HPE Aruba Networking CX 6000 Switch Series

Key features

- Enterprise-class Layer 2 connectivity with support for ACLs, robust QoS and static routing
- Convenient built-in 1GbE uplinks and up to 740W of Class 4 PoE for support of IoT devices
- Compact and fanless 12 port model for quiet deployment
- Management flexibility with support for HPE Aruba Networking Central[1], easy-to-use Web GUI, CLI, and HPE Aruba Networking Switch Multi-Edit
- Simple deployment with Zero Touch Provisioning
- Software defined ready with REST APIs
- Simplify adds, moves, and changes with colorless ports

Product overview

The HPE Aruba Networking CX 6000 Switch Series is modern family of entry level access switches ideal for branch offices, midsize businesses, and small enterprises. Optimized for reliable, simple and secure access, the CX 6000 series provides a convenient and cost-effective wired access solution for networks supporting IoT, mobile, and cloud applications.

The CX 6000 series is based on the HPE Aruba Networking ASIC architecture with the programmable AOS-CX operating system used across the entire HPE Aruba Networking CX portfolio for a more consistent, more efficient operator experience. This fully managed series has convenient built-in uplinks with up to 740W of PoE+ to support IoT devices such as security cameras and wireless APs. A compact and fanless model is ideal for use in quiet, small work spaces.

The CX 6000 series is easy to deploy and use with flexible management choices that include Web GUI, CLI, cloud-based and on-premise HPE Aruba Networking Central management, so you can choose the best fit for your business and network environment. Delivering Layer 2 capabilities with enhanced access security, traffic prioritization, and IPv6 support, the CX 6000 also simplifies ownership and brings peace of mind with switch software embedded with no subscription required to enable and a Limited Lifetime Warranty.

Product differentiators

AOS-CX - a modern software system
The HPE Aruba Networking CX 6000 Switch Series is based on AOS-CX, a modern, database-driven operating system that is built on a modular Linux architecture.

[1] Aruba Central support in future release.

With the CX 6000 series, the benefits of the AOS-CX architecture is extended to small enterprise deployments providing the following unique capabilities:

- Easy access to all network configuration state information
- REST APIs for fine-grained programmability of network tasks
- A micro-services architecture that enables full integration with other workflow systems and services
- All software processes communicate with the database rather than each other, ensuring near real-time state and resiliency

HPE Aruba Networking ASICs — programmable innovation

Based on over 30 years of continuous investment, HPE Aruba Networking's ASICs create the basis for innovative and agile software feature advancements, unparalleled performance and deep visibility. These programmable ASICs are purpose-built to allow for a tighter integration of switch hardware and software within campus and data center architectures to optimize performance and capacity. The CX 6000 is based on the HPE Aruba Networking ASIC architecture.

Access layer performance

The HPE Aruba Networking CX 6000 Switch Series uses internally developed HPE Aruba Networking ASICs that provide very low latency, increased packet buffering, and adaptive power consumption. Each switch includes the following:

- Up to 104 Gbps in non-blocking bandwidth and up to 77.3 Mpps for forwarding
- Selectable queue configurations that allow for increased performance by defining a number of queues and associated memory buffering to best meet the requirements of network applications

Management flexibility

Innovative design supports cloud-based and on-premise management, CLI and easy to use Web GUI with same hardware, eliminating rip and replace of equipment as network management needs grow.

Cloud-based HPE Aruba Networking Central[1] provides single pane of glass, unified network operations of wired, WLAN, SD-WAN, and public cloud infrastructure.

Simplify adds, moves, and changes

Reduce manual IT operation tasks around initial deployment or on-going configuration changes to accommodate adds, moves, and changes with colorless ports using local user roles and local-MAC-Authentication (LMA). Instead of statically pre-configuring access ports to VLANs and maintaining the switch port to VLAN mapping, colorless ports can automatically apply the role/policy required.

