

Cisco ASR 1000 Series Embedded Services Processors

Product Overview

The Cisco® ASR 1000 Series Embedded Service Processors (ESPs) are based on the innovative, industry-leading Cisco QuantumFlow Processor for next-generation forwarding and queuing in silicon. These modules use the first generation of the hardware and software architecture known as Cisco QuantumFlow Processor.

The 5-, 10-, 10-N-, and 20-Gbps Cisco ASR 1000 Series ESPs (part numbers ASR1000-ESP5, ASR1000-ESP10, ASR1000-ESP10-N, and ASR1000-ESP20, respectively) provide four centralized forwarding-engine options for the Cisco ASR 1000 Series Aggregation Services Routers. Additionally, the ASR 1002-Fixed includes a non-modular, fixed ESP with throughput of 2.5-Gbps.

The Cisco ASR1000-ESP10-N is the nonencryption version of the ASR1000-ESP10. The ASR1000-ESP10-N can only support noncrypto Cisco IOS® Software images and will never support encryption capabilities such as IPSec. In future releases, the ASR1000-ESP10-N may support secured network management features such as SSH, SSL, and SNMPv3.

The Cisco ASR 1000 Series ESPs are responsible for the data-plane processing tasks, and all network traffic flows through them. The modules perform all baseline packet routing operations, including MAC classification, Layer 2 and Layer 3 forwarding, quality-of-service (QoS) classification, policing and shaping, security access control lists (ACLs), VPNs, load balancing, and NetFlow. They are also responsible for features such as firewalls, intrusion prevention, Network Based Application Recognition (NBAR), Network Address Translation (NAT), and flexible pattern matching.

The Cisco ASR 1002-Fixed is the only chassis that supports the 2.5-Gbps ESP, which is integrated in the chassis. The 5-Gbps Cisco ASR 1000 Series ESP (ASR1000-ESP5) supports 5-Gbps bandwidth and is supported exclusively in combination with the Cisco ASR1002 Router chassis. The 10-Gbps Cisco ASR 1000 Series ESP (ASR1000-ESP10 and ASR1000-ESP10-N; Figure 1) supports 10-Gbps bandwidth, is supported on all Cisco ASR 1000 Series chassis, and can optionally be deployed in customer networks that require 1+1 redundancy.¹ The 20-Gbps Cisco ASR 1000 Series ESP (ASR1000-ESP20) supports 20-Gbps bandwidth, is supported on the Cisco ASR 1004 and ASR 1006 Router chassis, and can optionally be deployed in customer networks that require 1+1 redundancy.

Performance highlights of the 20-Gbps ESP include hardware-assisted policing, encryption capability of 8 Gbps, and special jitter- and latency-minimizing multicast packet replication. The encryption capability of the 10-Gbps ESP is rated for 4 Gbps whereas the 5-Gbps ESP is rated for 1.8 Gbps and the 2.5-Gbps ESP is rated for 1.0 Gbps. The ASR1000-ESP10-N has the same performance characteristics as the ASR1000-ESP10 but does not support encryption services.

¹ Please see fault-tolerant configuration in Table 4.

Figure 1. Cisco ASR 1000 Series ESP (10 Gbps shown)



Applications

The Cisco 2.5-, 5-, 10-, 10-N-, and 20-Gbps ESPs facilitate the following solutions:

- **Service provider broadband:** The Cisco ASR 1000 Series Router serves as a broadband aggregation router that terminates up to 32,000 subscriber sessions and supports features such as Session Border Controller (SBC) (formally known as Cisco unified Border Element (SP Edition)) for voice over IP (VoIP) and video (for example, Cisco TelePresence™) services and hardware-assisted per-user firewall for security.
- **Service provider edge (PE):** The Cisco ASR 1000 Series Router interfaces with service provider-provisioned voice and multimedia (for example, Cisco TelePresence) services directly at the edge. No overlay network, network appliances, or service blades are required in this solution for lower operating expenses (OpEx) and flexible deployment models. This router supports protected signaling for both voice and video services and facilitates 32,000 voice calls concurrent with 20 Gbps of data traffic with accounting, firewall, and call quality features enabled.
- **Service provider-managed customer premise equipment (CPE):** The Cisco ASR 1000 Series Router serves as a WAN aggregation router with high-density Gigabit Ethernet or WAN link aggregation and 10 Gigabit Ethernet uplink capability. Key benefits are Layer 2 and Layer 3 VPN functions and line-rate IP Multicast support for triple-play (data, voice, and video).
- **Enterprise WAN aggregation:** The Cisco ASR 1000 Series Router at the WAN aggregation head-end facilitates a branch architecture that offers excellent investment protection with services and scale. Solution benefits consist of a multigigabit encryption rate (up to 8-Gbps IP Security [IPsec²]), optimization of the WAN to route around brownouts in the service provider network to guarantee mission-critical applications. The ASR1000-ESP10-N supports all of the described services except for IPsec encryption.
- **Enterprise Internet gateway:** The Cisco ASR 1000 Series Router as an Internet gateway delivers multigigabit Cisco IOS Firewall capability in a router without the need for service blades. All firewall processing is performed in silicon by the Cisco QuantumFlow Processor at up to 2.5, 5, 10 or 20 Gbps. In addition, the router provides high-speed logging through

² This product includes software developed by Cavium Networks.

Sampled NetFlow Version 9 and ongoing forwarding with baseline and firewall features enabled.

- **Data monitoring (Encapsulated Remote Switched Port Analyzer [ERSPAN]):** The Cisco ASR 1000 Series Router can capture Layer 2 through Layer 7 packet data and route it through the Layer 3 cloud to the data center. No service blades are required in this solution, which offers full packet visibility compared to IP Traffic Export.

Performance and Scaling

Table 1 lists the performance and scaling features offered by the 5-Gbps Cisco ASR 1000 Series ESP module.

Table 1. ASR1000-ESP5 Performance and Scaling

Feature	Specification
Performance	
Up to 7.5 Mpps	Forwarding performance will vary depending on features configured
4 Mpps	For the combination of the following commonly-used features: IPv4 forwarding, IP Multicast, ACL, QoS, Reverse Path Forwarding (RPF), load balancing, and Sampled NetFlow
Bandwidth³	
5 Gbps	For the combination of commonly-used features above + FW/NAT; Shared by all Cisco ASR 1000 Shared Port Adapter (SPA) Interface Processor (ASR1000-SIP10) cards
1.8 Gbps	For the combination of commonly-used features above + IPsec* encryption
Scaling	
Access control	4,000 unique ACLs and 50,000 ACEs per system
Broadband	12,000 sessions and 6,000 L2TP tunnels
Internet Protocol (IP)	500,000 IPv4 and 125,000 IPv6 routes; Multicast: 64,000 routes and 1,000 groups
Quality of service (QoS)	Flexible number of queues per interface: <ul style="list-style-type: none"> • Up to 64,000 queues; • Three levels of hierarchy; • Two Low Latency Queuing (LLQ) queues per policy, with up to 1,000 policies; 8 Kbps policing/queuing granularity; <100 microsecond latency for high-priority applications
Real-time traffic	2,000 Compressed Real-Time Transport Protocol (CRTP) sessions
Security	IPsec*: 5,000 tunnels; FW/NAT: 250,000 sessions and 10,000 sessions/sec setup rate
L3VPN	1,000 VRFs
GRE	1,000 tunnels
Cisco Unified Border Element (SP Edition) (formerly called Session Border Controller or SBC)	4,000 sessions (each session represents a complete voice call with 14 SIP messages per call, i.e., 2 call-legs on the SBC consisting of 2 media-legs for a bi-directional media flow and 7 SIP messages per call-leg)

*This product includes software developed by Cavium Networks.

Table 2 lists the performance and scaling features offered by the 10-Gbps Cisco ASR 1000 Series ESP module.

³ Rated bandwidth for all Cisco ASR 1000 Series products refers to the maximum sustainable forwarding throughput.

