



Product Assessment

Cisco ASR 9000 Series Aggregation Services Routers

Carrier Ethernet in Transport and Routing Infrastructure

October 5, 2010



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Cisco ASR 9000 Series Aggregation Services Routers

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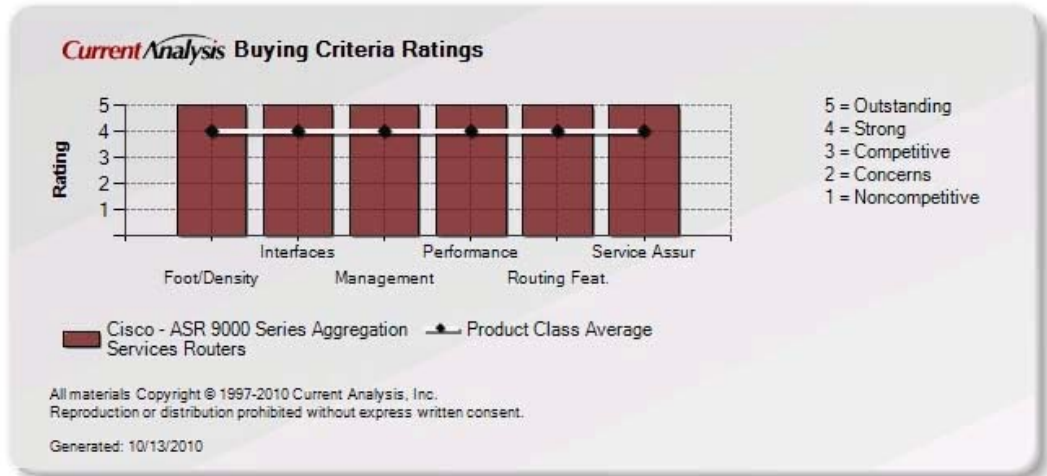
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Product Class:

Carrier Ethernet
in Transporting
and Routing
Infrastructure

Summary

Buying Criteria



Current Perspective: **Very Threatening**

Cisco's Aggregation Services Router 9000 (ASR 9000) is very threatening to the competition, because it represents the next generation of edge router service capabilities that service providers will need as they prepare to support the massive growth in bandwidth, subscriber density and service awareness in their edge and aggregation networks. Cisco launched the ASR900 in November 2008 and followed with the first customer shipment in March 2009, and announced general availability in May 2009. The system addresses the requirements posed by mobile and fixed line operators as well as cable-based network applications through its ability to service large scale Ethernet deployments.

Cisco based the ASR 9000 on new space-efficient hardware designed specifically to satisfy Ethernet transport requirements, initially to support GigE and ten GigE services but with an architecture that scales to support 100 GigE services. The ASR 9000 will ultimately support up to 400 Gbps/slot and deliver a maximum of 6.4 Tbps of switching performance. With the currently available line cards, the system provides 160 Gbps/slot and it can deliver leading densities of up to 128 10GigE and 320 GigE interfaces per chassis. The ASR 9000 also supports Cisco's IPoDWDM transport, which can leverage existing optical networks through the reduction of transport elements and, in some cases, the complete elimination of regeneration sites, which further reduces capital and operational costs. Cisco's Virtual Transponder management model for IPoDWDM, can be adapted to accommodate existing service provider operational models.

With greater capacity and density upgrades planned, service providers will be able to leverage enhancements to the platform as needed to satisfy future demands, such as the planned four port 100GigE line card modules that will provide support for 32 x 100GigE interfaces in a single ASR 9010-10 chassis. In addition to capacity, the ASR 9000 supports advanced services features such as video streaming and media-monitoring technology (VidMon). Given the expected proliferation of video services, Cisco integrated VidMon support onto each of its line cards in order to support

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time-sensitive next-generation video and data services. The ASR 9000 addresses the ever-growing requirement to conserve energy, by using a new six-brick modular power system that reduces energy consumption when the system is not fully loaded. The ASR 9000 leverages the advantages of Cisco's IOS XR operating system, which was first introduced on the CRS-1 and followed by the XR 12000 Series. The CRS Series is deployed in over 300 service provider networks. IOS XR provides the modularity and self-healing capabilities needed to insure non-stop operation as well as the virtualization support required to deliver emerging cloud-based services. From a network and provisioning management perspective, the ASR9000 leverages Cisco's Active Network Abstraction (ANA), which provides a framework for service activation provisioning, service assurance, and Ethernet MPLS OAM support and management capabilities.

