Cisco 8000 Series Routers

Contents

Cisco 8000 Series

Figure 1.
Cisco 8201, 8202, 8808, 8812, and 8818

High-performance networking systems have historically been divided into routing or switching classes, with distinct hardware and software. Over time, this distinction has become less pronounced. This convergence has occurred with the evolution of feature-rich switching chips and routing chips that balance traditional Service Provider (SP)-class capabilities with many benefits of switching Application-Specific Integrated Circuits (ASICs).

Cisco® 8000 Series routers complete this journey. They deliver provider-class routing functionality at unmatched density, performance, and power. This enables Cisco 8000 Series to be deployed into an unprecedented range of routing roles – all supported with a single ASIC architecture and operating system – thus streamlining qualification, deployment, and operations.

The Cisco 8000 Series combines Cisco's revolutionary Cisco Silicon One, IOS XR software, and a set of clean-sheet chassis to deliver a breakthrough in high-performance routers. The 8000 Series comprises a full range of feature-rich, highly scalable, deep-buffered, 400G-optimized routers ranging from 10.8 Tbps in a 1 RU footprint to an industry-leading, rack-mountable modular system capable of ~260 Tbps of full duplex, line rate forwarding in its initial release.

The Cisco 8000 Series includes two distinct router architectures that both utilize the Cisco Silicon One ASIC. The 8800 Series provides the highest bandwidth via modular chassis with a redundant control plane and switch fabric. The 8800 Series includes the Cisco 8808, Cisco 8812, and Cisco 8818. These chassis deliver up to 14.4 Tbps per line card via 100 and 400 Gigabit Ethernet (GbE) ports.

The Cisco 8200 Series utilizes Cisco's new Router-on-Chip (RoC) model to deliver full routing functionality with a single ASIC per router. The RoC architecture is distinguished from System-on-Chip (SoC) switches by supporting large forwarding tables, deep buffers, more flexible packet operations, and enhanced programmability. Both the 8201 and 8202 provide 10.8 Tbps of network bandwidth with dramatically lower power than contemporary 10 Tbps systems.

Cisco 8000 Series hardware

The 8000 Series includes five routers to address a broad range of bandwidth needs and facility requirements.

Table 1. Cisco 8000 Series chassis options

Chassis	Bandwidth	Ports	Height
Cisco 8201	10.8 Tbps	24 QSFP56-DD 400 GbE 12 QSFP28 100 GbE	1 RU
Cisco 8202		12 QSFP56-DD 400 GbE 60 QSFP28 100 GbE	2 RU
Cisco 8808	115.2 Tbps	48 QSFP28 100 GbE with MACSec 36 QSFP56-DD 400 GbE	8 slots / 16 RU
Cisco 8812	172.8 Tbps		12 slots / 21 RU
Cisco 8818	259.2 Tbps		18 slots / 33 RU

Silicon innovation with the Cisco Silicon One ASIC

At over twice the network capacity of all other high-scale ASICs, Cisco Silicon One is the first routing silicon to break through the 10 Tbps benchmark for network bandwidth. This is accomplished without sacrificing route capacity, packet-per-second forwarding performance, or feature flexibility.

To achieve this unprecedented performance, one of the most challenging factors limiting capacity was addressed. High-scale routing and deep buffering typically require off-chip memories. Connecting an ASIC to these memories reduces the bandwidth available to the data path. This is one of the key reasons that routing chips traditionally have less bandwidth than SoC designs. The Cisco Silicon One architecture achieves high-performance and full routing capabilities without external memories. This is enabled by the clean-sheet internal architecture that includes an on-chip High Bandwidth Memory (HBM). Originally developed for high-end graphics, HBM provides a significant increase in memory performance while lowering power consumption. It is located on the chip package and connects to the forwarding logic via an ultra-fast silicon interface. In Cisco Silicon One ASIC, the HBM is used for both deep buffering and to extend the forwarding tables, thus eliminating the need for external memories.

The Cisco Silicon One architecture supports multiple modes of operation. It can function as an RoC, a line card network processor, and a switch fabric element. This flexibility enables consistent software in multiple roles and rapid silicon evolution.

