

Product Intelligence Report

Cisco Aggregation Service Router 9000 (ASR 9000) Series



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Summary

Analytical Summary

Cisco's Aggregation Services Router 9000 (ASR 9000) is very threatening to the competition, because it represents the next level of edge router service scale that service providers will need as they prepare to support the massive growth in bandwidth and subscriber density in their edge and aggregation networks. The ASR 9000, which was launched in November 2008, has appeal in wireline as well as wireless and cable applications due to its ability to aggregate large quantities of Ethernet-related traffic. Since its inception, Cisco has announced five significant Tier-1 service provider deployments and it notes that a significant number of additional service providers are trialing the device to support new video-driven services. Announced customers to date include Verizon Wireless, Deutsche Telecom, Softbank Broadband, Cogent Communications, and Telstra.

The ASR 9000 is based on new space-efficient hardware designed specifically to satisfy Ethernet transport requirements, initially for GigE and 10 GigE but scalable to 100 GigE as that market matures. The system is designed to support up to 400 Gbps/slot and reach a maximum of 6.4 Tbps of switching performance; with current line cards, the system provides 160 Gbps/slot performance and it can support leading densities such as 128 10GigE and 320 GigE interfaces. It also supports Cisco's IPoDWDM capabilities to better leverage existing optical transport networks. With further capacity and density upgrades planned, service providers will be able to support enhancements to the platform as needed to satisfy future demands, such as the planned 32x 100GigE interface support in the ASR 9010 chassis. In addition to capacity, the ASR 9000 supports advanced services features such as video streaming and media-monitoring technology (ViDmon), which has been integrated onto the line cards to support time-sensitive next-generation video and data services. The ASR 9000 addresses the requirement to conserve energy, using a new six-brick modular power system that reduces energy consumption when the system is not fully loaded. The ASR 9000 is also supported by Cisco's IOS XR operating system, which was first introduced on the CRS-1 and is now operating in well 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

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support required to deliver 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 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 will enhance the strength of Cisco's edge solution. Cisco noted that pricing for the system begins near \$80,000 and general availability was declared, on schedule, in Q1 2009.

Strengths and Weaknesses

Strengths

- The ASR 9000 can 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 system has been verified to deliver 160 Gbps per slot using the current line cards.
- 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 160 Gbps/slot and supports up to 128 10GigE ports and 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 and threefold the packet buffer capacity, yielding up to three million queues per chassis. The 10GigE 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, others), enabling the support of network-synchronized services to support applications such as mobile backhaul and TDM migration. Media-monitoring technology (ViDmon) has been integrated onto the line cards to support time-sensitive, next-generation video and data services.
- The ASR 9000 operates under Cisco's field-proven modular IOS XR operating system (introduced on the CRS-1 in 2004), 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 was designed with innovative modular power and cooling that includes the

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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 draw the capacity required for efficient power use, combined with a patented intelligent energy-efficient fan/cooling system.

Weaknesses

- The ARS 9000 will support 6.4 Tbps of switching capacity (400 Gbps/slot) and up to 32x 100GigE interfaces in the future; however, Cisco has not provided a detailed roadmap regarding the availability of these features.
- The initial launch also noted support for enhanced edge functionality such as SBC and subscriber management (which are available on the 7600 platform and others); a more detailed roadmap would help operators plan when to leverage this capability and expand beyond Layer 2 and Layer 3 service deployments.

■ Product Metrics
Cisco Aggregation Service Router 9000 (ASR 9000) Series

System Performance and Architecture	
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
Service Performance	160 Gbps per slot; up to 400 Gbps per slot planned; fully distributed, line card-based packet-forwarding
Architecture	Modular, power-efficient architecture
Chassis Size	9010: 24.5 RU; 9006: 11.5 RU
Interface Density	
100 Gbps Ports/Chassis	Planned 9010: up to 32; 9006: up to 16; with four-port 100GigE line card
10 Gbps Ports/Chassis	9010: up to 128; 9006: up to 64; with 16-port SFP+ line card
1 Gbps Ports/Chassis	9010: up to 320; 9006: up to 160; with 40-port 100/1000 SFP line card
10/100/1000 Base-Mbps Ports/Chassis	Same density as 1 GigE
Other Interfaces	10G IPoDWDM supported on 10G line card, ITU standard, 100GHz spacing, for integrated G.709/OTN transponder capabilities
Service Assurance	
Hardware Redundancy	Redundant RSP and fabric with zero packet loss on switchover redundancy All system components are hot swappable, including power supplies, fans, RSP/fabrics modules, line cards, and optics.
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 active-active route switch processor (RSP), memory-less switch fabric, control plane chassis control bus, no single point of failure; separate high and low-priority queues for multicast and unicast; multicast replication in switch fabric
Interface Redundancy 1:1	802.3ad with LACP across ports and slots – inter-/intra- chassis Multi-chassis (MC) lag planned
Interface Redundancy 1:N	LAG with LACP across ports and slots; MC LAG planned
Redundant Hot Swappable Components	Yes
SONET APS	Planned for CHOC12 shared port adaptors.
RRP, Standard/Proprietary	Planned support for REP in mesh/ring topologies , compatible with G.8032
Resilience/Availability	
Control, Data, and Management Plane Separation	Yes
Graceful Restart	Yes
50ms Link Failover	Yes