Existing Cisco customers should welcome the arrival of the platform, which will have a very high impact on the IP service edge market, since it offers the capabilities to meet today's service delivery challenges as well as tomorrow's expected (and even unexpected) opportunities. The combination of scale and performance coupled with the ability to support advanced services such as high-quality video, strengthens Cisco's overall service provider edge solution portfolio. Cisco noted that pricing for the system begins near \$80,000 and announced the product's general availability in May 2009. Since the product's inception, Cisco has announced multiple significant Tier 1 service provider deployments and it notes that a significant number of additional service providers continue to evaluate the system to offer support for high quality video services. Announced customers to date include Verizon Wireless, Deutsche Telecom, Softbank Broadband, Cogent Communications, Swisscom, NTT America, Telstra, Eastlink, Telx, Neutral Tandem and Abertis.

Strengths and Weaknesses**Strengths**

- The ASR 9000 will ultimately scale up to 400 Gbps per slot and deliver up to 6.4 Tbps of switching capacity per system, which provides the foundation for next-generation Ethernet-based business, video, triple play and cloud-based services. High-scale edge routing and Ethernet switching support will be required to meet service demands from the continued growth in IP-centric services such as video and mobile data.
- The ASR 9000 delivers a full suite of Layer 2 and Layer 3 Ethernet aggregation services. Layer 2 services include EoMPLS, VPLS, H-VPLS, VPWS and full P2P/P2MP pseudowire support, including redundancy and multi-segment capabilities to enable interworking and provide cross-connect support. Layer 3 services include native IP multicast as well as MPLS VPNs, including Inter-AS VPNs to enable MPLS VPN service providers to offer global services across multi-carrier infrastructures. Also supported are resiliency mechanisms such as MPLS TE/FRR, IP-FRR, and native IP multicast and H-QoS.
- The ASR 9000 delivers up to 128 ten GigE ports or up to 320 GigE ports at full line rate. Line cards support H-QoS, Layer 2 and Layer 3 service features. A basic version of each line card supports up to 96,000 queues, while an extended version supports up to 384,000 queues, a threefold increase in the packet buffer capacity, yielding up to 3 million queues per chassis. EANTC's mega test verified the system's 160 Gbps per slot performance using the 16 port 10 GigE interface. The 10 GigE line cards also support IPoDWDM for integrated G.709/OTN transponder capabilities.
- The ASR 9000 Ethernet line cards provide standards-based line-interface functions for delivering and deriving transport-class network timing (Sync-E, BITS, DTI etc.), enabling the support of network-synchronized services to support applications such as mobile backhaul and TDM migration. Integrated media-monitoring technology, VidMon, supports time-sensitive, video and data services.

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- The ASR 9000 operates under Cisco's field-proven modular IOS XR operating system (introduced on the CRS-1 in 2004 and subsequently on the XR 12000 series), which delivers resiliency and virtualization features to enable in-service software upgrades (ISSUs), process restart, and state check-pointing to reduce downtime and to secure service separation. Network, device, and service management is provided by Cisco's Active Network Abstraction (ANA), which provides a framework for service activation provisioning, assurance, Ethernet MPLS OAM support and management.
- The ASR 9000 uses an advanced modular power and cooling that includes the ability to install up to six modular power bricks with redundant AC or DC (versus the more traditional approach of two power bricks). The flexible power bricks only deliver the capacity required. Efficient power use combined with a patented intelligent energy-efficient fan/cooling system provides a lower overall cost of ownership model.

