Cisco ASR 9000 Series Route Switch Processor 440

Product Overview

Cisco® ASR 9000 Series next generation Route Switch Processor (RSP440) is one option to be the main system processor for the Cisco ASR 9000 Series Aggregation Services Routers and supports the scalable, low-power, next-generation network edge platforms. The Cisco ASR 9000 Series RSP440 is designed with a system architecture to accommodate convergence of Layer 2 and Layer 3 services as required by today's service providers in wireline, data center interconnect (DCI), and Radio Access Network (RAN) aggregation applications.

Cisco ASR 9000 Series Routers offer one of the industry's highest-capacity edge platforms, optimized for aggregation of dense 10 Gigabit Ethernet and 100 Gigabit Ethernet connections.

In addition to a higher capacity and scale, the Cisco ASR 9000 Series offers:

- Distributed forwarding and control planes for higher performance
- Network virtualization technology to provide excellent resilience and capacity expansion
- Modularized system components in both hardware and software, isolating failure and faults to subsystem and component
- Hardware-based signaling for the fabric, providing industry-leading resilience with zero packet loss on switchover
- Built-in redundancy in hardware components such as the route switch processor (RSP), switch fabric, control-plane chassis control bus, and power supplies, thereby avoiding a single point of failure
- Advanced network timing technologies support for precise frequency and time distribution throughout the network
- Extensive selection of time-division multiplexing (TDM) and Ethernet interfaces for flexible deployment in multiservice edge (MSE) and RAN aggregation environments with packet- and circuit-based transport

The Cisco ASR 9000 Series operates in a fully distributed fashion, meaning that all packet-forwarding decisions and actions take place on each individual line card. The Cisco ASR 9000 Series line cards provide a flexible programming infrastructure with high-density hierarchical quality-of-service (H-QoS) services, security, and integrated Synchronous Ethernet (SyncE). The distributed nature of the Cisco ASR 9000 Series also presents itself in the control plane. The distributed control plane facilitates scale in features such as Bidirectional Forwarding Detection (BFD) and Ethernet operations, administration, and management (EOAM), which improve resilience and provide comprehensive instrumentation.

Cisco ASR 9000 Series routers bring the time-tested and robust carrier-class capabilities of Cisco IOS® XR Software to the Carrier Ethernet edge. The operating system supports true software process modularity. The capabilities of Cisco IOS XR Software allow each process to run in separate protected memory, including each routing protocol along with multiple instances of control, data, and management planes supported.The software also supports distributed route processing.

Figure 1. Cisco ASR 9000 Series Route Switch Processor 440

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The Cisco ASR 9000 Series RSP440 is designed to deliver the high scalability, performance, and fast convergence required for today's and tomorrow's demanding video, cloud, and mobile services. The RSP440 provides a superior set of features that deliver unprecedented scale, service flexibility, and high availability:

- Switch fabric architecture:
  - Active-active switch fabric architecture that provides scalability and high availability
  - Multistage low-latency nonblocking architecture
  - Service intelligence and traffic prioritization
- Superior network timing capabilities with support for:
  - Centralized Building Integrated Timing Supply (BITS) and DOCSIS® Timing Interface (DTI) timing reference systems
  - Precision Time Protocol (PTP), or IEEE 1588-2008, through dedicated 10/100-Mbps Ethernet port
  - Bidirectional time of day (ToD) with 10MHz and 1-pps interfaces

Route Switch Processor Types

The Cisco ASR 9000 Route Switch Processor 440 is available in service-edge-optimized and packet-transport-optimized models. The service-edge-optimized version offers a higher amount of memory essential for large-scale comprehensive service deployment. Both versions of RSP440 support service-optimized as well as transport-optimized line cards. Different line cards can be mixed on the same chassis, providing maximum design flexibility.

Features and benefits of the Cisco ASR 9000 Series RSP440 are listed in Table 1.