Table 2. ASR1000-ESP10 and ASR1000-ESP10-N Performance and Scaling

Feature	Specification
Performance	
Up to 15 Mpps	Forwarding performance will vary depending on features configured
8 Mpps	For the combination of the following commonly-used features: IPv4 forwarding, IP Multicast, ACL, QoS, Reverse Path Forwarding (RPF), load balancing, and Sampled NetFlow
Bandwidth⁴	
10 Gbps	For the combination of commonly-used features above + FW/NAT; Shared by all Cisco ASR 1000 Shared Port Adapter (SPA) Interface Processor (ASR1000-SIP10) cards
4 Gbps	For the combination of commonly used features above + IPsec* encryption (not supported on the ASR1000-ESP10-N)
Scaling	
Access control	4,000 unique ACLs and 50,000 ACEs per system
Broadband	24,000 sessions and 12,000 L2TP tunnels
Internet Protocol (IP)	1,000,000 IPv4 and 250,000 IPv6 routes; Multicast: 64,000 routes and 1,000 groups
Quality of service (QoS)	Flexible number of queues per interface: <ul style="list-style-type: none"> • Up to 128,000 queues; • Three levels of hierarchy; • Two Low Latency Queuing (LLQ) queues per policy, with up to 1,000 policies; 8 Kbps policing/queuing granularity; <100 microsecond latency for high-priority applications
Real-time traffic	4,000 Compressed Real-Time Transport Protocol (CRTP) sessions
Security	IPsec*: 10,000 tunnels (not supported on the ASR1000-ESP10-N); FW/NAT: 500,000 sessions and 20,000 sessions/sec setup rate
L3VPN	1,000 VRFs
GRE	2,000 tunnels
Cisco Unified Border Element (SP Edition) (formerly called Session Border Controller or SBC)	9,000 sessions (each session represents a complete voice call with 14 SIP messages per call, i.e., 2 call-legs on the SBC consisting of 2 media-legs for a bi-directional media flow and 7 SIP messages per call-leg)

*This product includes software developed by Cavium Networks.

Table 3 lists the performance and scaling features offered by the 10-Gbps Cisco ASR 1000 Series ESP module.

Table 3. ASR1000-ESP20 Performance and Scaling

Feature	Specification
Performance	
Up to 20 Mpps	Forwarding performance will vary depending on features configured
10.4 Mpps	For the combination of the following commonly-used features: IPv4 forwarding, IP Multicast, ACL, QoS, Reverse Path Forwarding (RPF), load balancing, and Sampled NetFlow
Bandwidth⁵	
20 Gbps	For the combination of commonly-used features above + FW/NAT; Shared by all Cisco ASR 1000 Shared Port Adapter (SPA) Interface Processor (ASR1000-SIP10) cards
8 Gbps	For the combination of commonly-used features above + IPsec* encryption

⁴ Rated bandwidth for all Cisco ASR 1000 Series products refers to the maximum sustainable forwarding throughput.

⁵ Rated bandwidth for all Cisco ASR 1000 Series products refers to the maximum sustainable forwarding throughput.

Feature	Specification
Scaling	
Access control	16,000 unique ACLs and 50,000 ACEs per system
Broadband	32,000 sessions and 16,000 L2TP tunnels
Internet Protocol (IP)	1,000,000 IPv4 and 250,000 IPv6 routes; Multicast: 128,000 routes and 1,000 groups
Quality of service (QoS)	Flexible number of queues per interface: <ul style="list-style-type: none"> • Up to 128,000 queues; • Three levels of hierarchy; • Two Low Latency Queuing (LLQ) queues per policy, with up to 1,000 policies; 8 Kbps policing/queuing granularity; <100 microsecond latency for high-priority applications
Real-time traffic	4,000 Compressed Real-Time Transport Protocol (CRTP) sessions
Security	IPsec*: 10,000 tunnels; FW/NAT: 1,000,000 sessions and 40,000 sessions/sec setup rate
L3VPN	4,000 VRFs
GRE	4,000 tunnels
Cisco Unified Border Element (SP Edition) (formerly called Session Border Controller or SBC)	64,000 sessions (each session represents a complete voice call with 14 SIP messages per call, i.e., 2 call-legs on the SBC consisting of 2 media-legs for a bi-directional media flow and 7 SIP messages per call-leg)

*This product includes software developed by Cavium Networks.