Weaknesses

- The ARS 9000 system architecture supports up to 6.4 Tbps of switching capacity (400 Gbps/slot) and will support up to 32 x 100GigE interfaces per chassis in the near term; however, Cisco has not provided a detailed roadmap regarding the availability of additional features.
- The initial launch also noted support for enhanced edge functionality such as SBC and subscriber management (which are currently available on the 7600 platform and others); Cisco has not offered a more detailed roadmap would help operators plan to leverage additional functionality and capability, beyond basic Layer 2, Layer 3 and video monitoring services.

Point and Counterpoint

Point: The competition will point out that the ASR 9000, although positioned by Cisco as a platform for mobile backhaul and aggregation is overkill for the level of traffic levels projected for most mobile networks, including those that are evolving toward LTE.

Counterpoint: Cisco will explain that the ASR 9000 is a series of platforms, the eight-slot 9010 and the six-slot 9006, which can be right-sized to handle traffic growth for the next three to five years. Cisco will also point out the native ability of the system to deliver and derive transport-class network timing, which is mandatory to support applications such as mobile backhaul and TDM migration. The rich level of timing support is also offered on the SIP-700, which can be used to reuse for existing IP NGN and certain legacy interfaces.

Point: Competitors will highlight that service providers will need to perform a complete fork-life upgrade in order to achieve the benefits of the ASR 9000.

Counterpoint: Cisco will point out that the ASR 9000 is a next generation architecture; however, it can also reuse Cisco's shared port adapters (SPAs) technology through the use a SPA Interface Processor (SIP-700). Service providers can take advantage of modular port adapters that are interchangeable across Cisco's IP NGN routing platforms and preserve investment in line cards (SPAs).

Point: Competitors will tend to spread "FUD" related to the demise of the 7600, now that the long awaited ASR 9000 has arrived, but without all of the requisite advanced services features, which Cisco had added to the platform over the past decade.

Counterpoint: Cisco will point out that the ASR 9000 brings all of the requisite features to the table that are required in order to deal with the emerging video and data traffic being projected for

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service provider networks. With a capacity of up to 400 Gbps/slot and high density 10 GigE line cards with built in video monitoring capabilities, the system is being adopted by multiple service providers on a global basis.

Buying/Selecting Criteria**Footprint and Density: Outstanding**

- The ASR 9000 series is available in two chassis sizes to provide operators with the ability to scale performance and port density to match specific site and application requirements. Models include the 9010, which delivers 1.28 Tbps of switching capacity in a 21 RU chassis; and the 9006, which delivers 800 Gbps of switching capacity in a ten RU chassis. Each provides future support of up to 6.4 Tbps and 3.2 Tbps for the 9010 and 9006 chassis respectively.
- The power options for the ASR 9000 include three different power supplies: 3-kW AC, 2-kW DC and 1.5-kW DC. A fully loaded 9010 will draw 3,140 Watts and a fully loaded 9006 will draw 1,900 Watts, making it one of the more power efficient platforms in its class.
- The ASR 9000 supports the following port densities: 128 ports of 10 GigE per chassis, 320 ports of GigE ports/chassis. The system can connect to LAN, WAN and OTN interfaces in support of Cisco's IPoDWDM integration, which is G.709/OTN compliant.
- For class comparisons based on a fully loaded rack with 44 RU of mounting space, excluding power considerations, the ASR 9000 delivers a total 10 GigE density of up to 256 non-blocking ports per rack, which is about the average for the class based on currently available or short term roadmap announced support.

