



Avaya Virtual Services Platform 9000 Series

The Virtual Services Platform 9000 Series is an agile, streamlined, next-generation Ethernet Switching solution that delivers performance, capacity, and — most crucially — reliability for mission-critical networks.

The VSP 9000 4.0 VSP Operating System Software releases deliver:

- 9048XS-2 48-port 10 Gigabit - “Generation-2” - Ethernet Interface Module
- 9012QQ-2 12-port 40 Gigabit - “Generation 2” - Ethernet Interface Module
- Scalability enhancements: IP Route scalability up to 1,000k; IS-IS Adjacencies up to 128; support for IS-IS Accept Policies

The progressive evolution of the data center has created a new networking environment, no longer simply an extension of the enterprise campus; the data center has developed into an autonomous network with specific requirements and challenges. The Virtual Service Platform 9000 Series is the future-ready and future-proof solution to deliver the sought-after combination of performance, reliability, and scalability.

With mission-critical application demands increasing networks are required to ensure uninterrupted business operations and a quality user experience. Most networks are now called upon to provide 24/365 access, helping to drive business agility, accelerate time-to-service, respond to the needs of new applications and increase efficiency — all while IT budgets are being pressurized to deliver more and more efficiency.

Individual business imperatives will continue to evolve and so too must the network; cost-effectively adapting — forklift upgrades cause excessive disruption. The need is for a platform that is flexible and versatile, easily accommodates both growth and change — a platform that delivers support for new applications ahead of the pack. Equally important, that platform must be space and energy efficient. The right communications solution is critical to your success; the Avaya Virtual Services Platform 9000 Series is that solution.

The Virtual Services Platform 9000 (VSP 9000) Series is a next-generation solution for mission-critical data centers and campus core networks, designed for the needs of large enterprises, and other such as multi-tenant operators. The VSP 9000

Series rises to meet customer requirements for a future-proof, ultra-reliable network that easily and cost-effectively facilitates services integration; it provides a less complex, more agile virtual network infrastructure. It simplifies the network and helps reduce the cost of deploying new services; the VSP 9000 Series enables the building of a dynamic data center, helping to deliver 24/365 uninterrupted access to enterprise applications and services.

The VSP 9000 Series delivers industry-leading performance and scalability, with immediate support for very high-density 1 and 10 Gigabit Ethernet, high-density 40 Gigabit Ethernet, and future-ready for 100 Gigabit Ethernet. The fully scalable architecture helps ensure that network capacity seamlessly scales in line with performance requirements, without complex or expensive re-engineering.

The VSP 9000 Series transforms the network and, as a result, the business, providing an ultra-reliable foundation for services such as communications-enabled Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) business processes, and unified communications. It not only simplifies the core network architecture but also offers enhanced flexibility and scalability to enable faster time-to-service in both data center and very large campus core deployment scenarios. By enabling the virtualized compute infrastructure to be more mobile, predictable, and available, the VSP 9000 Series fully delivers on the promise of centralizing services, all without compromising the high availability, performance, and security that's required in an enterprise environment.

Who has the VSP 9000 been developed for?

The VSP 9000 Series has been specifically developed for organizations that are planning new highly-virtualized data center deployments, and those that wish to deploy future-ready campus core solutions that support seamless IPv4, IPv6, and end-to-end network virtualization and service integration. The VSP 9000 Series is ideally suited for those organizations that:

- Require scalable, high-density 10GbE today, and with continued growth will need to position for 40/100GbE
- Are suffering from performance limitations that result in poor application responsiveness
- Demand best-in-class resiliency
- Need to simplify network infrastructure operations in a highly virtualized environment
- Are required to deliver virtual services for multiple customers or user groups in a cloud computing environment
- Seek to maximize their investment in server virtualization
- Desire a lossless-ready solution should storage convergence become their preferred option

The VSP 9000 Series is for organizations that need to stabilize IT costs and maximize the cost-effective use of their infrastructures. It is for companies that are virtualizing to increase the efficient and flexible use of servers and appliances, and want to reduce maintenance costs. It is for those who are running out of space in the data center and are experiencing exponential increases in power and cooling costs. It is for organizations that want to simplify, save, and equip their networks for the future.

The key benefits of the VSP 9000

- An ultra-reliable platform, helping to ensure uninterrupted business operations
- Delivers very high-density 1 and 10 Gigabit Ethernet today, meeting immediate performance and reliability needs

- A highly flexible platform, offering an upgradable switching engine and an adaptable architecture designed to deliver multi-Tbps scalability
- Is ready for a seamless evolution to 40 and - ultimately - 100 Gigabit Ethernet
- Supports a sophisticated suite for device and network virtualization capabilities; delivering versatile, end-to-end, L2 and L3 services
- Helps to lower operating costs, by reducing management complexity and simplifying the architecture

The VSP 9000 Series is one of the most robust products on the market for the demanding role of high-end Core Switch, and because it is so robust, it can deliver more uptime and can empower more dependable application access.

Multicast enhancements to Avaya Fabric Connect

Many of today's networks are constrained when attempting to make use of applications that require Multicast. The problems include inefficient bridged IP Multicast configurations, or routed IP Multicast that requires complex protocols; making networks burdensome to configure and operate. The VSP 9000 builds on the simplicity and agility introduced with the Avaya Fabric Connect technology, by leveraging extensions to the Shortest Path Bridging (SPB) protocol to support a fully integrated and truly optimized IP Multicast solution.