Cost-effective enterprise-class access

To provide ideal deployment for branch offices, midsize businesses, and small enterprises, the CX 6000 family includes five fixed 1U models. Highlights include:

- 1U models support 24 and 48 access ports of IEEE 802.3 1GbE with four built-in 1GbE uplink SFP ports. The 24 port PoE models support up to 370W and the and 48 pot PoE models support up to 740W IEEE 802.3at Class 4 Power over Ethernet for up to 30W per port
- Compact and fanless model supports 12 ports of IEEE 802.3 1GbE with four uplinks (two built-in 1GbE uplink SFP ports, two built-in 1GbE ports), and 139W IEEE 802.3at Class 4 Power over Ethernet for up to 30W per port
- Support for Energy Efficient Ethernet IEEE 802.3az reduces power consumption during periods of low network traffic
- Support for pre-standard PoE detects and provides power to pre-standard PoE devices
- Auto-MDIX provides automatic adjustments for straight-through or crossover cables on all 10/100/1000 ports
- Unsupported Transceiver Mode (UTM) allows to insert and enable all unsupported 1G transceivers and cables. Note that there is no warranty nor support for the transceiver/cable when this feature is used
- Jumbo frames allow for high-performance backups and disaster-recovery systems; provides a maximum frame size of 9198 bytes
- Packet storm protection against broadcast, multicast and unknown unicast storms with user-defined thresholds

Resiliency and availability

To support a highly-available Layer 2 access deployment, the CX 6000 supports the following features:

- Uni-directional Link Detection (UDLD) to monitor link connectivity and shut down ports at both ends if uni directional traffic is detected, preventing loops in STP-based networks
- IEEE 802.3ad LACP supports up to 8 LAGs, each with up to 8 links per LAG; and provides support for static or dynamic groups and a user-selectable hashing algorithm
- IEEE 802.1s Multiple Spanning Tree provides high link availability in VLAN environments where multiple spanning trees are required; and legacy support for IEEE 802.1d and IEEE 802.1w
- SmartLink provides easy-to-configure link redundancy of active and standby link
- Hot-Patching support for standalone switches

Quality of Service (QoS) features

To support congestion actions and traffic prioritization, the CX 6000 includes the following:

- Strict priority (SP) queuing
- Traffic prioritization (IEEE 802.1p) for real-time classification
- Class of Service (CoS) sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ
- Rate limiting sets per-port ingress enforced maximums and per-port, per-queue minimums
- Large buffers for graceful congestion management

[1]Aruba Central support in future release.

Simplified configuration and management

The CX 6000 series supports a choice of management interfaces so you can choose the management tool that works best for your network environment. Migrating to a different management is non-disruptive due to innovative hardware design that supports cloud-based and on-premise management, CLI and easy-to-use- web GUI with same hardware. Features include:

- Intuitive, easy to use switch Web GUI provides easy to use dashboard, robust tool set and switch insights
- Cloud-based HPE Aruba Networking Central[1] provides single pane of glass management of wired and wireless network with automated alerts and easy to use configuration
- Built-in programmable and easy-to-use REST API interface
- Industry-standard CLI with a hierarchical structure for reduced training time and expense. Delivers increased productivity in multivendor environments
- sFlow (RFC 3176) is ASIC-based wire speed network monitoring and accounting with no impact on network performance; network operators can gather a variety of network statistics and information for capacity planning and real-time network monitoring purposes
- Management security restricts access to critical configuration commands, provides multiple privilege levels with password protection and local and remote syslog capabilities allow logging of all access
- SNMPv1/v2c/v3 support provides Read capability of industry standard Management Information Base (MIB), and private extensions
- SNMP support includes: Write Set Speed and Duplex, Write Port Security, Write POE Priority, Write Config Mgmt, SNMP-Read single OID for average CPU and memory, SNMP MIB View
- SNMP Trap include: Transceiver Traps (insertion/removal), SNMP Trap, SNMP MIB-SNMB Authentication, SNMPv2 MIB, Port Sec MIB-Port Sec, Config MIB-Running Config Change, Config MIB, AAA Server MIB, AAA Server State
- Remote monitoring (RMON) with standard SNMP to monitor essential network functions. Supports events, alarms, history, and statistics groups as well as a private alarm extension group
- TFTP and SFTP support offers different mechanisms for configuration updates; trivial FTP (TFTP) allows bidirectional transfers over a TCP/ IP network; Secure File Transfer Protocol (SFTP) runs over an SSH tunnel to provide additional security
- Debug and sampler utility supports ping and traceroute for IPv4 and IPv6
- Network Time Protocol (NTP) synchronizes timekeeping among distributed time servers and clients; keeps timekeeping consistent among all clock-dependent devices within the network so the devices can provide diverse applications based on the consistent time
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP) advertises and receives management information from adjacent devices on a network, facilitating easy mapping by network management applications
- Dual flash images provides independent primary and secondary operating system files for backup while upgrading
- Multiple configuration files can be stored to a flash image
- Unidirectional link detection (UDLD) monitors the link between two switches and blocks the ports on both ends of the link if the link goes down at any point between the two devices