Interface Support: Outstanding

- The ASR 9000 supports 10/100/1000 Mbps Ethernet requirements through a 40 port GigE line card and ten GigE port requirements with multiple modules; a four port 10 GigE XFP-based line card and an eight-port 10 GigE line XFP-based DX line card.
- The ASR 9000 also offers a combination GigE and ten GigE line card. The card offers a two-port 10 GigE and a 20-port 10/100/1000 Mbps SFP-based solution for applications that require a mix of interfaces.
- Cisco offers a future 16 X 10 GigE line card to support higher density services. EANTC tested the new line card and validated its full line rate performance in an independent third-party test.
- Cisco will offer a four X 100 GigE line card to support emerging 100G services. The planned 100 GigE card is compliant with IEEE P802.3ba standard.
- The ASR 9000 can also use Cisco's shared port adapters (SPAs) through the use a SPA Interface Processor (SIP-700). Service providers can take advantage of modular port adapters that are interchangeable across Cisco's IP NGN routing platforms to support interface such as Packet Over SONET (POS). The SIP-700 is integrated with the ASR 9000's synchronization circuitry to provide standards-based line-interface functions for delivering and deriving transport-class network timing, enabling support for applications such as mobile backhaul and TDM migration.

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Routing and Service Features: Outstanding

- The ASR 9000 supports a full range Layer 2 Ethernet Services which includes Ethernet Virtual Connections (EVCs), flexible VLAN classification/translation, IEEE bridging, IEEE 802.1s Multiple Spanning Tree (MST) and MST Access Gateway.
- For Layer 2 VPN services the ASR 9000 delivers Virtual Private LAN Services (VPLS), Hierarchical VPLS (H-VPLS), Virtual Private Wire Service (VPWS), Ethernet over MPLS (EoMPLS), pseudowire redundancy and multisegment pseudowire stitching.
- For Layer 3 services, the system provides a comprehensive suite of IPv4 and IPv6 capabilities including IPv4 Routing BGP, IS-IS and OSPF. Also features such as RPL, HSRP, VRRP, IPv6 and BGP PIC to provide the necessary carrier-grade routing processes.
- For MPLS the ASR 9000 provides support for Label Distribution Protocol (LDP), Targeted LDP (T-LDP), Resource Reservation Protocol (RSVP), Differentiated Services (DiffServ)-aware traffic engineering, MPLS L3VPN (including Carrier Supporting Carrier [CSC]). To ensure services are delivered according to service level agreements, the system supports MPLS Traffic Engineering (including TE-FRR) and MPLS TE Preferred Path features.
- To handle video traffic the system supports the following Multicast features: source-based and shared distribution trees, Protocol Independent Multicast sparse mode (PIM-SM), Bidirectional PIM (Bidir-PIM), PIM Source Specific Multicast (PIM SSM), Automatic route processing (AutoRP), Multiprotocol BGP (MBGP), and Multicast Source Discovery Protocol (MSDP). In addition Internet Group Management Protocol Versions 2 and 3 (IGMPv2 and v3) and IGMPv2/v3 snooping is supported.
- The ASR 9000 is scalable to meet growing service requirements and supports up to 3 million queues per system to insure traffic is prioritized and treated according to desired traffic classification and policies. The system provides all basic and advanced queueing mechanisms such as class-based weighted fair queueing (CBWFQ), weighted random early detection (WRED), priority queueing with propagation, 2/3-color (2R3C) policing, modular QoS CLI (MQC) and four level H-QoS.

Service Assurance: Outstanding

- The ASR 9000 Series supports high availability software features such as MPLS TE-Fast Reroute (FRR), bidirectional forwarding detection (BFD), 802.3ad link aggregation bundles, non-stop forwarding (NSF) and nonstop routing (NSR), which reside under the control of Cisco's IOS-XR software release 3.9.0, which is designed to address the Carrier Ethernet foundation for visual networking.
- To assist with on-going management and fault detection, the ASR 9000 supports a full range of Ethernet OAM (IEEE 802.3ah and IEEE 802.1ag) tools plus MPLS OAM (label switched path [LSP] ping, LSP traceroute, and virtual circuit connectivity verification [VCCV]) functions to provide additional visibility and trace capabilities.
- The ASR 9000 Series supports a full range of Ethernet services and includes support for features such as Ethernet Virtual Connections (EVCs), Flexible VLAN classification and translation, IEEE bridging, IEEE 802.1s multiple spanning tree (MST), MST access gateway, L2VPN, VPLS, HVPLS, VPWS, Ethernet over MPLS (EoMPLS), pseudowire redundancy and multisegment pseudowire stitching.
- For Layer 3 services the system supports IPv4/IPv6 routing, BGP/BGP-PIC, IS-IS, and OSPF. The system also supports route policy language (RPL), hot standby router protocol (HSRP) and virtual router redundancy protocol (VRRP) to deliver additional resiliency and nonstop delivery of Ethernet services.