Both Bridged and Routed IP Multicast traffic are supported, avoiding the inefficiencies or complexities that exist today, without any additional technology or protocols. This optimized functionality is achieved by the straightforward expediency of extending SPB's control plane to exchange advertisement and membership information for IP Multicast streams. This innovative means that Fabric Connect now provides a complete solution for Layer 2 Unicast, Broadcast, and Multicast virtualization, as well as Layer 3 Unicast and Multicast routing and forwarding virtualization.

The integration of Multicast into Fabric Connect supports three operational modes:

- L2 VSN with Multicast - Virtual Services Networks with IGMP configured on access networks delivering optimized forwarding of Multicast traffic in a bridged environment
- L3 VSN with Multicast - Virtual Services Network with VRF-based Routed IP Multicast configured within the Fabric and IGMP configured on access networks
- IP Shortcuts with Multicast - Routed IP Multicast leveraging the Global Routing Table for direct, Layer 3 reachability within the Fabric and IGMP configured on access networks

The benefits of this innovation center around the simplicity of configuration and the optimization of how Multicast-based applications operate. The absence of a Root Bridge requirement or rendezvous points - with no election process and no blocked links - are themselves major steps forward in terms of efficiency and availability. Added to this, leveraging further extensions to the SPB protocol enable Avaya to deliver a solution that is agile, flexible, simple, stable, highly scalable, and notable for the ability to be quickly deployed; time-to-service being the catchword for modern businesses.

Meeting the need

The VSP 9000 Series is specifically designed to support new and emerging requirements. Virtual application LANs enable applications hosted on virtual machines to move - on demand - from one location to another in a completely seamless fashion, and application-specific deep-packet filters help to ensure that only relevant traffic enters the virtual application LAN, delivering application security.

The networking industry is a perpetual work-in-progress, an 'unfinished masterpiece', and the number of standards and recommendations now runs into the thousands. Equipment that is based on a traditional ASIC architecture is limited in that these are set at a certain point in this history and cannot easily adapt to future change. Typically this means that newer features and functionality are supported only in hardware and require additional software processing. The switching architecture of the VSP 9000 Series is uniquely based on Network Processing Units

(NPU) rather than the ASIC technology typically found in rival products. NPUs are scalable computational arrays specifically designed for network-related functions such as efficient examination and manipulation of packet headers, and include the ability for deep packet inspection and manipulation. The Avaya specialized high-performance NPU is known as the Route Switch Processor (RSP) and being an in-house development, Avaya has direct control over functional development. It delivers fast-path protection through its ability to support in-life firmware upgrades and provides 10Gbps line rate switching and routing capabilities regardless of Standards evolution.

The VSP 9000 Series leverages the RSP to deliver faster implementations of new, performance-optimized functionalities, thus meeting the needs of evolving applications — often directly driven by the evolution of Standards — without ASIC re-spins and major hardware changes.

How the VSP 9000 delivers

The VSP 9000 Series is designed to meet three critical network requirements, and it has the power to meet these requirements today, and to also scale as the business evolves and grows — an agility that delivers best-in-class longevity and investment protection.

It's the foundation for the future

The VSP 9000 Series supports up to 480 ports of 10G Ethernet, and the system architecture is future ready for higher densities and the introduction of 40G and 100G Ethernet. The VSP 9000 Series is now available in two formats: the 12-slot VSP 9012, a compact 14RU chassis (allowing three chassis per rack), and the new 10-slot VSP 9010 featuring highly efficient front-to-back cooling. This architecture, combined with a lossless crossbar fabric, allows for seamless evolution to Converged Enhanced Ethernet functionality in support of the IEEE's Data Center Bridging initiative. Leveraging the fully programmable RSP provides the VSP 9000 Series with the flexibility to incorporate future standards and protocol developments without a forklift upgrade, thus helping to provide optimal performance and investment protection.

It's carrier-class reliable

The VSP 9000 Series builds upon our solid foundation of always-on technology to deliver maximum availability and continuity of business operations with zero service interruption. The VSP 9000 Series Operating System is based on a carrier-class real-time Linux operating system — bringing to the enterprise high-availability technologies that have been field-proven by a huge, global installed-base of Service Providers. Avaya Networking Solutions have a deep heritage of carrier-grade resiliency with our pioneering Switch Cluster technology utilizing Split Multi-Link Trunking and Routed Split Multi-Link Trunking. The VSP 9000 Series takes this to the next level with a set of explicit, hardware-assist features which enhance robustness, scalability, predictability for control plane and fast-path protection. Reactions to failures occur in milliseconds, optimizing network operations, and instantaneous all-port re-routing means dramatically reduced packet loss. Innovative “in-service control plane integrity check” and “rapid failure detection and recovery of data path” provide system-level health check and self-healing capabilities. Hitless patching enables one software module to be patched without the requirement to reload the complete system image, thereby minimizing maintenance down time. And redundant control processor and switch fabric modules help ensure the VSP 9000 Series handles business critical information with utmost reliability.

It's your gateway to simplified and agile virtual networking services

This platform enables future services integration that can help consolidate and simplify network deployments. Avaya has pioneered a faster, simpler way to provide agile virtual network services. The VSP 9000 Series advances this innovation, offering Layer 2 and 3 VPN services and “Virtual Service Networks”; leveraging an enhanced implementation of the IEEE’s open and interoperable Shortest Path Bridging and the Avaya Virtualization Provisioning Service to deliver solutions that far surpass rival offerings.