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■ Product Metrics

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MPLS Fast Reroute	Yes, MPLS TE-FRR, link/node/path
Hitless Layer 2 Failover	Yes
Hitless Layer 3 Failover	Yes
Non-stop Services	Yes
Hitless Software Upgrade	Yes, ISSU, process restart/check-pointing
VRRP	Secure domain routing (SDR)
Features	
CoS/QoS	H-QoS/COS
Number of Forwarding Classes Supported per Port	8
Service-based QoS	Yes
Interface-based QoS	Yes
Subscriber-based QoS	Yes, 384K queues per line card
Rate Shaping/Limiting/Marking	Yes
Line Rate Forwarding with Features Enabled	Yes, including multicast traffic
Layer 2, IEE 802.1p Traffic Prioritization, DSCP	Yes
Policy-based Traffic Management	Yes
Hierarchical QoS	4 levels, up to 96K queues/card (basic line card) 4 levels, up to 384K queues/card (extended line card)
Ethernet Cross-Connect	MPLS TE Preferred Path
Other QoS Features	3M queues per system
Video Monitoring	Integrated ViDmon video quality support included on Ethernet line cards for reduced OpEx & simplified video operation
Video Caching	Planned: support for AVSM module with over 4 TBs of storage to support video content streaming /caching
Load Balancing	Yes – 802.3ad/ LACP
Link Aggregation	Yes – 802.3ad
MPLS	Yes
Routing Protocols	
RIP v1, v2	Yes
OSPF v2	Yes
BGP v4	Yes
IS-IS	Yes
IPv4	Yes
IPv6	Yes, currently supported
Route Scalability	
IPv4 Routes	1M, planned scale to 2M+

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 Product Metrics

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IPv6 Routes	1M
MAC Addresses	500K, planned scale to 1M+
EoMPLS Tunnels	Yes
MPLS VPNs	32K
VLAN IDs	8K
Other	8K VPLS instances
Layer 2 VPN capabilities	
IEEE.802.1Q VLAN Tagging	Yes
IEEE 802.1v VLAN Classification by Protocol & Port	Yes
IEEE.802.1ad VLAN Stacking (Q-In-Q)	Yes
IEEE 802.3ad Static Load Sharing	Yes
IEEE 802.1 ah MAC - Mac - Provider Bridging	Yes
IEEE 802.1ah Extensions for Backbone Bridging	Yes
IEEE 802.1ah Extensions for Backbone Transport	Plans pending market requirements
Port-based VLAN Support	Yes
Subscriber-based VLAN Support	Yes
Multiple STP Domains per VLAN (IEEE.802.1s)	Yes
Layer 2 Protocol Tunneling	Yes
Layer 3 VPN Capabilities	
MPLS VPNs	Scalable IPv4 Layer 3 VPN backbone services; Inter-AS VPNs; Carrier Supporting Carrier (CSC)
Ethernet over MPLS (EoMPLS)	Yes
Support for Hybrid L2/L3 Tunneling Mechanisms	L2/L3 interworking supported
L2 VPNs Tunneled through MPLS	Yes
H-VPLS	Yes
EoMPLS Tunnels	Yes
Vendor-specific Enhancements/Support	LDP/BGP-signaled VPLS
Multicast Support	
IGMP v1, v2, v3	Yes
IGMP Snooping/Filtering	Yes
PIM-DM/SM/SSM	Yes
Additional Multicast Support	Also supports Anycast; Multicast-based resiliency mechanism known as MoFRR planned

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Product Metrics
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Pseudo Wire Support	
CES	Yes - SyncE
Packet	Yes
Interworking, FR - ATM	N/A
Other	PWE3 redundancy and multi-segment stitching support
Management Support	
PPP/HDLC, cHDLC	N/A
PPPoE	Planned IPoE/ISG for broadband
Network Management	
Network Management	CLI, SNMP, native XML, Cisco ANA management framework with service activation; includes L2/L3 ACLs, L2CP, MAC limiting, TACAS+, RPL, SSH, IPSec
	Embedded Event Manager
	Carrier Ethernet Fault/Assurance Manager and Activation
Physical Specifications	
Slots/Chassis	9010:10; 9006: 6
I/O Slots	9010:8; 9006: 4
NEBS Compliance	Yes, active certifications to meet NEBS, ETSI, and EMC standards; in progress for new hardware components
Power Requirements	Powered by three different power supplies: 3-kW AC, 2-kW DC, and 1.5-kW DC; fully loaded 9010: 3,140 Watts; fully loaded 9006: 1,900 Watts
Chassis Options	Two chassis options
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
Advertized Price	Contact vendor
Availability	IOS XR Software Release 3.7.2
Additional Info.	
Customers	Announced Customer include Verizon Wireless, Deutsche Telecom, Softbank Broadband, Cogent Communications, and Telstra; over 200 service providers are using the ASR series (ASR 1000 and ASR 9000)
Partners	All standard Cisco partners

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■ Product Metrics

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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.
Special Notes	Integrated video quality support - ViDmon
Special Notes	Designed to meet ETSI, EMC, Immunity and NEBS-3, Core requirements; certifications in progress