HPE Aruba Networking Switch Multi-Edit — automated switch configuration and management

The entire CX portfolio empowers IT teams to orchestrate multiple switch configuration changes for smooth end-to-end service rollouts. HPE Aruba Networking Switch Multi-Edit introduces automation that allows for rapid network-wide changes, and ensures policy conformance post network updates. Intelligent capabilities include search, edit, validation (including conformance checking), deployment and audit features. Capabilities include:

- Centralized configuration with validation for consistency and compliance
- Time savings via simultaneous viewing and editing of multiple configurations
- Customized validation tests for corporate compliance and network design
- Automated large-scale configuration deployment without programming

Note: A separate software license is required to use HPE Aruba Networking Switch Multi-Edit.

Layer 2 Switching

The following Layer 2 services are supported:

- VLAN support and tagging support for IEEE 802.1Q (4094 VLAN IDs) and 512 VLANs simultaneously
- Jumbo packet support improves the performance of large data transfers; supports frame size of up to 9,198 bytes
- Rapid Per-VLAN Spanning Tree (RPVST+) allows each VLAN to build a separate spanning tree to improve link bandwidth usage; is compatible with PVST+
- STP supports standard IEEE 802.1D STP, IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) for faster convergence, and IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
- MVRP allows automatic learning and dynamic assignment of VLANs
- Bridge Protocol Data Unit (BPDU) tunneling transmits STP BPDUs transparently, allowing correct tree calculations across service providers, WANs, or MANs
- Port mirroring duplicates port traffic (ingress and egress) to a monitoring port; supports 4 mirroring groups
- Internet Group Management Protocol (IGMP) Controls and manages the flooding of multicast packets in a Layer 2 network

[1]Aruba Central support in future release.

Layer 3 Services
The following Layer 3 services are supported:

- Address Resolution Protocol (ARP) determines the MAC address of another IP host in the same subnet; supports static ARPs
- Domain Name System (DNS) provides a distributed database that translates domain names and IP addresses, which simplifies network design; supports client and server
- Supports internal loopback testing for maintenance purposes and increased availability; loopback detection protects against incorrect cabling or network configurations and can be enabled on a per-port or per VLAN basis for added flexibility

Layer 3 Routing
The following Layer 3 routing services are supported:

- Static IP routing provides manually configured routes.
- Dual stack static IPv4 and IPv6 routing provides simple manually configured IPv4 and IPv6 routing
- Dual IP stack maintains separate stacks for IPv4 and IPv6 to ease the transition from an IPv4-only network to an IPv6-only network design

Multicast
- IGMP Snooping allows multiple VLANs to receive the same IPv4 multicast traffic, lessening network bandwidth demand by reducing multiple streams to each VLAN
- Multicast Listener Discovery (MLD) enables discovery of IPv6 multicast listeners; support MLD v1 and v2
- Internet Group Management Protocol (IGMP) utilizes Any-Source Multicast (ASM) to manage IPv4 multicast networks; supports IGMPv1, v2, and v3
- IP multicast snooping (data-driven IGMP) prevents flooding of IP multicast traffic

IPv6 capabilities
- IPv6 host enables switches to be managed in an IPv6 network
- Dual stack (IPv4 and IPv6) transitions from IPv4 to IPv6, supporting connectivity for both protocols
- MLD snooping forwards IPv6 multicast traffic to the appropriate interface
- IPv6 ACL/QoS supports ACL and QoS for IPv6 network traffic
- IPV6 static routing

Security
Each CX 6000 Switch comes with an integrated trusted platform module (TPM) for platform integrity. This ensures the boot process started from a trusted combination of AOS-CX switches. Other security features include:

- Access control list (ACL) support for both IPv4 and IPv6; allows for filtering traffic to prevent unauthorized users from accessing the network, or for controlling network traffic to save resources; rules can either deny or permit traffic to be forwarded; rules can be based on a Layer 2 header or a Layer 3 protocol header
- ACLs also provide filtering based on the IP field, source/ destination IP address/ subnet, and source/ destination TCP/UDP port number on a per-VLAN or per-port basis
- Remote Authentication Dial-In User Service (RADIUS)
- Terminal Access Controller Access-Control System (TACACS+) delivers an authentication tool using TCP with encryption of the full authentication request, providing additional security
- Management access security for both on- and off-box authentication for administrative access. RADIUS or TACACS+ can be used to provide encrypted user authentication. Additionally, TACACS+ can also provide admin authorization services
- Control Plane Policing sets rate limit on control protocols to protect CPU overload from DOS attacks
- Supports multiple user authentication methods. Uses an IEEE 802.1X supplicant on the client in conjunction with a RADIUS server to authenticate in accordance with industry standards
- Supports MAC-based client authentication
- Concurrent IEEE 802.1X, Web, and MAC authentication schemes per switch port accepts up to 32 sessions of IEEE 802.1X, Web, and MAC authentications
- Secure management access delivers secure encryption of all access methods (CLI, GUI, or MIB) through SSHv2, SSL, and/or SNMPv3
- Switch CPU protection provides automatic protection against malicious network traffic trying to shut down the switch
- ICMP throttling defeats ICMP denial-of-service attacks by enabling any switch port to automatically throttle ICMP traffic
- Identity-driven ACL enables implementation of a highly granular and flexible access security policy and VLAN assignment specific to each authenticated network user
- STP BPDU port protection blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks
- STP root guard protects the root bridge from malicious attacks or configuration mistakes
- Dynamic ARP protection blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data
- DHCP (snooping) protection blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks
- Supports DHCPv4 Relay
- Port security allows access only to specified MAC addresses, which can be learned or specified by the administrator
- MAC address lockout prevents particular configured MAC addresses from connecting to the network
- Source-port filtering allows only specified ports to communicate with each other

- Secure shell encrypts all transmitted data for secure remote CLI access over IP networks
- Secure Sockets Layer (SSL) encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch
- Secure FTP allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file
- Critical Authentication Role ensures that important infrastructure devices such as IP phones are allowed network access even in the absence of a RADIUS server
- MAC Pinning allows non-chatty legacy devices to stay authenticated by pinning client MAC addresses to the port until the clients logoff or get disconnected
- Security banner displays a customized security policy when users log in to the switch
- Dynamic IPv4 Lockdown works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing
- DHCP smart relay allows the DHCP relay agent to use secondary IP addresses when the DHCP server does not reply the DHCP-OFFER message
- Private VLAN (PVLAN) provides traffic isolation between users on the same VLAN; typically a switch port can only communicate with other ports in the same community and/or an uplink port, regardless of VLAN ID or destination MAC address. This extends network security by restricting peer-peer communication to prevent variety of malicious attacks.
- Supports device fingerprinting – Identify a device based on collected attributes and analyze that information using ClearPass Device Insight for better visibility and to enable informed network access control decisions.

Convergence

- LLDP-MED (Media Endpoint Discovery) defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones
- PoE allocations supports multiple methods (allocation by usage or class, with LLDP and LLDP-MED) to allocate PoE power for more efficient power management and energy savings.
- Auto VLAN configuration for voice RADIUS VLAN: uses a standard RADIUS attribute and LLDP-MED to automatically configure a VLAN for IP phones
- Supports CDPv2 to configure legacy IP phones

Additional information

Green initiative support for RoHS (EN 50581:2012) and WEEE regulations

Customer first, customer last support

When your network is important to your business, then your business needs the backing of HPE Aruba Networking Support Services. Partner with HPE Aruba Networking product experts to increase your team productivity, keep pace with technology advances, software releases, and obtain break-fix support.

Foundational Care for HPE Aruba Networking support services include priority access to HPE Aruba Networking Technical Assistance Center(TAC) engineers 24x7x365, flexible hardware and onsite support options, and total coverage for HPE Aruba Networking products. HPE Aruba Networking switches with assigned HPE Aruba Networking Central subscriptions benefit with option for additional hardware support only.