The introduction of virtualization has fundamentally changed how compute, network and storage resources are used and managed. From fixed sets of resources within physical constraints, we've now moved to virtual machines

Integrated IP Multicast Routing

A very topical use-case for our superior IP-based Multicast Routing capability is Video Surveillance, or IP CCTV, as this is gaining a lot of attention by companies operating in many industry verticals, particularly for high definition implementations. Video needs Multicast to function properly, however mentioning Multicast generally makes network architects break out in a cold sweat. Traditional Multicast uses an interdependent laundry list of protocols, including PIM, to function. It's complicated to deploy, it's slow to recover, it doesn't scale, and can drop video due to slow time to recovery as protocols wait for one another before doing their job.

With Avaya Fabric Connect you run one protocol with full, native, integrated IP Multicast Routing capability. The solution uses less CPU resources, converges in less than 200 milliseconds and is simple to deploy and maintain. Those that specialize in deploying security solutions, rave about Fabric Connect and report huge improvements in performance, scalability, reliability, plus a corresponding reduction in complexity; a true, win-win proposition.

that can be created, moved, and removed on demand, and whose resource parameters can be changed dynamically. There is often a requirement for virtual machines to be moved from one physical server to another over disparate geographies.

As multi-core processing architectures and virtualization trends take hold, new possibilities have emerged in how applications can be written. Newer, more powerful distributed applications are being developed and older applications are being retrofitted into the new service-oriented architectures. An optimized network must support the unprecedented agility of this virtualized compute environment.



VSP 9000 Series - 9010 Chassis (left) & 9012 Chassis (right)

Virtualization Capabilities

The VSP 9000's lossless architecture, along with its multi-Tbps architectural design and ultra-reliability, leverages device and network virtualization to empower services integration, simplifying how enterprise data centers and core networks are architected.

Device Virtualization

The Avaya VRF-Lite capability allows the use of the single hardware platform to support multiple Layer 3 routing domains, each supporting unique customers or user groups.

In configuring the switch to have multiple routing instances, more sophisticated connections are made possible and overlapping IP address spaces are supported. The system can be configured to provide inter-VRF forwarding capabilities to allow access to common resources without incurring additional capital or operational expenses.

Combining VRF-Lite with other technologies provides a seamless connectivity environment for virtual users, connecting from anywhere in the enterprise network or branch offices without complex set-up or configuration.

Network Virtualization

The Avaya Fabric Connect technology is designed as an enhanced and extended implementation of the Shortest Path Bridging (SPB) standard. It offers the ability to create a simplified network layer that dynamically virtualizes individual elements to fully and efficiently utilize network and computing resources, thus reducing the strain on networking resources and personnel. Fabric Connect provides a number of 'Virtual Service Network' types:

- L2 VSNs operate at Layer 2, extending VLANs across the Fabric
- L3 VSNs operate at Layer 3, interconnecting and extending VRFs
- Inter-VSN Routing provides the ability to natively route between VSNs, and
- IP Shortcut Routing enables direct L3 connectivity between individual end-points

High availability is another unique value that Avaya brings to the fabric networking challenge; leveraging our tried and tested capabilities we are able to provide comprehensive high availability (HA) solutions at both Layer 2 and Layer 3. The Avaya Switch Cluster technology empowers dual/multi-path fabric access options, with further optimization available with the Distributed vRouting feature, and this helps ensure that L3 gateway placement is fully flexible and delivers maximum efficiency.

Virtualization Provisioning Service

Avaya's Virtualization Provisioning Service (VPS) improves efficiency and flexibility when managing highly dynamic virtual machine environments across the extended data center. Enhanced orchestration and management optimize the efficiency of VMware vCenter live migrations, facilitating more efficient real-time maintenance, dramatically improving time-to-service, reducing errors, delivering effective disaster recovery, and lowering total cost of ownership.

Capability meets simplicity

The combination of virtualized networking services, application awareness, and orchestration capabilities drive network simplification and can lower OPEX. For example VMware vMotion virtual applications are dynamically and seamlessly moved or extended within and between data centers; without the provisioning complexity associated with rival solutions. Fabric Connect offers a robust, resilient alternative to today's existing increasingly complex offerings and it delivers Ethernet-based services and solutions, all while maintaining Ethernet's key value propositions of simplicity and cost-effectiveness.

The VSP 9000 can offer you:

- Very high-density 1 and 10 Gigabit Ethernet aggregation
- High-density 40 Gigabit Ethernet, and future-ready for 100 Gigabit Ethernet
- Highly robust hardware with no single point-of-failure
- Hardened carrier-class operating system

- Highly available equipment-level device, combining with native support for Avaya's Switch Cluster technology to deliver an always-on network-level solution
- Built in diagnostics such as ingress/egress mirroring, Layer 3 remote mirroring, packet capturing, filter logging
- Hitless software patching without reload of the complete system image
- Instantaneous re-route across all ports to minimize packet loss
- Efficient Layer 2 and 3 network virtualization services providing supports for multiple customers and user groups on the same platform
- A robust, resilient alternative to today's existing, often complex and/or compromised, offerings
- Highly efficient support for both IPv4 and IPv6 traffic
- Future-ready support for storage convergence with an architecture optimized for Lossless Ethernet

VSP 9000 Series Hardware

The VSP 9000 Series is available in two Chassis variants, the new 9010 10-slot version and the original 9012 12-slot version.