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Services Routers**Transport and Routing
Infrastructure**System and Service Management: Outstanding**

- The ASR 9000 uses Cisco's IOS XR Software management which provides industry-standard interfaces, including modular command-line interface (CLI), simple network management protocol (SNMP) and native XML interfaces. For service providers that leverage existing OAM tools, support of these standard management paradigms will help reduce integration efforts.
- The ASR 9000 also uses Cisco's Active Network Abstraction (ANA). ANA is a flexible, vendor-neutral management framework for a multitechnology, multiservice network environment. Operating between the network and the operations support system (OSS) layer, Cisco ANA aggregates virtual network elements (VNEs) into a software-based virtual network, much as real network elements create the real-world network. Cisco ANA dynamically discovers network components and tracks the status of network elements in near real time.

System Performance and Architecture: Outstanding

- The ASR 9000 Series provides an in-place upgrade roadmap to a switching capacity of up to 400 Gbps per slot without a chassis replacement; current or soon to be available line cards will deliver up to 160 Gbps per slot. The systems line cards utilize network processors to support an array of Carrier Ethernet applications. Line-cards are available in a base and extended-scale configuration, complemented by a non-blocking switch fabric on the route switch processor (RSP) modules, a future ready backplane (BP), and a thermal and power infrastructure on the chassis.
- The ASR 9000 provides performance and reliability via redundant RSPs and switching fabric. The system uses a redundant active-active RSP, memory-less switch fabric, and a control plane chassis control bus, which offers no single point of failure. There are separate high and low-priority queues for multicast and unicast traffic, which enables the system to perform all multicast replication in the switch fabric for efficiency.
- All ASR 9000 system components are hot swappable, including power supplies, fans, RSP/fabrics modules, line cards and optics. The system is available with redundant AC or DC power systems and uses flexible power bricks based on capacity required for efficient power use. The power bricks are housed in field serviceable power entry modules (PEMs) and have an intelligent energy-efficient fan/cooling system.
- The ASR 9000 Series provides support for up to 320 GigE ports per chassis and up to 128 10 GigE ports using the 16 port 10 GigE line card. A four-port 100 GigE line card will provide up to 32 ports per chassis.
- The ASR 9000 Series features a fully integrated timing infrastructure, allowing the routers to take in timing inputs (Synchronous Ethernet, Building Integrated Timing Supply [BITS], Data Over Cable Service Interface Specification [DOCSIS] Timing Interface [DTI] etc.) and distribute them over the backplane to each slot. This capability provides rich support mobile convergence; mobile RAN backhaul; and TDM circuit emulation, without sacrificing performance or scale.

