# HPE Aruba Networking CX 10000 Switch Series

Deploy software-defined stateful services where data is processed

## Product overview

HPE Aruba Networking CX 10000 Switch Series delivers a flexible and innovative approach to address the security performance, agility, and scalability demands of both traditional enterprise data centers and emerging distributed, edge, and colocated centers of data.

The switch helps network and security administrators distribute intelligence to the data center network-server edge, overcoming legacy network and security design limitations that often require overly complex, highly inefficient, and costly architecture designed to address decades old requirement.

The switch combines the best-of-breed network operating system, HPE Aruba Networking CX, for data center, campus, and edge in addition to the fully programmable AMD Pensando data processing unit (DPU).

This allows the HPE Aruba Networking CX 10000 to deliver stateful software-defined services inline, at scale, with wire-rate performance and orders of magnitude scale and performance improvements over traditional L2/L3 switches at a fraction of their total cost of ownership (TCO).

The switch allows operators to extend industry-standard leaf-spine networking with distributed stateful segmentation, east–west firewalling, NAT, encryption, and telemetry services—all delivered inline, all the time, on every access port, closer to where critical enterprise applications run.

The switches' distributed services architecture is agnostic of network deployment architecture. This allows the flexibility to enable stateful services delivery, when deployed as access, leaf top of rack (ToR), or end of row (EoR) in a data center, and potentially in the aggregation layer in campus or edge data center designs.

The switches offer 3.6 Tbps of line-rate switching capacity with interface configurations supporting 1/10/25GbE (SFP/SFP+/SFP28) and 40/100GbE (QSFP+/QSFP28) connectivity, in a compact 1U form factor. Consequently, it offers a fantastic investment for customers migrating from older 1GbE/10GbE to faster 25GbE, or from 10GbE/40GbE to 100GbE ports.

## Product differentiators

**HPE Aruba Networking CX Operating System—a modern software system**

The switch is based on the CX Operating System, a modern, database-driven operating system that automates and simplifies many critical and complex network tasks.

A built-in time series database enables customers and developers to utilize software scripts for historical troubleshooting, as well as past trends analysis. This helps predict and avoid future problems due to scale, security, and performance bottlenecks.

Every CX switch includes HPE Aruba Networking CX Switch Operating System at no cost and with an active, perpetual set of native features that has everything needed to deploy, connect, and troubleshoot an enterprise network, including:

- HPE Aruba Networking CX Network Analytics Engine (NAE)
- Dynamic Segmentation
- Switch stacking
- High availability and resiliency
- Quality of service (QoS)
- Layer 2 switching
- Layer 3 services and routing
- IP multicast
- Network security
- Support for HPE Aruba Networking Switch Multi-Edit Software

The switch requires an additional HPE Aruba Networking Central Advanced license to extend the HPE Aruba Networking Central Foundational network features with distributed, accelerated stateful firewall, pervasive telemetry services, and container infrastructure.

The switch can further be upgraded with the HPE Aruba Networking CX Premium Feature Pack that includes all HPE Aruba Networking Central Advanced Feature Pack functionality plus IPSec VPN encryption, NAT, and additional network and security services at a future date.

For more information on the HPE Aruba Networking Central Advanced license, read the HPE Aruba Networking CX Switch license ordering guide.

Because HPE Aruba Networking CX Switch Operating System is built on a modular Linux® architecture with a stateful database, our operating system provides the following unique features:

- Easy access to all network state information for unique visibility and analytics
- REST application programming interfaces (APIs) and Python scripting for fine-grained programmability of network tasks
- A microservices architecture that enables full integration with other workflow systems and services
- Continual state synchronization that provides superior fault tolerance and high availability
- Near real-time state and resiliency and the ability to independently upgrade individual software modules for higher availability

**Distributed stateful services**

Embedded natively in the switch, the HPE Aruba Networking CX Switch Operating System is an industry unique, inline stateful software service, enabled through the AMD Pensando programmable DPU, delivered at scale with wire-rate performance. The services include stateful firewalling and secure segmentation, distributed denial of service (DDoS) protection, deep flow-based session-level telemetry with logging, enabled natively in the fabric switching infrastructure without requiring host-based agents or dedicated appliances.

**Operational benefits include:**

- Overcoming the design, performance, and cost limitations of software only and dedicated appliances—protecting the unprotected assets in your data center
- Improving security posture, limiting appliance sprawl
- Extending Zero Trust segmentation deeper into the data center for any type of host
- Delivering isolation and multitenancy for virtualized, bare-metal, or containerized workloads
- Optimizing network traffic flows, bandwidth, and performance, which reduces operational complexity associated with service stitching
- Overcoming centralized networking service layer chokepoints, which reduces downtime
- Simplifying operations through unified network and security automation and management with HPE Aruba Networking Fabric Composer
- Addressing deployments where security agents can't be deployed into servers
- Accelerating infrastructure service provisioning
- Lowering CapEx/OpEx expenditure on security and services

**HPE Aruba Networking CX Network Analytics Engine**

For enhanced visibility and troubleshooting, HPE Aruba Networking CX Network Analytics Engine automatically interrogates and analyzes events that can impact network health. Advanced telemetry and automation allow you to easily identify and troubleshoot networks, system, application, and security issues using Python agents and REST APIs.

The time series database (TSDB) stores configuration and operational data to help quickly resolve network issues. You can also use the data to analyze trends, identify anomalies, and predict future capacity requirements.

**HPE Aruba Networking Virtual Switching Extension**
The ability of HPE Aruba Networking CX Switch Operating System to maintain synchronous state across dual control planes allows a unique high availability solution called HPE Aruba Networking Virtual Switching Extension (VSX).