The front of the new VSP 9010 Chassis features I/O slots – supporting eight I/O Modules, dual Control Processor Modules, and Cooling Modules. Two redundant Cooling Modules provide for front-to-back cooling of all system components: I/O and Control Processor Modules, and Switch Fabric Modules. Power Supplies are also accessed at the front of the Chassis. The rear of the 9010 Chassis hosts the Switch Fabric Modules, plus connectivity and control for Power Supplies. Up to eight Power Supplies are supported offering N+1 and A/B power grid redundancy. At 21RU, up to two 9010 Chassis can be supported in a 7-foot rack.

The front of the VSP 9012 features I/O slots - supporting ten I/O Modules, dual Control Processor Modules, and side-to-side Cooling Modules for front-mounted modules. Power Supplies are also

accessed at the front of the Chassis. The rear of the 9012 Chassis hosts the Switch Fabric Modules, plus connectivity and control for Power Supplies, and separate front-to-back Cooling Modules for the Switch Fabrics. Up to six Power Supplies are supported offering N+1 redundancy. Being a compact 14RU means that one 7-foot rack can support three 9012 Chassis.

Common to both Chassis versions:

- Five Ethernet interface module types are currently supported: 12-port 40 Gigabit QSFP+ Ethernet, 24-port and 48-port 10 Gigabit SFP+ Ethernet (also supporting 1 Gigabit SFPs), 48-port Gigabit SFP Ethernet, and 48-port 10/100/1000.
- The two Control Processor modules offer 1+1 redundancy, with the control plane decoupled from the Switching Fabric, leveraging a mid-plane architecture.
- The output of Cooling Modules is automatically adjusted depending on system temperature and fan status, with sensors located on each slot to test the temperature and manage the fan speed accordingly.
- Up to six Switch Fabric Modules are supported with N+1 redundancy. This is a distributed architecture in which the load is dynamically distributed and shared, and in the event of a Switch Fabric Module failure any performance constraint is gracefully managed.
- Power requirements are automatically load-shared across all installed units
- Auxiliary Module slots are reserved for future use.

The 9010 Chassis is specifically designed to address deployment scenarios with the most demanding HVAC requirements, where hot/cold aisle cooling is of paramount importance. The original 9012 Chassis is suitable for typical deployments scenarios, and by virtue of its two additional I/O slots it offers 25% higher port density.

How can your network benefit?

The VSP 9000 is designed to maximize the efficiency and potential of your network:

Network Processing Unit (NPU) advantage

Examples are numerous that detail how the performance of newer features cannot be guaranteed by manufacturers that utilize fixed ASIC technology, including one instance where a rival's top-selling product was only able to deliver IPv6 forwarding performance at 50% of the levels claimed for IPv4. Yet, our unique network processing unit (NPU) has been specifically designed to continue to deliver the same hardware-based performance levels without an upgrade – churn – to hardware. We've leveraged this advantage to deliver emerging functionality such as our next-generation device and network virtualization capabilities.

A future-proof platform

- Very high density – up to 480 ports of 1 or 10 Gigabit Ethernet and high density 40 Gigabit Ethernet
- Highly scalable lossless fabric architecture supporting future 100Gbps interface connectivity, services integration, Converged Enhanced Ethernet and future enabling the expansion of the infrastructure to align with the needs of your business
- Field-programmable RSP network processor delivers flexible data forwarding and investment protection for Layer 2-4 10Gbps line-rate capabilities without requiring forklift upgrades for future standards
- IPv4/IPv6 forwarding rate of up to 3,570 million packets per second, per system, allowing for more efficient data transfer

Reliable

- Unmatched resiliency powered by Avaya unique Switch Cluster technology (using split multi-link trunking and Routed Split Multi-Link Trunking protocols); High Availability mode engages all links when forwarding traffic, resulting in industry-leading performance and maximization of investment

- Instantaneous all-port re-routing results in the elimination of packet loss
- Redundant and hot swappable control processor and switch fabric modules, plus redundant cooling fans and power supplies, for unparalleled reliability

Simple, flexible and dynamic

- Helps ensure an uninterrupted virtual application transition within and between data centers (dynamic application allocation of a VMware application)
- High-availability Switch Cluster optimizes virtual routing and forwarding capacity for multiple customers, enabling always-on and concurrent forwarding of Layer 2/3 traffic across all links

Achieving maximum uptime

Ensuring uninterrupted business operations requires a reliable and resilient platform with no single point-of-failure, and the VSP 9000 can deliver this. From the very outset, the VSP 9000 Series was designed and developed on the basis of leading-edge hardware resiliency. It provides 1+1 control plane redundancy, with separate management path between the control plane and I/O, 5+1 Switch Fabric redundancy, N+1 power supply or grid-feed redundancy, and system cooling fan redundancy. In-service control plane integrity check, rapid detection and recovery of data path and hardware assist are designed to protect the control plane against denial-of-service attacks and system overload, and are just some of the mechanisms in place to ensure system availability.

However, uptime maximization also requires software that allows for easy and efficient management of your network. The VSP 9000 Series utilizes a carrier-grade Linux operating system, and combines this with a complete set of reporting capabilities and operation-focused features to help ensure this is achieved with streamlined efficiency.