Table 1. Features and Benefits of Cisco ASR 9000 Series RSP440

Feature	Benefit
Highly scalable fabric	• Designed to support high 1/10/100-Gbps port densities • Provides built-in scalability for investment protection
Dual RSP to provide an active-active switch fabric	• Offers traffic load balancing simultaneously across both fabrics • Offers highly available system where loss of one RSP allows for unimpeded performance per slot
Distributed forwarding plane architecture	Allows line cards to support independent forwarding for enhanced performance and scale
Control plane extension ports	Combining the redundant pair of chassis into a single logical entity provides advantages in management, scalability, and high availability.
Memoryless switch fabric	Provides transparent nonblocking low-latency packet forwarding

Feature	Benefit
Virtual output queuing and arbitration	• Offers service intelligence with prioritization of traffic (unicast and multicast) • Provides efficient congestion management mechanism and avoids problems related to head-of-line blocking
Centralized arbiter	Uses an efficient credit mechanism to help ensure transparent switchover with zero packet loss
IEEE 1588 support	Delivers timing services over the packet network efficiently and reliably
Two independent clock source connections: BITS and Synchronization Supply Unit (SSU) DTI	Offers redundant, centralized network synchronization support
Two 16-GB solid state drives (SSDs)	Allows storing of core dumps and helps reduce the system mean time to repair (MTTR)
Embedded Universal Series Bus (eUSB) memory port	Provides access to USB flash memory devices for software image loading and recovery
Front-panel LEDs	Provides visual indication of RSP status (active or standby), power management, and activity on compact flash and hard disk drive (HDD)
Management ports	Provides easy access to system console

Table 2 lists all the hardware that ships with the Cisco ASR 9000 Series RSP440.

Table 2. Hardware Available

Product Number	Product Description
Cisco ASR 9000 Series Route Switch Processor	
A9K-RSP440-TR and A9K-RSP440-SE	Route switch processor, bidirectional nonblocking fabric, controller, two 16-GB SSDs; includes the following: • Switch fabric ◦ High-capacity full-duplex integrated dual switch fabric • Memory internal ◦ 6-GB Error-Correcting Code (ECC)-protected DRAM for A9K-RSP440-TR ◦ 12-GB ECC-protected DRAM for A9K-RSP440-SE ◦ Solid state disk: two 16-GB SSDs ◦ 8-GB embedded USB • Memory external ◦ USB 2.0 Type A receptacle • Timing system ◦ Timing: Two independent clock source connections ◦ IEEE 1588 support: Copper 10/100-Mbps RJ-45 Ethernet port ◦ GPS - ToD (RS422 and RS232) - 1-pps RS422 or 1.0/2.3 50-ohm RF connector - 10MHz in/out 1.0/2.3 50-ohm RF connector • Management ◦ Two 100/1000 BASE-T (RJ-45) LAN management ports ◦ One console port ◦ One auxiliary port ◦ Two 10-GE Small Form-Factor Pluggable Plus (SFP+) virtualization cluster ports • Alarms ◦ Alarm outputs: Critical alarm (CR), major alarm (MJ), and minor alarm (MN) • LEDs ◦ Amber alarm cut-off (ACO) and lamp test ◦ System synchronization alarm (SYNC) ◦ Compact Flash activity (CF) ◦ Solid State Drive (SSD) ◦ Fan tray visual indicator (UFAN/LFAN)

Software

The Cisco ASR 9000 Series delivers superior scale, service flexibility, and high availability into access and aggregation networks. It is powered by Cisco IOS XR Software – an innovative self-healing, distributed operating system designed for always-on operation.

Cisco ASR 9000 Series Carrier Ethernet applications include business services such as Layer 2 VPN (L2VPN) and L3VPN, Internet Protocol Television (IPTV), Content Delivey Networks (CDNs), and mobile backhaul transport networks. Features supported include Ethernet Services; L2VPN; IPv4, IPv6, and L3VPN; Layer 2 and Layer 3 Multicast; IP over dense wavelength-division multiplexing (IPoDWDM); SyncE; EOAM and Multiprotocol Label Switching (MPLS) OAM; Layer 2 and Layer 3 access control lists (ACLs); H-QoS; MPLS Traffic Engineering Fast Reroute (MPLS TE-FRR); Multichassis Link Aggregation (MC-LAG); Integrated Routing and Bridging (IRB); Cisco Nonstop Forwarding (NSF) and Nonstop Routing (NSR); Point-to-Multipoint Traffic Engineering (P2MP-TE); Lawful Intercept; Smart Call Home (SCH); and Multi Gigabit Service Control (MGSCP).