Product Metrics
Product: Cisco ASR 9000 Series Aggregation Services Routers

Architecture	
Switch Fabric	9010: 1.28 Tbps, up to 6.4 Tbps in the future; 9006: .8 Tbps, up to 3.2 Tbps future; driven by line cards
Distribution of Intelligence	160 Gbps per slot; up to 400 Gbps per slot planned; fully distributed, line card-based packet-forwarding
Queuing, Buffering	384K Queues per line card
Performance	
Switching Capacity	9010: 1.28 Tbps, up to 6.4 Tbps in the future; 9006: .8 Tbps, up to 3.2 Tbps future; driven by line cards
Full Duplex Switching Capacity	9010: 640 Gbps, up to 6.4 Tbps in the future; 9006: 400 Gbps, up to 1.6 Tbps future; driven by line cards
Routing/Switching Performance	Not specified
Full Duplex Service Performance	160Gbps/slot (current); up to 400 Gbps/slot based on future line cards
Rack Density	9010: 2; 9006: 3
Service Assurance	
Hardware Redundancy	System components are hot swappable
Redundant Power, Fans, Feeds	Available with redundant AC or DC; flexible power bricks based on capacity required for efficient power use - housed in field serviceable Power Entry Modules (PEMs); intelligent energy-efficient fan/cooling system
Redundant Switch Fabric/Forwarding Engines	Redundant RSP and fabric with zero packet loss on switchover redundancy
Interface Redundancy 1:1	
Interface Redundancy, 1:N	
Redundant Hot Swappable Components	Yes
SONET APS	Not supported
RPR, Standard/Proprietary	Not supported
Resilience/Availability	Fully redundant platform
Control, Data, and Management Plane Separation	Yes
Graceful Restart	Yes
50 ms Link Failover	Yes
MPLS Fast Reroute	Yes, MPLS-TE FRR, @ Link/node/path levels
Non-Stop Switching/Hitless Layer 2 Failover	Yes
Non-Stop Routing/Hitless Layer 3 Failover	Yes
Non-Stop Services/Hitless Layer 4 Failover	Yes
Hitless Software Upgrade	Yes, ISSU, process restart/check-pointing

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Product Metrics *(Continued)*
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Ethernet Port Density	
100 Gbps Ports/Chassis	Planned 9010: up to 32; 9006: up to 16; with four-port 100GigE line card
40 Gbps Ports/Chassis	Future roadmap
10 Gbps Ports/Chassis (non-blocking)	9010: up to 64 with 8 port card; up to 128 with 16-port SFP+ line card; 9006: up to 32 with 8 port card; up to 64; with 16-port SFP+ line card
10 Gbps Ports/Chassis (over-subscribed)	Line rate
1 Gbps Ports/Chassis (non-blocking)	9010: up to 320; 9006: up to 160; with 40-port 100/1000 SFP line card
1 Gbps Ports/Chassis (over-subscribed)	Line rate
10/100 Mbps Ports/Chassis	Same density as 1 GigE
100 Mbps Ports/Chassis	Same density as 1 GigE
Legacy TDM-ATM Port Density	
T3/E3 Ports/Chassis	Not supported
ATM Ports/Chassis (OC-3)	Not supported
ATM Ports/Chassis (OC-12)	Not supported
ATM Ports/Chassis (OC-48)	Not supported
ATM Ports/Chassis (OC-192)	Not supported
Package Over SONET Port Density	
POS Ports/Chassis (OC-3/STM-1)	Not supported
POS Ports/Chassis (OC-12/STM-4)	Supported via SIP-700/Channelized OC12/STM-4 SPA
POS Ports/Chassis (OC-48/STM-16)	Supported via SIP-700/Channelized OC48/STM-16 SPA (Sept 2010)
POS Ports/Chassis (OC-192/STM-64)	Supported via SIP-700/Channelized OC192/STM-64 SPA (Sept 2010)
Wave Division Multiplexing Interfaces	
WDM Lambdas/Chassis	10G IPoDWDM supported on 10G line card, ITU standard, 100GHz spacing, for integrated G.709/OTN transponder capabilities
Interfaces	
10/100 Mbps Ethernet	40 port 100/1000 SFP line card
100 Mbps Ethernet	40 port 100/1000 SFP line card
100/1000 Mbps Ethernet	40 port 100/1000 SFP line card
1 Gbps Ethernet	40 port 100/1000 SFP line card
10 Gbps Ethernet	16 port SFP line card
40 Gbps Ethernet	Planned
100 Gbps Ethernet	Planned
DS-1/DS-3/HSSI	Not supported
ATM	Not supported
POS	Supported

