2 Class A
Industry EMC, safety, and environmental standards	• SR-3580 NEBS level 3 (GR-63-CORE issue 4, GR-1089-CORE issue 6) • ETS 300 019-2-1, Class 1.2 Storage • ETS 300 019-2-2, Class 2.3 Transportation • ETS 300 019-2-3, Class 3.2 Stationary
ROHS compliance	• ROHS5

Table 7. Ordering information

Product Number	Description
WS-X45-SUP9-E	Catalyst 4500 E-Series Supervisor 9-E
WS-X45-SUP9-E=	Catalyst 4500 E-Series Spare Supervisor 9-E
WS-X45-SUP9-E/2	Catalyst 4500 E-Series Redundant Supervisor 9-E
C4500E-LB	LAN BASE software license
C4500E-IPB	IP BASE software license
C4500E-LIC=	Base product ID for paper-delivered software upgrade licenses
C4500E-LB-IPB	LAN Base to IP Base upgrade license (paper delivery)
C4500E-LB-ES	LAN Base to Enterprise Services upgrade license (paper delivery)
C4500E-IP-ES	IP Base to Enterprise Services upgrade license (paper delivery)
C4500E-LIC-PAK	Base product ID for paper-delivered software licenses for spare Supervisor Engine 9-E
C4500E-IP-ES-S	IP Base to Enterprise Services upgrade license for spare Supervisor Engine 9-E (paper delivery)
C4500E-IPB-S	IP Base software license for spare Supervisor Engine 9-E (paper delivery)
L-C4500-LIC=	Base product ID for electronically delivered software upgrade licenses
L-C4500E-LB-IP	LAN Base to IP Base upgrade license (electronically delivered)
L-C4500E-IP-ES	IP Base to Enterprise Services upgrade license (electronically delivered)
L-C4500E-LB-ES	LAN Base to Enterprise Services upgrade license (electronically delivered)
SD-X45-2GB-E	Cisco Catalyst 4500 2 GB SD memory card for Supervisor 9-E
USB-X45-4GB-E	Cisco Catalyst 4500 4 GB USB device for Supervisor 9-E

Licensing

Software activation licensing

The Cisco Catalyst 4500E platform with Supervisor 9-E enables Software Activation Licensing (SAL). Each Supervisor 9-E ships with a universal image containing all feature sets: LAN Base, IP Base, and Enterprise Services. The level of functions is determined by the license applied.

SAL allows customers to:

- Speed deployment and roll out new Cisco software activation feature sets across global networks
- Centrally and more accurately manage and track software and license compliance
- Easily conduct software compliance audits to meet regulations without affecting network operations
- Simplify operations:
  - Simplified upgrades and license transfers save time and improve productivity; you can add new capabilities simply by using a license file
  - You can easily track software assets, licenses, and feature set status
  - A single software image improves service delivery
- Ease the ordering process:
  - "Try and buy" lets you use a temporary license to try and evaluate new Cisco IOS Software functions before purchasing them
  - A pay-as-you-grow software key supports new features incrementally without service calls

For more information about Cisco software licensing, visit https://www.cisco.com/go/sa.

Cisco Limited Lifetime hardware Warranty

The Cisco Limited Lifetime hardware Warranty (LLW) includes 10-day advance hardware replacement for as long as the original end user owns the product. Table 8 describes the Limited Lifetime hardware Warranty.

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 review carefully the warranty statement shipped with your specific product before use.

For additional information about warranty terms, visit https://www.cisco.com/go/warranty.

Adding a Cisco Technical Services contract to your device coverage provides benefits not available with a warranty, including access to the Cisco Technical Assistance Center (TAC), a variety of hardware replacement options to meet critical business needs, updates for licensed Cisco IOS Software, and registered access to the extensive Cisco.com knowledge base and support tools. Table 9 describes the benefits and features of Cisco Technical Services.

For information about Cisco Technical Services, go to https://www.cisco.com/go/ts.

Table 8.   Limited Lifetime Hardware Warranty

	Cisco Limited Lifetime Hardware Warranty[1]
Warranty duration	The warranty lasts as long as the original end user continues to own or use the product, except for the fan and power supply, which are limited to 5 years.
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 our service center will use commercially reasonable efforts to ship a replacement part within 10 business days after receipt of the RMA request and confirmation that a replacement part is the appropriate response. Actual delivery times may vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to the customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
Cisco TAC support	None.
Cisco.com access	The warranty allows guest access only to Cisco.com.

[1] Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

Cisco and partner services

Deploy the innovative, highly secure, intelligent edge in the Cisco Enterprise network using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst 4500E Series Switches into your architecture and incorporate network services onto that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology. Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. Table 9 shows the Cisco Technical Services available for Cisco Catalyst 4500E Series Switches.

For additional information about Cisco Services, visit https://www.cisco.com/go/services.

Table 9.   Cisco Technical Services for Cisco Catalyst 4500E Series Switches

Technical Services
Cisco Smart Net Total Care™ Service
● 24-hour global access to the Cisco TAC
● Unrestricted access to the extensive Cisco.com resources, communities, and tools
● Next-Business-Day (NBD), 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement[1] and onsite parts replacement and installation available
● Ongoing operating system software updates within the licensed feature set[2]
● Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
Cisco Smart Foundation Service
● NBD advance hardware replacement as available
● Business hours access to the Cisco TAC for Small and Medium-sized Businesses (SMBs) (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 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 Cisco SP Base contracts on all network equipment are required.

Footnotes:
[1] Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with NBD delivery. Where NBD is not available, same-day shipment is provided. Restrictions apply; please review the appropriate service descriptions for details.
[2] Cisco operating system updates include maintenance releases, minor updates, and major updates within the licensed feature set.

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