Please refer to the Cisco ASR 1000 Series Routing Processor data sheet for a list of software features and benefits applicable to broadband, service provider edge, and enterprise deployments.

Product Specifications

Table 4 lists specifications of the 5-, 10-, 10-N-, and 20-Gbps Cisco ASR 1000 Series ESP modules.

Table 4. Specifications of Cisco ASR1000-ESP5, ASR1000-ESP10, ASR1000-ESP10-N, and ASR1000-ESP20

Feature	Specification
Product compatibility	For ASR1000-ESP5: Cisco ASR1002 Router chassis only For ASR1000-ESP10: Cisco ASR1002, ASR1004, and ASR1006 Router chassis For ASR1000-ESP10-N: Cisco ASR1002, ASR1004, and ASR1006 Router chassis For ASR1000-ESP20: Cisco ASR1004 and ASR 1006 Router chassis
Software compatibility	Cisco IOS XE Software Release 2.1 (for ESP5 and ESP10 only); and Cisco IOS XE Software Release 2.2 or higher
Protocols	Refer to Cisco IOS XE Software Release 2.1 and Release 2.2 (or higher) protocol support
Connectivity	Refer to Cisco ASR 1000 Series SIP data sheet for SPA support
Memory	For ASR1000-ESP5: 256Mb Cisco QuantumFlow Processor, 1Gb DRAM, 10Mb TCAM, and 64Mb packet buffer memory For ASR1000-ESP10: 512Mb Cisco QuantumFlow Processor, 2Gb DRAM, 10Mb TCAM, and 128Mb packet buffer memory For ASR1000-ESP10-N: 512Mb Cisco QuantumFlow Processor, 2Gb DRAM, 10Mb TCAM, and 128Mb packet buffer memory For ASR1000-ESP20: 1Gb Cisco QuantumFlow Processor, 4Gb DRAM, 40Mb TCAM, and 256Mb packet buffer memory
Reliability and availability	For ASR1000-ESP10, ASR1000-ESP10-N, and ASR1000-ESP20: high availability 1 + 1 redundancy in dual ESP configuration in combination with Cisco ASR1006 Router chassis Support for Online Insertion and Removal (OIR) Support for Nonstop Forwarding (NSF) and Stateful Switchover (SSO) Support for In Service Software Upgrade (ISSU)
MIBs	RFC 2737 compliant