HPE Aruba Networking Pro Care adds fast access to senior HPE Aruba Networking TAC engineers, who are assigned as a single point of contact for case management, reducing the time spent addressing and resolving issues.

For complete details on Foundational Care and HPE Aruba Networking Pro Care, please visit: https://www.arubanetworks.com/supportservices/

Warranty, services and support

- Limited Lifetime Warranty, see https://www.arubanetworks.com/support-services/ product-warranties/ for warranty and support information included with your product purchase
- For software releases and documentation, refer to https://asp.arubanetworks.com/downloads
- For more detailed information on HPE Aruba Networking AOS-CX software release and features, please visit the AOS-CX Switch Software Documentation Portal
- Explore and compare switch features for each platform and software release on the HPE Aruba Networking Switch Feature Navigator
- For support and services information, visit https://www. arubanetworks.com/support-services/arubacare/

Specifications

	HPE Aruba Networking 6000 48G CL4 4SFP 740W Sw (R9Y03A)	HPE Aruba Networking 6000 48G Class4 PoE 4SFP 370W Switch (R8N85A)	HPE Aruba Networking 6000 48G 4SFP Switch (R8N86A)
Description	48x 10/100/1000BASE-T Ports 4x 1G SFP Ports Supports PoE Standards IEEE 802.3af, 802.3at 1x USB-C console port 1x USB Type-A Host port	48x 10/100/1000BASE-T Ports 4x 1G SFP ports Supports PoE Standards IEEE 802.3af, 802.3at 1x USB-C Console Port 1x USB Type-A Host port	48x 10/100/1000BASE-T Ports 4x 1G SFP ports 1x USB-C Console Port 1x USB Type-A Host port
Power supplies	Fixed power supply Up to 740W of Class 4 PoE Power	Fixed power supply Up to 370W of Class 4 PoE Power	Fixed power supply
Fans	Fixed fans	Fixed fans	Fixed fans

Physical characteristics

Dimensions	(H) 4.39 cm x (W) 44.25 cm x (D) 32.42 cm (1.73" x 17.42" x 12.77")	(H) 4.39 cm (W) 44.2 cm (D) 30.48 cm (1.73" x 17.4" x 12.0")	(H) 4.39 cm (W) 44.2 cm (D) 24.74 cm (1.73" x 17.4" x 9.74")
Configuration Weight	4.7 kg (10.36 lbs)	5.02 kg (11.07 lbs)	3.42 kg (7.54 lbs)

Additional Specifications

CPU	Dual Core ARM Cortex A9 @ 1.016 GHz	Dual Core ARM Cortex A9 @ 1.016 GHz	Dual Core ARM Cortex A9 @ 1.016 GHz
Memory and Flash	4 GB DDR3 16GB eMMC	4 GB DDR3 16 GB eMMC	4 GB DDR3 16 GB eMMC
Packet Buffer	1 MB	1 MB	1 MB

Performance

Model Switching Capacity	104 Gbps	104 Gbps	104 Gbps
Model Throughput Capacity	77.3 Mpps	77.3 Mpps	77.3 Mpps
Average Latency (LIFO-64-bytes packets)	1Gbps: 1.9 µs	1 Gbps: 1.9 µSec	1 Gbps: 1.9 µSec
Switched Virtual Interfaces (dual stack)	16	16	16
IPv4 Host Table (ARP)	1,024	1,024	1,024
IPv6 Host Table (ND)	512	512	512
IPv4 Unicast Routes	512	512	512
IPv6 Unicast Routes	512	512	512