System design innovation

Supporting the 8000 Series capabilities demanded a wide range of new approaches to platform design. By leveraging over 25 years of high-performance system design, Cisco has delivered unprecedented capacity without compromising forwarding performance or requiring oversubscription. This required new power supplies, a redesigned cooling architecture, and future-proof connectors.

The Cisco 8200 Series chassis requires extensive innovation to support high densities. Consolidating multiple components into a single ASIC requires significant chip power. In addition, 400 GbE optics require up to six times the power of 100 GbE QSFP28 modules. These challenges are addressed via advanced system design, including state-of-the-art fans and heat sinks, and QSFP-DD modular optics.

The 8800 chassis utilize a state-of-the-art orthogonal direct design with advanced cooling, high power capacity, new power supplies, and future-proof connectors. The chassis and all data path components for the 8800 Series benefit from a clean sheet design that allows the systems to take full advantage of the latest technologies and Cisco's design expertise. This design connects all forwarding path components directly without a backplane or midplane. In the 8800 Series, the line cards are oriented horizontally, and the eight fabric cards are oriented vertically. Every major component of the 8800 Series was developed with a clean-sheet approach – representing Cisco's unprecedented investment and commitment to a long lifecycle for the 8000 Series.

The 8800 chassis deliver significant improvements over previous orthogonal chassis, including:

- State-of-the-art redundant fans
- Network Equipment Building System (NEBS)-compliant air filters with doors for simplified line card access
- Future-proof power capacity with power-saving internal distribution
- New power supplies for power feed redundancy with reduced provisioning
- Cable management for up to 864 fibers

Cisco 8200 Series

Figure 2.
Cisco 8201

Figure 3.
Cisco 8202

The Cisco 8200 Series design yields unprecedented power efficiency. To achieve equivalent routed bandwidth and scale, other routers require multiple devices such as off-chip Ternary Content-Addressable Memory (TCAMs) and fabric ASICs.

The 8200 Series 1 and 2 RU footprints allow them to be deployed in locations that traditionally required much larger chassis and special accommodations for power and cooling. Provisioning 10.8 Tbps in the most efficient 100G-generation chassis requires over seven times the space and four times the power. While SoC systems fit into the 1 RU footprint, their lack of buffering, smaller feature set, and low scale constrain their ability to serve in many provider and Data Center Interconnect (DCI) roles. For example, traditional SoC devices provide only low hundreds of microseconds of buffering – limiting their suitability for traffic flows without very low round-trip times. In contrast, the 8200 Series provides tens of milliseconds of buffering and supports large forwarding tables. The ability to deploy a full-featured router into power- and space-constrained facilities such as colocation, Content Delivery Networks (CDNs), Internet Exchange Points (IXPs), or older central office sites opens new possibilities for network designs.

Cisco 8800 Series

Figure 4.
Cisco 8812

With up to ~260 Tbps via 648 400 GbE ports, the Cisco 8800 Series delivers breakthrough density and efficiency with the extensive scale, buffering, and feature capabilities common to all the Cisco 8000 Series of routers. It includes three chassis – the 8808, 8812, and 8818 – to meet a broad set of network and facility requirements.

In addition to reducing per-port power relative to previous generations, the Cisco 8800 Series enables even greater savings by reducing the number of routers required in a given location – potentially removing entire layers from a network. This results in a significant reduction in the total number of router port and optics, one of the top contributors to network costs.

Cisco 8800 Series line cards

The initial release of the Cisco 8800 Series supports two line cards. The 36-port QSFP56-DD 400 GbE line card provides 14.4 Tbps via 36 QSFP56-DD ports. It provides up to 144 ports of 100 GbE via breakout and supports QSFP+, QSFP28, and QSFP28-DD modules. The 48-port QSFP28 100 GbE line card provides 4.8 Tbps with MACsec support on all ports. It also supports QSFP+ optics for 10G and 40G compatibility.