Continued

Product Metrics *(Continued)*
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Features	
CoS/QoS	H-QOS 4 Levels up to 96K/384K queues per line card for basic/extended linecard respectively
Hardware-based QoS	Yes
Forwarding Classes/Port	8
Service-based QoS	Yes
Interface-based QoS	Yes
Subscriber-based QoS	Yes, 384K queues per line card
Rate Shaping/Limiting/Marking	Yes, including multicast
Line Rate Forwarding	Yes
Layer 2, IEE 802.1p Traffic Prioritization	Yes
Policy-based Traffic Mangement	Yes
Hierarchial QoS	4 levels, up to 96K queues/card (basic line card); 4 levels, up to 384K queues/card (extended line card)
Load Balancing	Yes, 802.3ad/LACP
Link Aggregation	Yes, 802.3ad
MPLS	Yes, Scalable IPv4 Layer 3 VPN backbone services; Inter-AS VPNs; Carrier Supporting Carrier (CSC); Ethernet over MPLS (EoMPLS)
Routed Protocols	IPv4; IPv6
Routing Protocols	Rip v1/v2; OSPF v2; BGP v4; IS-IS;
Route Scalability	1M IPv4 routs (2M planned); 1m IPv6 routes; 1M MAC Addresses;
VLANs/Multicast	EoMPLS Tunnels; MPLS VPNs, 500K; VLAN IDs, 8K; VPLS Instances, 8K
Advanced Service Modules/Capabilities	
Application Awareness/Assurance	Not supported
Deep Packet Inspection	Not supported
Intrusion	Not supported
IPSec	Not supported
Session Border Control	Not supported
Subscriber Management	Not supported
Video Service Support	Video Monitoring capability on each line card; AVSM inherits all the highavailability characteristics of the router optimizing the network insertion point for advanced content services and moving the content sourcing closer to the consumer, Fast channel change and onboard error correction capability for both unicast and multicast
Network Management	
EMS	CISCO, ANA Management Framework; CLI, SNMP, native XML, Cisco ANA management framework with service activation; includes L2/L3 ACLs, L2CP, MAC limiting, TACAS+, RPL, SSH, IPSec
Fault Management	Embedded Event manager, Carrier Ethenret Falut/Assurance Manager
Configuration Management	CISCO, ANA Management Framework with service activation;
Accounting	CISCO, ANA Management Framework

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Product Metrics *(Continued)*
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Performance Management	CISCO, ANA Management Framework
Security	Cisco ANA management framework with L2/L3 ACLs, L2CP, MAC limiting, TACAS+, RPL, SSH, IPSec
Provisioning	Cisco ANA management framework with service activation
Physical Specifications	
Slots/Chassis	10 slots for 9010, 6 slots for 9006
I/O Slots	8 slots for 9010, 4 slots for 9006
NEBS Compliance	Yes, NEBS3 Certified on all Chassis for ASR9000
Power Requirements	Powered by three different power supplies: 3-kW AC, 2-kW DC, and 1.5-kW DC
Power Draw & Thermal Load	Fully loaded 9010: 3,140 Watts; fully loaded 9006: 1,900 Watts
Chassis Options	9010: 10 ; 9006: 8
System Applications	Ethernet-based business services, Residential triple play services, Mobile services – Ethernet backhaul of 4G traffic, Carrier Ethernet transport, Real-time gaming, Video services/targeted advertising, Wholesale services, Cloud/managed services, Hosted service provider edge services
RU	9010: 24.5 RU; 9006: 11.5 RU
Chassis/Rack	9010: 2; 9006: 3 RU
Availability	Since 2009
Additional Information	
Customers	Announced customers to date include Verizon Wireless, Deutsche Telecom, Softbank Broadband, Cogent Communications, Swisscom, NTT America and Telstra.
Partners	Netflow partners include Concord Communications (performance and availability management), Narus (Internet Business Infrastructure Solutions), XACCT (IP billing record creation and account provisioning), Portal Software
Special Notes	The ASR 9000 provides an integrated timing infrastructure, which can take in timing inputs (Sync-E, BITS, DTI, etc.) and distribute them over the backplane to each slot.
Special Notes	The ASR 9000 per/slot performance, failover, and QoS implementations were validated in an independent test conducted by the European Advanced National Test Center (EANTC) in June 2009.
Special Notes	Additional edge functionality such as session border control (SBC), etc. will be available in subsequent releases of the platform.