	HPE Aruba Networking 6000 48G CL4 4SFP 740W Sw (R9Y03A)	HPE Aruba Networking 6000 48G Class4 PoE 4SFP 370W Switch (R8N85A)	HPE Aruba Networking 6000 48G 4SFP Switch (R8N86A)
Performance (continued)			
MAC Table Capacity	8,192	8,192	8,192
IGMP Groups	512	512	512
MLD Groups	512	512	512
IPv4/IPv6/MAC ACL Entries (ingress)	256 / 128 / 256	256 / 128 / 256	256 / 128 / 256
Environment			
Operating Temperature	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)
Operating Relative Humidity	5% to 95% at 104°F (40°C) non-condensing	15% to 95% at 104°F (40°C) non-condensing	15% to 95% at 104°F (40°C) non-condensing
Non-Operating	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)
Non-Operating Storage Relative Humidity	5% to 90% @ 149°F (65°C) non-condensing	15% to 90% @ 149°F (65°C) non-condensing	15% to 90% @ 149°F (65°C) non-condensing
Max Operating Altitude	10000 feet (3 km) Max	10000 feet (3 km) Max	10000 feet (3 km) Max
Max Non-Operating Altitude	15000 feet (4.6 km) Max	15000 feet (4.6 km) Max	15000 feet (4.6 km) Max
Acoustic	Sound Power, LWAd = 4.95 Bel Sound Pressure, LpAm (Bystander) = 35.91 dB	Sound Power, LWAd = 4.3 Bel Sound Pressure, LpAm (Bystander) = 29.8 dB	Sound Power, LWAd = 3.6 Bel Sound Pressure, LpAm (Bystander) = 24.6 dB
Primary Airflow	Side-to-side	Side-to-side	Side-to-side
Electrical Characteristics			
Frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
AC Voltage	100-127 VAC / 200-240 VAC	100-127 VAC / 200-240 VAC	100-127 VAC / 200-240 VAC
Current	9.2 A / 4.9 A	4.9 A / 2.4 A	0.8 A / 0.5 A
Power Consumption (230 VAC)	Idle: 37.5W Max Power (w/o PoE): 49.7W Max Power (w/ PoE): 890W	Idle: 30.6W Max Power (w/o PoE): 45W Max Power (w/ PoE): 480W	Idle: 20.6W Max Power (w/o PoE): 44.2W

	HPE Aruba Networking 6000 48G CL4 4SFP 740W Sw (R9Y03A)	HPE Aruba Networking 6000 48G Class4 PoE 4SFP 370W Switch (R8N85A)	HPE Aruba Networking 6000 48G 4SFP Switch (R8N86A)
Safety			
	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2019, 3rd Ed., CSA C22.2 No. 62368-1:19, 3rd Ed.	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2014, 2nd Ed., CSA C22.2 No. 62368-1:14, 2nd Ed.,	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2014, 2nd Ed., CSA C22.2 No. 62368-1:14, 2nd Ed.,
Emissions			
	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A
Lasers			
	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)
Immunity			
Generic	CISPR 35: 2016	CISPR 35: 2016	CISPR 35: 2016
EN	EN 55035:2017 / A11:2020	EN 55035:2017 / A11:2020	EN 55035:2017 / A11:2020
ESD	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11	IEC 61000-4-11
Harmonics	IEC / EN 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	IEC / EN 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Mounting and Enclosure			
	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit available); horizontal surface mounting; wall mounting	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit included); horizontal surface mounting.	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit included); horizontal surface mounting.

	HPE Aruba Networking 6000 24G Class4 PoE 4SFP 370W Switch (R8N87A)	HPE Aruba Networking 6000 24G 4SFP Switch (R8N88A)	HPE Aruba Networking 6000 12G Class4 PoE 2G/2SFP 139W Switch (R8N89A)
Description	24x 10/100/1000BASE-T Ports 4x 1G SFP ports Supports PoE Standards IEEE 802.3af, 802.3at 1x USB-C Console Port 1x USB Type-A Host port	24x 10/100/1000BASE-T Ports 4x 1G SFP ports 1x USB-C Console Port 1x USB Type-A Host port	12x 10/100/1000BASE-T Ports 2x 1G SFP ports 2x 1GbE ports Supports PoE Standards IEEE 802.3af, 802.3at 1x USB-C Console Port 1x USB Type-A Host port
Power supplies	Fixed power supply Up to 370W of Class 4 PoE Power	Fixed power supply	Fixed power supply Up to 139W of Class 4 PoE Power
Fans	Fixed fans	Fixed fans	Fanless

Physical characteristics

Dimensions	(H) 4.39 cm (W) 44.2 cm (D) 26.82 cm (1.73" x 17.4" x 10.56")	(H) 4.39 cm (W) 44.2 cm (D) 20.12 cm (1.73" x 17.4" x 7.92")	(H) 4.39 cm (W) 25.4 cm (D) 25.5 cm (1.73" x 10.0" x 10.04")
Configuration Weight	4.19kg (9.24 lbs)	2.62 kg (5.78 lbs)	2.78 kg (6.13 lbs)