The 8800 Series line cards utilize multiple Cisco Silicon One forwarding ASICs to achieve high performance and bandwidth with line rate forwarding.
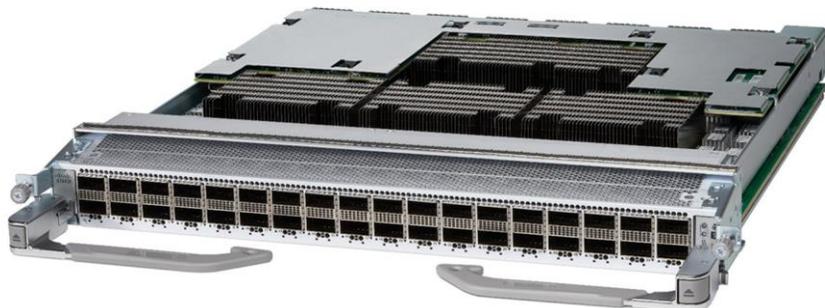

Figure 5.
36-port QSFP56-DD 400 GbE line card

Figure 6.
48-port QSFP28 100 GbE line card

Cisco 8800 Series switch fabric

The Cisco 8800 Series switch fabric is powered by 8 fabric cards that provide 7+1 line rate redundancy. In addition, the fabric supports a separate operational model with 4+1 fabric card redundancy to provide an entry-level option for systems with only the 48-port 100 GbE line card. This mode reduces cost and power for networks that want to take advantage of the latest platforms but are not yet ready to broadly deploy 400 GbE.

Figure 7.
Cisco 8812 fabric card

Security

Security is a major concern for all Cisco customers. Attacks on networking equipment can have disastrous results. Network operators need assurance that their equipment is secure and running authorized Cisco software. Cisco 8000 Series routers support hardware root of trust based on the Trusted Computing Group (TCG) and IEEE 802.1 AR standards. This approach is far more reliable than a software-based security approach. All Cisco 8200 routers are FIPS 140-2 Level 2 compliant and support advance security features to ensure platform and OS integrity.

- Cisco secures the supply chain of every system at manufacturing time. A technology called "Chip Protection" allows customers to be assured that the hardware they receive from Cisco has no counterfeit components. This is accomplished with the use of unique identifiers that are stored inside Trusted Anchor Module (TAM) device as a way to identify and track componenets through the entire lifecycle of Cisco 8000. The checks cover all major components, including network processors, CPUs, and Field-Programmable Gate Arrays (FPGAs).

- Every image a customer downloads from Cisco site is cryptographically signed using Cisco private keys. Each platform has a TAM (based on the TCG standard) that uses built-in cryptographic functions to validate the image signature. Once the signature is validated, the software is confirmed authentic and is ready for install.

- During normal operation, the JTAG (Joint Test Action Group - a method of chip testing and verification) ports on chips are monitored. JTAG is one of the most common attack surfaces and therefore must be secured. Cisco uses a technology called "Secure JTAG" to monitor the port. If any illegal activity is detected, it is flagged and the system CPU is held in reset mode.

- Secure Boot root of trust is anchored in the TAM. It establishes an authentication chain where each software module authenticates the next module in the boot process.

Cisco IOS XR software

Cisco IOS XR7 is a unified network OS spanning access, aggregation, edge, and core. The networking protocol stack within XR7 can be cut down by two-thirds when the IP transport architecture is simplified. Improvements to XR7 internal architecture have reduced the memory footprint by 35%. By reducing code size and the resources required, XR7 can be installed onto even the most constrained hardware designs with full security features without impact to boot times.

Modernizing XR7 with install procedures using standard Linux software package managers has also improved operations. Instead of "one-size-fits-all," XR7 provides modularity so customers only load what they will use. Service providers can easily access new software packages from trusted Cisco Red Hat Package Manager (RPM) repositories. Alternatively, they can build their own repository of both Cisco and custom software packages, which can be fetched for final system configuration without spending time trying to sort out software dependencies. All the required Cisco software packages, any home-grown/third-party software packages, as well as the router configuration can be pulled into a single Cisco software image known as a "Golden ISO." Customized images can now be installed consistently and with confidence across devices in the network.

Cisco IOS XR7 brings an unmatched level of openness for programmability and customization.