Reporting features include:

- A “flight recorder” style logging capability to help with continuous real-time monitoring of internal control message flows

- Key Health Indicators to provide system operators an view of system health on all levels: OS, system applications / protocols I/O modules, ports and the forwarding path
- Hardware-assisted protection for control plane integrity, constantly monitoring system health and protecting against loop-induced system crashes
- Dedicated “in-service control plane integrity check” and “rapid failure detection and recovery of data path” sub-systems provide real-time health checking and self-healing capabilities
- Checksum logic tests to determine if hardware, firmware or data corruption has occurred
- Memory error-code detection and correction
- Detailed packet statistics and counters for failure debugging
- The ability to remotely update flash images
- Dual flash images to assist when restoring
- Card-based Flash Memory for log capture and retrieval
- Common alarms and logging
- LED indication on cards to indicate activity and system health
- Process separation

This future-proof platform features unique, field-proven technologies, including Switch Clustering, an online packet capture functionality for all ports, and ‘ERSPAN’; an enhanced traffic mirroring capability that supports the encapsulation of ACL-defined, Port- or Flow-based sessions so that they can be forwarded seamlessly across the IP network.

The new ‘VSP Talk’ feature provides critical system health and event monitoring for the VSP 9000 Series, delivered in real-time directly to a smartphone or desktop Instant Messaging client. VSP Talk provides unsolicited, real-time updates and also facilitates on-demand ‘show’ functionality. Leveraging XMPP, VSP Talk is introduced with initial support for Google Talk, Avaya Aura, and other standards-based platforms. Ideal for monitoring systems in real-time and

particularly post-maintenance, VSP Talk supports an abbreviated, IM-style command syntax to accelerate interactive administration. VSP Talk is completely secure, featuring process isolation, transport and password encryption, and full audit logging. When situational awareness is key, stay informed whether you’re on the other side of the campus or the other side of the planet.

Why choose Avaya

Avaya has the ability to work within multi-vendor environments but can also serve as your sole provider for efficient networking across all layers of the data center and campus, core to edge. Avaya is delivering carrier-grade reliability to the enterprise network.

The VSP 9000 leverages unique and innovation technologies to achieve both blazing performance and rock-solid resiliency, and delivers these in a fully interoperable solution to enable network- and system-level self-healing for uninterrupted business operations. The powerful network virtualization technologies used in the VSP 9000 leverages are specifically designed to support the needs of an evolving virtualized compute environment.

With a highly-scalable switching architecture, the VSP 9000 leverages provides an efficient platform for flexible scaling and growth to meet future network and application requirements by quickly adapting to business needs, without the need for a forklift upgrade in the availability-sensitive network core. Avaya offers core-to-edge network solutions that ensure design efficiency and lower operational burden.

The bottom line

The VSP 9000 Series is purpose-built to support dynamic data center and very high-density 10 Gigabit Ethernet network core deployments. It can alleviate infrastructure complexity and reduce power consumption with a truly scalable architecture; it is designed to be the high-performance platform for the coming decade.

Uptime is essential - mission-critical applications must be delivered 24/365, without interruption - and the ultra-resilient VSP

9000 delivers against this challenge. It empowers the services needed today and positions networks for the emerging needs of tomorrow, and it does so with a foundation that can be genuinely trusted.

Features such as its hardware-based control plane protection, hardware-assisted Switch Cluster failure and detection, and the carrier-grade operating system make the VSP 9000 Series one of the most robust high-end Core Switches on the

market. The VSP 9000 Series has been architected to help meet emerging application requirements, reduce operating expenses and protect investments as both technology and businesses evolve. Virtualization is a key enabling capability, and Avaya is leading the way with our innovative network virtualization technologies; creating the perfect storm of capability and simplicity.

The Avaya VSP 9000 Series is the platform for today and is future-ready for tomorrow, delivering dependable networking infrastructure for successful business evolution.

Learn More

To learn more about the Avaya Virtual Service Platform 9000, contact your Avaya Account Manager, Avaya Authorized Partner or visit us at:

www.avaya.com.

Specifications

General & Performance

- Frame length: 64 to 1518 Bytes (802.1Q Untagged), 64 to 1522 bytes (802.1Q Tagged)
- Jumbo Frame support: up to 9.6 KBytes
- Multi-Link/Split Multi-Link Trunks/LAG: up to 512 Groups, with 16 Links per Group
- VRRP Backup Master
- VLANs: up to 4,084
- RSMLT Core & Edge: 4000 VLANs & 512 SMLT links
- Multiple Spanning Tree Instances: up to 64
- MAC Address: up to 128k
- IP Interfaces: 4,343
- Dynamic ARP Entries: up to 64k
- VRRP Interfaces: up to 512
- IP Forwarding Table: 1,000k
- IP static Routes: up to 10k
- Circuitless IP Instances: up to 256
- ECMP Routes: up to 64k
- RIP Instances: up to 64
- RIP Routes: up to 10k
- OSPF Instances: up to 64
- OSPF Areas: up to 80
- OSPF Adjacencies: up to 512
- OSPF Routes: up to 64k
- BGP Peers: up to 256
- BGP Routes: up to 1,500k
- BGP 4-Octet AS support
- VRF Instances (IPv4): up to 512
- IS-IS Adjacencies: up to 128
- SPB Nodes: up to 1,000
- L2 VSNS, with HA options: up to 4,000
- L3 VSNS, with HA options: up to 512
- Inter-VSN Routing, with HA options
- IP Shortcut Routing, with HA options
- IPv6 Interfaces: 4k
- IPv6 Routes: up to 128k
- IPv6 Static Routes: up to 10k
- IPv6 Configured Tunnels: up to 2k
- PIM Active Interfaces: up to 512
- IP Multicast Streams: up to 6k (with SMLT)
- IGMP v1 / v2 / v3 interfaces: 4k
- Policy-based Routing
- Flow-based Policers: up to 16k
- Hardware-assisted Ingress & Egress Port & VLAN ACLs
- Enterprise Device Manager GUI, on-box & off-box
- Configuration & Orchestration Manager
- Virtualization Performance & Fault Manager
- Virtualization Provisioning Service
- System and Filter Logging
- On-box Packet Capture
- Mirroring: 1:1 / 1:M / M:1 / M:M
- Layer 2 & 3 Remote Mirroring (aka ERSPAN)
- IPFIX Flows: up to 960k
- Key Health Indicators
- Flight Recorder
- Hardware-assisted Control Plane Protection
- Hardware-assisted Rapid Failure Detection & Recovery (sub-20msec)
- High Availability mode
- Lossless Ethernet mode
- Microsoft NLB (Unicast- / Multicast- / IGMP-modes)