Additional Specifications

CPU	Dual Core ARM Cortex A9 @ 1.016 GHz	Dual Core ARM Cortex A9 @ 1.016 GHz	Dual Core ARM Cortex A9 @ 1.016 GHz
Memory and Flash	4 GB DDR3 16 GB eMMC	4 GB DDR3 16 GB eMMC	4 GB DDR3 16 GB eMMC
Packet Buffer	1 MB	1 MB	1 MB

Performance

Model Switching Capacity	56 Gbps	56 Gbps	32 Gbps
Model Throughput Capacity	41.6 Mpps	41.6 Mpps	23.8 Mpps
Average Latency (LIFO-64-bytes packets)	1 Gbps: 1.5 µSec	1 Gbps: 1.5 µSec	1 Gbps: 2.3 µSec
Switched Virtual Interfaces (dual stack)	16	16	16
IPv4 Host Table (ARP)	1,024	1,024	1,024
IPv6 Host Table (ND)	512	512	512
IPv4 Unicast Routes	512	512	512
IPv6 Unicast Routes	512	512	512

	HPE Aruba Networking 6000 24G Class4 PoE 4SFP 370W Switch (R8N87A)	HPE Aruba Networking 6000 24G 4SFP Switch (R8N88A)	HPE Aruba Networking 6000 12G Class4 PoE 2G/2SFP 139W Switch (R8N89A)
Performance (continued)			
MAC Table Capacity	8,192	8,192	8,192
IGMP Groups	512	512	512
MLD Groups	512	512	512
IPv4/IPv6/MAC ACL Entries (ingress)	256 / 128 / 256	256 / 128 / 256	256 / 128 / 256
Environment			
Operating Temperature	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)	32°F to 113°F (0°C to 45°C) up to 5000 ft (1.5 km) derate by 1°C for every 1000 ft (305 m) from 5000 ft (1.5 km) to 10000 ft (3.0 km)
Operating Relative Humidity	15% to 95% at 104°F (40°C) non-condensing	15% to 95% at 104°F (40°C) non-condensing	15% to 95% at 104°F (40°C) non-condensing
Non-Operating	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)	-40°F to 158°F (-40°C to 70°C) up to 15000 ft (4.6 km)
Non-Operating Storage Relative Humidity	15% to 90% @ 149°F (65°C) non-condensing	15% to 90% @ 149°F (65°C) non-condensing	15% to 90% @ 149°F (65°C) non-condensing
Max Operating Altitude	10000 feet (3 km) Max	10000 feet (3 km) Max	10000 feet (3 km) Max
Max Non-Operating Altitude	15000 feet (4.6 km) Max	15000 feet (4.6 km) Max	15000 feet (4.6 km) Max
Acoustic	Sound Power, LWAd = 3.9 Bel Sound Pressure, LpAm (Bystander) = 24.3 dB	Sound Power, LWAd = 3.9 Bel Sound Pressure, LpAm (Bystander) = 20.9 dB	Sound Power, LWAd = 0 Bel Sound Pressure, LpAm (Bystander) = 0 dB
Primary Airflow	Side-to-side	Side-to-side	-
Electrical Characteristics			
Frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
AC Voltage	100-127 VAC / 200-240 VAC	100-127 VAC / 200-240 VAC	100-127 VAC / 200-240 VAC
Current	4.6 A / 2.3 A	0.6 A / 0.4 A	1.8 A / 0.9 A
Power Consumption (230 VAC)	Idle: 22.9W Max Power (w/o PoE): 32.7W Max Power (w/ PoE): 455W	Idle: 15.4W Max Power (w/o PoE): 33W	Idle: 16W Max Power (w/o PoE): 21.9W Max Power (w/ PoE): 170W