Network management	Network management through Cisco ASR 1000 Series Route Processor: <ul style="list-style-type: none"> • Telnet (command-line interface [CLI]) • Console port (through the CLI) • Simple Network Management Protocol (SNMP) (RFC 2665) 				
Status LED descriptions	No.	LED Label	LED	Color-State	Behavior Description
		PWR	Power	Solid green	All power rails are within spec.
				Off	Off, the route is in standby mode.
		STAT	System status	Solid green	Cisco IOS Software has successfully booted.
				Yellow	BOOT ROMmon has successfully loaded.
				Red	System failure. On Power up, turned off by software.
		ACTV	Activity	Green	Lit when this is the active RP/
		STBY	Standby	Yello	Lit when this is the standby RP.
Physical dimensions (H x W x D)	0.92 x 16.7 x 14.19 in. (0.02 x 0.428 x 0.36m)				
Power	For ASR1000-ESP5, ASR1000-ESP10, and ASR1000-ESP10-N: 188W max (typ. 140W) For ASR1000-ESP20: 230W max (typ. 150W)				
Approvals and compliance	Safety <ul style="list-style-type: none"> • UL60950 and CAN/CSA-C22.2 No. 60950. Information technology equipment • AS/NZS 60950 • IEC/EN 60950 Information technology equipment • 73/23/EEC • Electromagnetic Emissions Certification • AS/NZ 3548: 1995 (including AMD I + II) Class A • EN55022: 1998 Class A • CISPR 22: 1997 • EN55022: 1994 (including AMD I + II) • 47 CFR Part 15: 2000 (FCC) Class A • VCCI V-3/01.4 Class A • CNS-13438: 1997 Class A • GR1089: 1997 (including Rev. 1: 1999) • Immunity • EN300386: 2000-TNE EMC requirements; product family standard; high priority of service; central office and noncentral office locations • EN50082-1: 1992/1997 • EN50082-2: 1995-Generic Immunity Standard, Heavy Industrial • CISPR24: 1997 • EN55024: 1998-Generic ITE immunity standard • EN61000-4-2: 1995 + AMD I + II ESD, Level 4/8 kV contact, 15 kV air • IEC-1000-4-3: 1995 + AMD 1-Radiated Immunity, 10 V/m • IEC-1000-4-4: 1995-Electrical Fast Transients, Level 4/4 kV/B • IEC-1000-4-5: 1995 + AMD 1-DC Surge-Class 3; AC Surge-Class 4 • EN61000-4-6: 1996 + AMD 1-RF conducted immunity, 10V rms • EN61000-4-11: 1995-Voltage Dips and Sags • ETS300 132-2: 1996 + corrigendum, December 1996 • GR1089:1997 (including Rev1: 1999) • Network Equipment Building Standards • The module meets the following Networking Equipment Building Standards (NEBS): • GR-1089-CORE • GR-63-CORE • European Telecommunication Standards Institute (ETSI) • ETSI 300 386-1 - Levels for equipment with a "high priority of service" that is installed in "locations other than telecommunication centers" • ETSI 300 386-2:1997 - Levels for equipment with a "high priority of service" that is installed in "locations other than telecommunication centers" • ETSI 300 132-2: December 1994 - Power supply interfaces at the input to 				

	telecommunications equipment Sections 4.8 and 4.9
Environmental	Storage temperature: -38 to 150°F (-40 to 70°C) Operating temperature, nominal: 41 to 104°F (5 to 40°C) Operating temperature, short term: 23 to 131°F (-5 to 55°C) Storage relative humidity: 5 to 95% relative humidity (RH) Operating humidity, nominal: 5 to 85% RH Operating humidity, short term: 5 to 90% RH Operating altitude: -60 to 4000m (up to 2000m conforms to IEC/EN/UL/CSA 60950 requirements)

System Requirements

Table 5 gives system requirements.

Table 5. System Requirements

System	Requirement
Hardware	For ASR1000-ESP5: Cisco ASR 1002 Router chassis only For ASR1000-ESP10 and ASR1000-ESP10-N: Cisco ASR 1002 Router chassis; or Cisco ASR 1004 Router chassis with one instance of Cisco ASR 1000 Series Route Processor and one instance of Cisco ASR 1000 Series SIP; or Cisco ASR 1006 Router chassis with at least one instance of Cisco ASR 1000 Series Route Processor and one instance of Cisco ASR 1000 Series SIP For ASR1000-ESP20: Cisco ASR 1004 Router chassis with one instance of Cisco ASR 1000 Series Route Processor and one instance of Cisco ASR 1000 Series SIP; or Cisco ASR 1006 Router chassis with at least one instance of Cisco ASR 1000 Series Route Processor and one instance of Cisco ASR 1000 Series SIP
Software	Cisco IOS XE Software Release 2.1 (for ESP5 and ESP10 only) or higher (ESP10-N and ESP20: Release 2.2 or higher)

Ordering Information

To place an order, visit the Cisco Ordering Home Page at <http://www.cisco.com/en/US/ordering/index.shtml> and refer to Table 6. For further information, please refer to the "Cisco ASR 1000 Series Aggregation Services Routers Orderability" product bulletin.

Please refer to Table 7, Table 8 and Table 9 for compatible hardware. Refer to Table 10 for compatible software.

To download software, visit the Cisco Software Center at: <http://www.cisco.com/public/sw-center>.