The Cisco ASR 9000 Series Multiservice Edge (MSE) and Ethernet MSE (E-MSE) capabilities allow enterprises to offer powerful business VPN services with strong service-level agreement (SLA) enforcement. Such services typically require simultaneous scale increases across multiple dimensions; for example, the number of Virtual Route Forwarding (VRF) interfaces, IPv4 and IPv6 route scaling, BFD sessions, and instances of Border Gateway Protocol (BGP) Cisco NSR interfaces. A Cisco ASR 9000 Series system configuration requiring high multiple dimensional scale requires the service-edge optimized A9K-RSP440-SE model to support the increased system scale.

Timing synchronization is an integral part of traditional circuit-based networks, so the availability of equivalent functionality in next-generation Ethernet-based architectures has quickly become a critical requirement. The advanced integrated timing options of the Cisco ASR 9000 Series provide a flexible solution for converging TDM and SDH with next-generation Ethernet-based networks in a single platform. Cisco ASR 9000 Series timing synchronization capabilities and a wide range of transport options provide mobile operators with a simple and cost-effective migration path from second-generation (2G) technologies and TDM transport, to fourth-generation (4G) services and Ethernet-based transport architectures. The Cisco ASR 9000 Series has standard compliant PTPv2, GPS, DTI, and BITS connections on the RSP440, and SyncE support natively on the line cards, giving mobile providers ample options for time and frequency synchronization. Additionally, the Cisco ASR 9000 Series RSP supplies centralized clocking functions throughout the system, providing consolidated timing distribution and recovery to and from the line cards.

Product Specifications

Table 3 provides details about two chassis variants of the Cisco ASR 9000 Series, the Cisco ASR 9010 and Cisco ASR 9006. Both systems are designed to the same high standards of performance and reliability, feature the same power and thermal innovations, and can share RSPs, line cards, power entry modules (PEMs), and power supplies, for maximum flexibility in your network planning.

Table 3. Product Specifications

Category	Part Number or Specification
Chassis	• ASR-9010-AC and ASR-9010-DC • ASR-9006-AC and ASR-9006-DC • ASR-9010-AC-V2 and ASR-9010-DC-V2 • ASR-9006-AC-V2 and ASR-9006-DC-V2

Category	Part Number or Specification	
Line cards	• A9K-40GE-L • A9K-40GE-B • A9K-40GE-E • A9K-8T/4-L • A9K-8T/4-B • A9K-8T/4-E • A9K-4T-L • A9K-4T-B • A9K-4T-E • A9K-2T20GE-L • A9K-2T20GE-B • A9K-2T20GE-E	• A9K-8T-L • A9K-8T-B • A9K-8T-E • A9K-16T/8-B • A9K-SIP-700 • A9K-2X100GE-TR • A9K-2X100GE-SE • A9K-24X10GE-TR • A9K-24X10GE-SE • A9K-MOD80-SE • A9K-MOD80-TR
Redundancy	• No single point of failure • Fabric redundancy • Power supply redundancy • RSP redundancy (both RSPs must be the same version, either A9K-RSP440-TR or A9K-RSP440-SE) • Software redundancy	
Power supply	• A9K-3KW-AC • A9K-2KW-DC • A9K-1.5KW-DC • PWR-3KW-AC-V2 • PWR-2KW-DC-V2	
Physical specifications	• Occupies one slot; dual redundant RSPs in two slots in Cisco ASR 9010 and ASR 9006 chassis • Height: 1.65 inches (4.2 cm) • Width: 16 inches (40.6 cm) • Depth: 26.53 inches (67.4 cm) • Weight: 20 lb (9 kg)	
Power input	• Worldwide ranging AC (200–240V; 50–60 Hz; 16A nominal) • Worldwide ranging DC (–48V to –60V; –54V; 50A nominal)	
Environmental conditions	• Operating temperature: 32 to 104℉ (0 to 40℃) • Storage temperature: –40 to 167℉ (–40 to 75℃) • Relative humidity: 10 to 90%, noncondensing • Regulatory compliance	
Power consumption	• Typical: 170 W • Maximum: 450 W	
Environmental Specifications		
Operating temperature (nominal)	41 to 104ºF (5 to 40ºC)	
Operating temperature (short-term)	23 to 131ºF (–5 to 55ºC) Note: Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year (a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period).	
Operating humidity (nominal) (relative humidity)	10 to 85%	
Operating humidity (short-term)	5 to 90% Note: Not to exceed 0.024 kg water or dry air	
Storage temperature	–40 to 158ºF (–40 to 70ºC)	
Storage (relative humidity)	5 to 95% Note: Not to exceed 0.024 kg water or dry air.	
Operating altitude	–60 to 4000m (up to 2000m conforms to IEC/EN/UL/CSA 60950 requirements)	