	HPE Aruba Networking 6000 24G Class4 PoE 4SFP 370W Switch (R8N87A)	HPE Aruba Networking 6000 24G 4SFP Switch (R8N88A)	HPE Aruba Networking 6000 12G Class4 PoE 2G/2SFP 139W Switch (R8N89A)
Safety			
	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2014, 2nd Ed., CSA C22.2 No. 62368-1:14, 2nd Ed.,	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2014, 2nd Ed., CSA C22.2 No. 62368-1:14, 2nd Ed.,	IEC / EN 62368-1: 2014 IEC / EN 62368-1: 2018 UL 62368-1: 2014, 2nd Ed., CSA C22.2 No. 62368-1:14, 2nd Ed.,
Emissions			
	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A	VCCI-CISPR 32, Class A CNS 15936, Class A FCC CFR 47 Part 15, Class A; EN 55032:2015 / A11:2020 / CISPR-32, Class A ICES-003 Issue 7: 2020, Class A AS/NZS CISPR 32: 2015, Class A
Lasers			
	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)	IEC / EN 60825-1:2014, Class 1 Class 1 Laser Products / Laser Klasse 1 (Applicable for accessories - Optical Transceivers only)
Immunity			
Generic	CISPR 35: 2016	CISPR 35: 2016	CISPR 35: 2016
EN	EN 55035:2017 / A11:2020	EN 55035:2017 / A11:2020	EN 55035:2017 / A11:2020
ESD	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Mounting and Enclosure			
	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit included); horizontal surface mounting.	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit included); horizontal surface mounting.	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit included); horizontal surface mounting; wall mounting; Kensington Security Slot.

Standards and protocols

- RFC 1591 DNS (client)
- SNMP RFC3411-3418
- SSHv1/SSHv2 Secure Shell
- IEEE 802.1D MAC Bridges
- IEEE 802.1p Priority
- IEEE 802.1Q VLANs
- IEEE 802.1s Multiple Spanning Trees
- IEEE 802.1w Rapid Reconfiguration of Spanning Tree
- IEEE 802.3 Type 10BASE-T
- IEEE 802.3ab 1000BASE-T
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- IEEE 802.3at Power over Ethernet
- IEEE 802.3az Energy Efficient Ethernet
- IEEE 802.3x Flow Control
- RFC 768 UDP
- RFC 783 TFTP Protocol (revision 2)
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 1350 TFTP Protocol (revision 2)
- RFC 2131 DHCP client
- RFC 4330 Simple Network Time Protocol (SNTP) v4
- RFC 951 BOOTP (VLAN 1 Only)
- RFC 1542 BOOTP Extensions (VLAN 1 only)
- IGMPv2/IGMPv3
- IGMP/MLD Snooping
- RFC 8201 Path MTU Discovery for IPv6
- RFC 2460 IPv6 Specification
- RFC 2925 Remote Operations MIB (Ping only)
- RFC 3315 DHCPv6 (client only)
- RFC 3513 IPv6 Addressing Architecture
- RFC 3596 DNS Extension for IPv6
- RFC 3176 sFlow
- RFC 4022 MIB for TCP
- RFC 4113 MIB for UDP (Partially)
- RFC 4251 SSHv6 Architecture
- RFC 4252 SSHv6 Authentication
- RFC 4253 SSHv6 Transport Layer
- RFC 4254 SSHv6 Connection
- RFC 4293 MIB for IP
- RFC 4419 Key Exchange for SSH
- RFC 4443 ICMPv6
- RFC 4861 IPv6 Neighbor Discovery
- RFC 4862 IPv6 Stateless Address Auto-configuration
- RFC 1213 MIB
- RFC 1493 Bridge MIB
- RFC 2674 802.1p and IEEE 802.1Q Bridge MIB (Partial support. MIB objects supported: ieee8021BridgeBasePort, ieee8021BridgeBasePort, ieee8021BridgePortMrpJoinTime, ieee8021BridgePortMrpLeaveTime, ieee8021BridgePortMrpLeaveAllTime)
- RFC 2737 Entity MIB
- RFC 2863 The Interfaces Group MIB
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- RFC 1098 A Simple Network Management Protocol (SNMP)
- ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
- SNMPv1/v2c/v3
- RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events)
- RFC 1098 A Simple Network Management Protocol (SNMP)
- RFC 2474 DiffServ precedence, with 2/4/8 queues per port
- RFC 2475 DiffServ Architecture
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2598 DiffServ Expedited Forwarding (EF)
- IEEE 802.1X Port Based Network Access Control
- RFC 1492 TACACS+
- RFC 2138 RADIUS Authentication
- RFC 2866 RADIUS Accounting
- Secure Sockets Layer (SSL)