IOS XR 7 supports open, model-driven APIs at all layers of the software stack. At the management layer, XR supports a comprehensive list of both native and industry-driven OpenConfig models with multiple encoding (XML and JSON) and transport (gRPC, Netconf) options. The APIs at the management layer allow operators to apply configuration to the device or retrieve the state of the system. The APIs also address advanced traffic engineering use cases, allowing applications to control the route followed by traffic within the network. These APIs can be used independently or combined with other ecosystem abstraction layers such as SONIC or P4Runtime.

IOS XR 7 also supports the OFA (Open Forwarding Abstraction) API, which provides a logical representation of all the forwarding and telemetry capabilities of the underlying hardware. In addition, IOS XR 7 provides a flexible consumption model allowing third-party application software to run on the device alongside IOS XR to enable customization options for the customer network. With application hosting capabilities, operators can host their own controller agent or custom protocol; use various hosting apps for telemetry collection, traffic engineering, and configuration management; or manage the box like a Linux machine using third-party software such as Chef, Puppet, or Ansible.

Cisco IOS XR 7 is the industry's most trusted network operating system.

XR7 is the most advanced network operating system for improving the security posture of the router. The Cisco Secure Boot subsystem ensures that the device boot image is genuine and untampered. With advanced signing technology, XR7 can establish software integrity enforcement and measurement. To further enhance the trusted defense posture, multiple runtime defenses within XR7 guard against malicious actors and make exploitation of bugs more difficult. Even if booted securely, a router may run for months or years without rebooting, which could leave vulnerabilities at runtime undetected for a long time. XR7 leverages Integrated Measurement Architecture (IMA) to significantly enhance security by verifying the integrity of running software. In the IMA appraisal mode, signature validations prevent unauthorized images to launch. In the IMA measurement mode, the hashes of all images are logged in a secure location used for verification. Records of run time processes can be sent for analysis, so the operator knows that system software, updates, or patches are running as intended.

Detailed information on XR7 can be found here:

For a complete list of supported features, refer to the Cisco Feature Navigator.

Baseboard management controller

The Baseboard Management Controller (BMC) provides specialized controllers that monitor the state of a computer or network equipment. It enables monitoring and management of various aspects of the system, such as health (for example, temperature and voltages) and log events for failure analysis. It also provides a range of other remote management capabilities, such as environmental control and firmware upgrades, even when the main CPU is rebooting or unavailable.

Ordering overview

The high-level hardware components are listed below. For full ordering information, refer to the ordering documentation.

Part Number	Description
8201-SYS	Cisco 8201 1 RU Chassis with 24x400 GbE QSFP56-DD and 12x100G QSFP28 and 32 GB DRAM
8202-SYS	Cisco 8202 2 RU Chassis with 12x400 GbE QSFP56-DD and 60x100 GbE QSFP28 and 32 GB of DRAM
8818-SYS	Cisco 8818 18-slot System
8812-SYS	Cisco 8812 12-slot System
8808-SYS	Cisco 8808 8-slot System
8800-LC-36FH	Cisco 8800 36x400 GbE QSFP56-DD Line Card
8800-LC-48H	Cisco 8800 48x100 GbE QSFP28 Line Card
8800-RP	Cisco 8800 Route Processor
8818-FC	Cisco 8818 Fabric Card
8812-FC	Cisco 8812 Fabric Card
8808-FC	Cisco 8808 Fabric Card

Physical characteristics

Series or model	Physical characteristics
Cisco 8000 Series	Operating temperature: 32 to 104°F (0 to 40°C) Nonoperating temperature: -40 to 158°F (-40 to 70°C) Humidity: 5% to 95% (noncondensing) Altitude: 0 to 9842 ft. (0 to 3000 m)
Cisco 8200 Series	Intel Broadwell 4-core 2.4 GHz CPU with 32 GB of DRAM. RS-232 console, 10 GbE Control Plane expansion, 1 GbE Management & BMC port, 1x USB2.0, GBP (ToD, 10MHz, 1PPS), 1588, and BITs (sync). Bidirectional air flow