Table 6. Ordering Information

Product Name	Part Number
Cisco ASR 1000 Embedded Services Processor 5Gbps	ASR1000-ESP5
Cisco ASR 1000 Embedded Services Processor 10Gbps	ASR1000-ESP10
Cisco ASR 1000 Embedded Services Processor 10Gbps noncrypto	ASR1000-ESP10-N
Cisco ASR 1000 Embedded Services Processor 20Gbps	ASR1000-ESP20

Table 7. ASR1000-ESP2.5 Compatible Hardware

Product Name	Part Number
Cisco ASR 1002-Fixed Router Chassis (ESP2.5 integrated)	ASR1002-F

Table 8. ASR1000-ESP5 Compatible Hardware

Product Name	Part Number
Cisco ASR 1002 Router Chassis	ASR1002

Table 9. ASR1000-ESP10 and ASR1000-ESP10-N Compatible Hardware

Product Name	Part Number
Cisco ASR 1002 Router Chassis	ASR1002
Cisco ASR 1004 Router Chassis	ASR1004
Cisco ASR 1006 Router Chassis*	ASR1006
Cisco ASR 1000 Route Processor 1, 2GB DRAM	ASR1000-RP1
Cisco ASR 1000 Route Processor 2, 8GB DRAM	ASR1000-RP2
Cisco ASR 1000 SPA Interface Processor 10	ASR1000-SIP10

*Supports 1+1 redundancy when configured with two ASR1000-ESP10 modules.

Table 10. ASR1000-ESP20 Compatible Hardware

Product Name	Part Number
Cisco ASR 1004 Router Chassis	ASR1004
Cisco ASR 1006 Router Chassis*	ASR1006
Cisco ASR 1000 Route Processor 1, 2GB DRAM	ASR1000-RP1
Cisco ASR 1000 Route Processor 2, 8GB DRAM	ASR1000-RP2
Cisco ASR 1000 SPA Interface Processor 10	ASR1000-SIP10

*Supports 1+1 redundancy when configured with two ASR1000-ESP10 modules.

Table 11. Compatible Software

Product Name	Part Number
Cisco ASR 1000 Series RP1 IP BASE W/O CRYPTO	SASR1R1-IPB-21SR (for ESP5 and ESP10 only); and SASR1R1-IPB-22SR; or higher
Cisco ASR 1000 Series RP1 IP BASE	SASR1R1-IPBK9-21SR (for ESP5 and ESP10 only); SASR1R1-IPBK9-22SR; or higher
Cisco ASR 1000 Series RP1 ADVANCED IP SERVICES W/O CRYPTO	SASR1R1-AIS-22SR; or higher
Cisco ASR 1000 Series RP1 ADVANCED IP SERVICES	SASR1R1-AISK9-21SR (for ESP5 and ESP10 only); and SASR1R1-AISK9-22SR; or higher
Cisco ASR 1000 Series RP1 ADVANCED ENTERPRISE SERVICES	SASR1R1-AESK9-21SR (for ESP5 and ESP10 only); and SASR1R1-AESK9-22SR; or higher
Cisco ASR 1000 Series RP1 ADVANCED ENTERPRISE SERVICES W/O CRYPTO	SASR1R1-AES-22SR; or higher
Cisco ASR 1000 Series RP2 IP BASE W/O CRYPTO	SASR1R2-IPB-23SR; or higher
Cisco ASR 1000 Series RP2 IP BASE	SASR1R2-IPBK9-23SR; or higher
Cisco ASR 1000 Series RP2 ADVANCED IP SERVICES W/O CRYPTO	SASR1R2-AIS-23SR; or higher
Cisco ASR 1000 Series RP2 ADVANCED IP SERVICES	SASR1R2-AISK9-23SR; or higher
Cisco ASR 1000 Series RP2 ADVANCED ENTERPRISE SERVICES	SASR1R2-AESK9-23SR; or higher
Cisco ASR 1000 Series RP2 ADVANCED ENTERPRISE SERVICES W/O CRYPTO	SASR1R2-AES-23SR; or higher

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you to protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, see Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about the Cisco ASR 1000 Series or the ESPs, visit <http://www.cisco.com/go/asr1000> or contact your local Cisco account representative.



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