Performance Specifications

	9010 (w/9095SF)	9012 (w/9090SF)
Raw System Switching Capacity	up to 9.6Tbps	up to 9.0Tbps
Aggregate Per-Slot Throughput	up to 480Gbps	up to 480Gbps
Per-Slot Frame Forwarding	up to 357Mpps	up to 357Mpps

System

- 9010 10-Slot Chassis with 8 Interface Module Slots
- 9012 12-Slot Chassis with 10 Interface Module Slots
- 9080CP Control Processor Module
- 9090SF Fabric Module, up to six per 9012 Chassis
- 9006AC 2kW Power Supply
- 9095 Switch Fabric Module, up to six per 9010 Chassis

Generation-1 Interface Modules

- 9024XL 24-port 10G SFP+ Ethernet Interface Module
- 9048GB 48-port 1G SFP Ethernet Interface Module
- 9048GT 48-port 10/100/1000 Ethernet Interface Module

Generation-2 Interface Module

- 9012QQ-2 12-port 40G QSFP+ Ethernet Interface Module
- 9048XS-2 48-port 10G SFP+ Ethernet Interface Module

IEEE & IETF Standards Compatibility

IEEE

- 802.1D MAC bridges (Spanning Tree Protocol)
- 802.1Q VLAN Tagging
- 802.1X Ethernet Authentication Protocol
- 802.1AX Link Aggregation Control Protocol (LACP)
- 802.1p Priority Queues
- 802.1s Multiple Spanning Tree Protocol (MSTP)
- 802.1v VLAN Classification by Protocol and Port
- 802.1w Rapid Spanning Tree Protocol (RSTP)
- 802.1ag Connectivity Fault Management
- 802.1aq Shortest Path Bridging (MAC-in-MAC)

- 802.1Qbb Priority-based Flow Control
- 802.3 10BASE-T Ethernet
- 802.3 CSMA/CD Ethernet (ISO/IEC 8802-3)
- 802.3i 10BASE-T Auto-Negotiation
- 802.3u 100BASE-FX
- 802.3u 100BASE-TX Fast Ethernet (ISO/IEC 8802-3, Clause 25)
- 802.3u Auto-Negotiation on Twisted Pair (ISO/IEC 8802-3, Clause 28)
- 802.3x Flow Control on the Gigabit Uplink port
- 802.3z Gigabit Ethernet
- 802.3ab 1000BASE-BX Ethernet
- 802.3ab 1000BASE-CWDM Ethernet

- 802.3ab 1000BASE-LX Ethernet
- 802.3ab 1000BASE-SX Ethernet
- 802.3ab 1000BASE-T Ethernet
- 802.3ab 1000BASE-XD Ethernet
- 802.3ab 1000BASE-ZX Ethernet
- 802.3ae 10GBASE-X
- 802.3ba 40 Gigabit and 100 Gigabit Ethernet over Copper and Fiber: implemented as 40GBASE-QSFP+

And hardware-ready for emerging technology such as:

- 802.1AX Link Aggregation
- 802.1Qbg Edge Virtual Bridging
- 802.1Qbp Equal Cost Multiple Paths for SPBM

Specifications

IEEE & IETF Standards Compatibility (cont.)

IETF Generic RFCs

- 768 UDP Protocol
- 783 TFTP Protocol
- 791 IP Protocol
- 792 ICMP Protocol
- 793 TCP Protocol
- 826 ARP Protocol
- 854 Telnet Protocol
- 894 A Standard for the Transmission of IP Datagrams over Ethernet Networks
- 896 Congestion control in IP/TCP internetworks
- 903 Reverse ARP Protocol
- 906 Bootstrap loading using TFTP
- 950 Internet Standard Sub-Netting Procedure
- 951 / 2131 BootP / DHCP
- 1027 Using ARP to implement transparent subnet gateways/ Nortel Subnet based VLAN
- 1058 RIPv1 Protocol
- 1112 IGMPv1
- 1122 Requirements for Internet Hosts
- 1256 ICMP Router Discovery
- 1305 Network Time Protocol v3 Specification, Implementation and Analysis
- 1340 Assigned Numbers
- 1340 Assigned Numbers
- 1519 Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy

- 1541 Dynamic Host Configuration Protocol
- 1542 Clarifications and Extensions for the Bootstrap Protocol
- 1583 OSPFv2
- 1587 The OSPF NSSA Option
- 1591 DNS Client
- 1723 RIP v2 – Carrying Additional Information
- 1745 BGP / OSPF Interaction
- 1771 / 1772 BGP-4
- 1812 Router Requirements
- 1866 HTMLv2 Protocol
- 1965 BGP-4 Confederations
- 1966 BGP-4 Route Reflectors
- 1981 Path MTU Discovery for IPv6
- 1997 BGP-4 Community Attributes
- 1998 An Application of the BGP Community Attribute in Multi-home Routing
- 2068 Hypertext Transfer Protocol
- 2131 Dynamic Host Control Protocol (DHCP)
- 2138 RADIUS Authentication
- 2139 RADIUS Accounting
- 2178 OSPF MD5 cryptographic authentication / OSPFv2
- 2236 IGMPv2 for snooping
- 2270 BGP-4 Dedicated AS for sites/single provide
- 2328 OSPFv2

- 2362 PIM-SM
- 2385 BGP-4 MD5 authentication
- 2439 BGP-4 Route Flap Dampening
- 2453 RIPv2 Protocol
- 2740 OSPF for IPv6
- 2796 BGP Route Reflection – An Alternative to Full Mesh IBGP
- 2819 Remote Monitoring (RMON)
- 2874 DNS Extensions for IPv6
- 2918 Route Refresh Capability for BGP-4
- 2992 Analysis of an Equal-Cost Multi-Path Algorithm
- 3046 DHCP Relay Agent Information Option 82
- 3065 Autonomous System Confederations for BGP
- 3162 RADIUS and IPv6
- 3315 DHCP for IPv6
- 3376 IGMPv3
- 3569 An overview of Source-Specific Multicast (SSM)
- 3513 Internet Protocol Version 6 (IPv6) Addressing Architecture
- 3587 IPv6 Global Unicast Address Format
- 3768 Virtual Router Redundancy Protocol
- 4213 Basic Transition Mechanisms for IPv6
- 4893 BGP Support for 4-Octet AS Number Space
- 6329 IS-IS Extensions supporting Shortest Path Bridging

IETF QoS RFCs

- 2474 / 2475 DiffServ Support
- 2475 An Architecture for Differentiated Service

- 2597 Assured Forwarding PHB Group
- 2598 Expedited Forwarding PHB

IETF Network Management RFCs

- 959 File Transfer Protocol
- 1155 SMI
- 1157 SNMP
- 1215 Convention for defining traps for use with the SNMP
- 1269 Definitions of Managed Objects for the Border Gateway Protocol: v3
- 1271 Remote Network Monitoring Management Information Base
- 1258 BSD Rlogin
- 1305 (NTP client / unicast mode only)
- 1350 The TFTP Protocol (Revision 2)
- 1354 IP Forwarding Table MIB
- 1389 RIP v2 MIB Extensions
- 1492 Terminal Access Controller Access-Control System
- 1757 / 2819 RMON
- 1907 SNMPv2

- 1908 Coexistence between v1 & v2 of the Internet-standard Network Management Framework
- 1930 Guidelines for creation, selection, and registration of an Autonomous System (AS)
- 2428 FTP Extensions for IPv6
- 2541 Secure Shell Protocol Architecture
- 2571 An Architecture for Describing SNMP Management Frameworks
- 2572 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- 2573 SNMP Applications
- 2574 User-based Security Model (USM) for v3 of the Simple Network Management Protocol (SNMPv3)
- 2575 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)

- 2576 Coexistence between v1, v2, & v3 of the Internet standard Network Management Framework
- 2616 Hypertext Transfer Protocol 1.1
- 4250 Secure Shell (SSH) Protocol Assigned Numbers
- 4251 Secure Shell (SSH) Protocol Architecture
- 4252 Secure Shell (SSH) Authentication Protocol
- 4253 Secure Shell (SSH) Transport Layer Protocol
- 4254 Secure Shell (SSH) Connection Protocol
- 4255 DNS to Securely Publish SSH Key Fingerprints
- 4256 Generic Message Exchange Authentication for SSH

IETF MIB RFCs

- 1156 MIB for network management of TCP/IP
- 1212 Concise MIB definitions
- 1213 TCP/IP Management Information Base
- 1213 MIB II
- 1354 IP Forwarding Table MIB
- 1389 RIP v2 MIB Extension
- 1389 / 1724 RIPv2 MIB extensions
- 1398 Ethernet MIB
- 1442 Structure of Management Information for version 2 of the Simple Network Management Protocol (SNMPv2)
- 1450 Management Information Base for v2 of the Simple Network Management Protocol (SNMPv2)

- 1573 Interface MIB
- 1650 Definitions of Managed Objects for the Ethernet-like Interface Types
- 1657 BGP-4 MIB using SMIv2
- 1850 OSPF MIB
- 2021 RMON MIB using SMIv2
- 2096 IP Forwarding Table MIB
- 2452 IPv6 MIB: TCP MIB
- 2454 IPv6 MIB: UDP MIB
- 2466 IPv6 MIB: ICMPv6 Group
- 2578 Structure of Management Information v2 (SMIv2)
- 2674 Bridges with Traffic MIB
- 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol

- 2863 Interface Group MIB
- 2925 Remote Ping, Traceroute & Lookup Operations MIB
- 2932 IPv4 Multicast Routing MIB
- 2933 IGMP MIB
- 2934 PIM MIB
- 3416 v2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)
- 4022 Management Information Base for the Transmission Control Protocol (TCP)
- 4113 Management Information Base for the User Datagram Protocol (UDP)

Specifications

	9010	9012
Weights & Dimensions		
Height:	91.50cm (36.10in) or 21RU	61.91cm (24.38in) or 14RU:
Width:	44.45cm (17.50in)	44.45cm (17.50in)
Depth:	85.79cm (33.75)	82.55cm (32.50in)
Weight (minimum):	82kg (181lb)	83kg (183lb)
Weight (maximum):	175kg (372lb)	185kg (396lb)
Cooling System	Two front-to-back Cooling Modules Two side-to-side Cooling Modules	Two front-to-back Cooling Modules
Safety Agency Approvals	Global basis for certifications: IEC 60950-1 with CB member deviations US: ULIEC 60950-1 Canada: CSA 22.2 No. IEC 60950-1 Europe: ENIEC 60950-1 (CE Marking) Australia/New Zealand: AS/NZA IEC 60950-1 Mexico: NOM Korea: MIC	
Environmental Specifications		
Operating temperature:	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)
Storage temperature:	-10°C to 60°C (14°F to 140°F)	-10°C to 60°C (14°F to 140°F)
Operating humidity:	Up to 90% relative humidity	Up to 90% relative humidity
Storage humidity:	Up to 90% relative humidity	Up to 90% relative humidity
Operating altitude:	3024m (10,000ft) maximum	3024m (10,000ft) maximum
Storage altitude:	3024m (10,000ft) maximum	3024m (10,000ft) maximum
Shock/bump:	IEC 68-2-27-29 (both 9010/9012)	
Vibration:	ETSI 300 019-1-3/IEC 68-2-6/IEC 68-2-27 (both 9010/9012)	
Electromagnetic Emissions & Immunity	Global basis for certification: CISPR 24:1997 USA: FCC CFR47, Part 15, Subpart B, Class A Canada: ICES-003, Issue-4, Class A Europe: EN 55022:2006/A1:2007, Class A; EN 61000-3-2/A14; EN 300 386 v1.3.3; EN 55024:1998/A1:2001/A2:2003; EN 6100-3-3:1995/A1:2001/A2:2005; EN 55024:1998 Australia/New Zealand: AS/NZS CISPR 22:2006, Class A Japan: VCCI-V3/97.04, Class A	
Country of Origin	Malaysia	

Ordering Information

Component	Part Code	Description
Chassis	EC1402001-E6	9012 12-Slot Chassis – complete with Front and Rear Cooling Modules, Rack Mount Kit, and Cable Guide Kit
	EC1402002-E6	9010 10-Slot Chassis - complete with Front-to-Back Cooling Modules, Rack Mount Kit, and Cable Guide Kit
System Modules	EC1404007-E6	9080CP Control Processor Module
	EC1404006-E6	9090SF Switch Fabric Module, for use with the 9012 Chassis
	EC1404009-E6	9095SF Switch Fabric Module, for use with the 9010 Chassis
Power Supplies	EC1405A01-E6	9006AC 100-240 VAC Power Supply – country-specific Power Cords sold separately
Interface Modules	EC1404008-E6	9012QQ-2 12-port 40G QSFP+ Ethernet Interface Module - QSFP+ Transceivers sold separately
	EC1404001-E6	9024XL 24-port 10G SFP+ Ethernet Interface Module - SFP+ Transceivers sold separately
	EC1404005-E6	9048XS-2 48-port 10G SFP+ Ethernet Interface Module - SFP+ Transceivers sold separately
	EC1404002-E6	9048GB 48-port 1G SFP Ethernet Interface Module - SFP Transceivers sold separately
	EC1404003-E6	9048GT 48-port 10/100/1000 RJ-45 Ethernet Interface Module
Software	EC1410003-4.0	Virtual Services Platform 9000 Base Software Kit for 1 Chassis – mandatory for every Chassis
	EC1410010	Virtual Services Platform 9000 Advanced License Kit for 1 Chassis – enabled features: BGP4 Limited (16 Peers, 64k Routes), IPv6 Routing, Layer 3 Remote Mirroring, Packet Capture (PCAP)
	EC1410015	Virtual Services Platform 9000 Premier License Kit for 1 Chassis – enabled features: Advanced License Features, BGP4 Unlimited (256 Peers, 500k Routes), CEE, VRF-Lite, Fabric Connect (Enhanced SPB)

(Principle components only, and does not include ancillary components such as Transceivers, etc)

About Avaya

Avaya is a leading, global provider of customer and team engagement solutions and services available in a variety of flexible on-premise and cloud deployment options. Avaya's fabric-based networking solutions help simplify and accelerate the deployment of business critical applications and services. For more information, please visit

www.avaya.com.

© 2015 Avaya Inc. All Rights Reserved.

Avaya and the Avaya logo are trademarks of Avaya Inc. and are registered in the United States and other countries. All other trademarks identified by ®, TM, or SM are registered marks, trademarks, and service marks, respectively, of Avaya Inc.
02/15 • DN4535-09