Series or model	Physical characteristics
Cisco 8201	(H) 1.73 x (W) 17.3 x (D) 20.1 in. (4.40 x 43.9 x 51.1 cm) – 1 RU 24 lbs (10.9 kg) Typical system power at 10.8 Tbps: 415 W 2 power supplies
Cisco 8202	(H) 3.45 x (W) 17.3 x (D) 20.1 in. (8.77 x 43.9 x 51.1 cm) – 2 RU 42 lbs (19 kg) Typical system power at 10.8 Tbps: 750 W 2 power supplies Optional air filter
Cisco 8800 Series	2 route processors Intel Broadwell 4-core 2.4 GHz CPU with 32 GB of DRAM. RS-232 console, 10 GbE Control Plane expansion SFP+, 1 GbE Management & BMC port, 2x USB2.0, GBP (ToD, 10MHz, 1PPS), 1588, and BITs (sync). Cable management, doors, and air filters 6.3 KW power supply for AC and high-voltage DC (180 to 305V AC, 192 to 200V DC) 4.4 KW power supply for 48V 60A DC (-40 to -75V DC) 4.8 KW power supply for 48V 100A DC (-40 to -75V DC) Horizontal line cards with 8 vertical fabric cards and 4 fan trays Rack mountable in standard 19 in. (48.3 cm) rack
Cisco 8808	(H) 28 x (W) 17.45 x (D) 33.73 in. (71.12 x 44.32 x 85.7 cm) – 16 RU – 8 line cards Depth with cable management, filter, and doors: 41.18 in. (104.6 cm) Weight: Unloaded, 162 lbs (73 kg); fully loaded, 643 lbs (292 kg) Typical system power at 115.2 Tbps: 13 KW 9 high-voltage power supplies or 12 48V DC power supplies
Cisco 8812	(H) 36.75 x (W) 17.45 x (D) 35.43 in. (93.345 x 44.23 x 90 cm) – 21 RU – 12 line cards Depth with cable management, filter, and doors: 41.55 in. (105.5 cm) Weight: Unloaded, 212 lbs (96 kg); fully loaded, 868 lbs (393 kg) Typical system power at 172.8 Tbps: 20 KW 9 high-voltage power supplies or 12 48V DC power supplies
Cisco 8818	(H) 57.75 x (W) 17.45 x (D) 35.43 in. (146.7 x 44.23 x 90 cm) – 33 RU – 18 line cards Depth with cable management, filter, and doors: 41.55 in. (105.5 cm) Weight: Unloaded, 283 lbs (128 kg); fully loaded, 1323 lbs (600 kg) 18 high-voltage power supplies or 24 48V DC power supplies

Compliance

Specification	Description
Regulatory compliance	Products should comply with CE Markings according to directives 2004/108/EC and 2006/95/EC.
Safety	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition AS/NZS 60950-1 GB4943
EMC: Emissions	47CFR Part 15 (CFR 47) Class A AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN32 Class A CNS13438 Class A
EMC: Immunity	EN55024 CISPR24 EN300386 KN 61000-4 Series
RoHS	The product is RoHS-6 compliant with exceptions for leaded-ball grid-array (BGA) balls and lead press-fit connectors.

Warranty

Service and support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco 8000 Series. These innovative Cisco Services offerings are delivered through a unique combination of people, processes, tools, and partners, and they are focused on helping you increase operating efficiency and improve your network. Cisco Advanced Services use an architecture-led approach to help you align your network infrastructure with your business goals and achieve long-term value. The Cisco SMARTnet™ service helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning resources.

With this service, you can take advantage of the Cisco Smart Call Home service, which offers proactive diagnostics and real-time alerts on your Cisco 8000 Series. Spanning the entire network lifecycle, Cisco Services offerings help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise.

Cisco environmental sustainability

Information about Cisco's environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the "Environment Sustainability" section of Cisco's Corporate Social Responsibility (CSR) Report.

Reference links to information about key environmental sustainability topics (mentioned in the "Environment Sustainability" section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant, or guarantee that it is complete, accurate, or up to date. This information is subject to change without notice.

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For more information

Learn more about the Cisco 8000 Series routers.

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