Category	Part Number or Specification
Compliance	
Network Equipment Building Standards (NEBS)	Cisco ASR 9000 is designed to meet: • SR-3580: NEBS Criteria Levels (Level 3) • GR-1089-CORE: NEBS Electromagnetic Compatibility (EMC) and Safety • GR-63-CORE: NEBS Physical Protection • VZ.TPR.9205: Verizon TEEER
ETSI standards	Cisco ASR 9000 is designed to meet (qualification in progress): • EN300 386: Telecommunications Network Equipment (EMC) • ETSI 300 019 Storage Class 1.1 • ETSI 300 019 Transportation Class 2.3 • ETSI 300 019 Stationary Use Class 3.1 • EN55022: Information Technology Equipment (Emissions) • EN55024: Information Technology Equipment (Immunity) • EN50082-1/EN-61000-6-1: Generic Immunity Standard
EMC standards	Cisco ASR 9010 is designed to meet: • FCC Class A • ICES 003 Class A • AS/NZS 3548 Class A • CISPR 22 (EN55022) Class A • VCCI Class A • BSMI Class A • IEC/EN 61000-3-2: Power Line Harmonics • IEC/EN 61000-3-3: Voltage Fluctuations and Flicker • EN 50121-4: Railway EMC
Immunity	Cisco ASR 9010 is designed to meet: • IEC/EN-61000-4-2: Electrostatic Discharge Immunity (8kV Contact, 15kV Air) • IEC/EN-61000-4-3: Radiated Immunity (10V/m) • IEC/EN-61000-4-4: Electrical Fast Transient Immunity (2kV Power, 1kV Signal) • IEC/EN-61000-4-5: Surge AC Port (4kV CM, 2kV DM) • IEC/EN-61000-4-5: Signal Ports (1kV) • IEC/EN-61000-4-5: Surge DC Port (1kV) • IEC/EN-61000-4-6: Immunity to Conducted Disturbances (10Vrms) • IEC/EN-61000-4-8: Power Frequency Magnetic Field Immunity (30A/m) • IEC/EN-61000-4-11: Voltage DIPS, Short Interruptions, and Voltage Variations • EN 50121-4: Railway EMC
Safety	Cisco ASR 9010 is designed to meet: • UL/CSA/IEC/EN 60950-1 • IEC/EN 60825 Laser Safety • ACA TS001 • AS/NZS 60950 • FDA : Code of Federal Regulations Laser Safety

Cisco Services for Cisco ASR 9000 Series

Through a lifecycle services approach, Cisco delivers comprehensive support to service providers to help them successfully deploy, operate, and optimize their IP Next-Generation Networks (IP NGNs). Cisco Services for the Cisco ASR 9000 Aggregation Services Routers provide the services and proven methodologies that help assure service deployment with substantial return on investment, operational excellence, optimal performance, and high availability. These services are delivered using leading practices, tools, processes, and lab environments developed specifically for Cisco ASR 9000 Series deployments and post-implementation support. The Cisco Services team addresses your specific requirements, mitigates risk to existing revenue-generating services, and helps accelerate time to market for new network services.

For more information about Cisco Services, contact your local Cisco account representative or visit http://www.cisco.com/go/spservices.

Ordering Information

Table 4 provides ordering information for the Cisco ASR 9000 Series Route Switch Processor.

Table 4. Ordering Information

Product Description	Supported Software Release	Part Number
Route Switch Processor optimized for packet transport	Cisco IOS XR Software Release 4.2.0 onwards	A9K-RSP440-TR
Route Switch Processor optimized for packet transport, spare	Cisco IOS XR Software Release 4.2.0 onwards	A9K-RSP440-TR=
Route Switch Processor optimized for service edge	Cisco IOS XR Software Release 4.2.0 onwards	A9K-RSP440-SE
Route Switch Processor optimized for service edge, spare	Cisco IOS-XR Software Release 4.2.0 onwards	A9K-RSP440-SE=

To place an order, visit Cisco Ordering Home Page or refer to Table 4.

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Cisco Systems, Inc.
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