HPE Aruba Networking Virtual Switching Extension is delivered through redundancy gained by deploying two chassis with an inter-switch link, with each chassis maintaining its independent control.

Designed using the best features of existing HA technologies such as Multi-Chassis Link Aggregation (MC-LAG) and virtual switching framework (VSF), HPE Aruba Networking Virtual Switching Extension enables a distributed architecture that is highly available during upgrades or control plane events.

Features include:

- Continuous configuration synchronization through HPE Aruba Networking CX Switch Operating System
- Flexible active-active network designs at Layers 2 and 3
- Operational simplicity and usability for easy configuration
- High availability by design during upgrades including support for HPE Aruba Networking Virtual Switching Extension live upgrade with Link Aggregation Control Protocol (LACP) traffic draining

## Managing the solution

**HPE Aruba Networking Fabric Composer**
HPE Aruba Networking Fabric Composer is an intelligent, API-driven, software-defined orchestration solution that simplifies and accelerates leaf-spine fabric provisioning and day-to-day operations across rack-scale compute and storage infrastructure. HPE Aruba Networking Fabric Composer supports deep IT ecosystem integrations, enables seamless configuration and operational experience, and is easy to manage, provision, and visualize the entire end-to-end network (Figure 1).

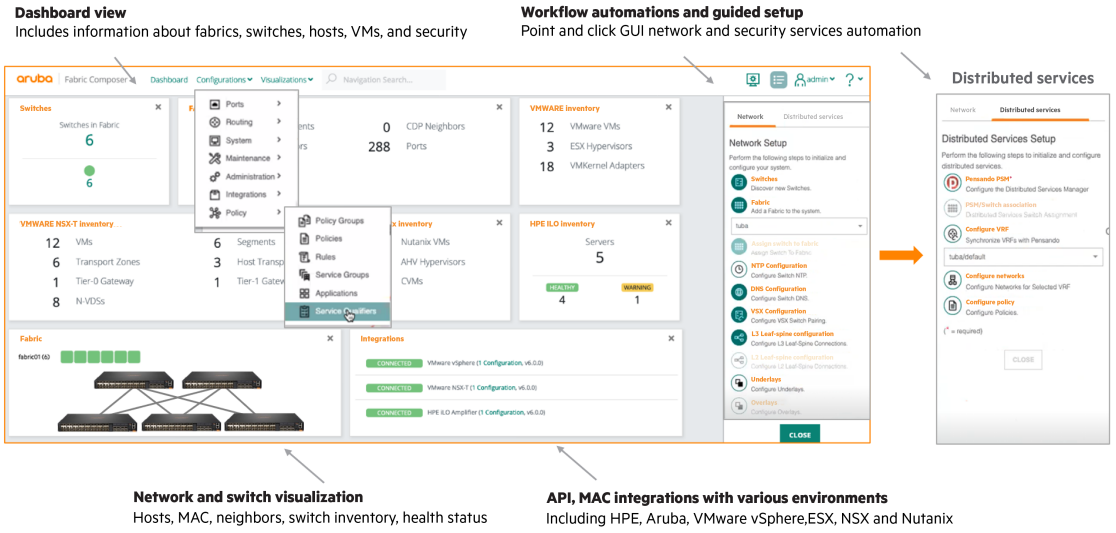


**Figure 1.** HPE Aruba Networking Fabric Composer dashboard

What makes HPE Aruba Networking Fabric Composer different from other solutions is that the software can orchestrate a discrete set of switches as a single entity, which significantly simplifies operations and troubleshooting. This solution is fully infrastructure and application aware, providing automation of various configuration and lifecycle events.

HPE Aruba Networking Fabric Composer also provides unified network and security management for the switch platform. This provides automated switch and network configurations while also unifying security policy and distributed firewalls across the entire switching fabric. This unified network and security policy management significantly simplifies operations and troubleshooting. This solution is implemented to augment switch-by-switch configuration, so operators can access any device directly and make local changes, which means you get the best environment for both traditional network operators in addition to DevOps and SecOps automation.

## Unified security policy configuration

- **Ease of deployment**—Beyond traditional zero touch deployment approaches, which require significant up-front work, AFC user-friendly, guided wizards of HPE Aruba Networking Fabric Composer provide turnkey workflows that walk customers through the fabric deployment process, radically simplifying operations. HPE Aruba Networking Fabric Composer is agnostic of topology and can equally support standards-based VXLAN EVPN fabric as well as traditional HPE Aruba Networking Virtual Switching Extension deployments seamlessly. Any complexity of deploying the fabric is hidden, helping ensure that network operators don't need to understand the specific protocols and commands in HPE Aruba Networking CX Switch Operating System in order to deploy best practice architectures.

- **Service orchestration**—The operational benefits of HPE Aruba Networking Fabric Composer also extend to services because now, with the switch, you can orchestrate provisioning and securing tenants on the fabric in a simplified wizard driven workflow. This is enabled through an integration with AMD Pensando Policy and Services Manager (PSM). The solution allows SecOps and NetOps teams to accelerate application rollouts while helping ensure strict compliance and secure segmentation requirements are met. From rapid and error-free fabric deployment to automation and security, we are truly delivering a cloud-like experience to our customers with HPE Aruba Networking Fabric Composer and the AMD Pensando PSM across virtualized, bare-metal, and containerized deployments.
- **Easy integration**—The event-driven automation engine within HPE Aruba Networking Fabric Composer supports integration packs that are easily installed and offer integrations with VMware Cloud Foundation™, VMware vCenter®, VMware vSAN™, Nutanix, HPE SimpliVity, and HPE iLO Amplifier. Integrations allow customers to enjoy the benefits of automated fabric provisioning, event-based workflow automations, end-to-end network and host visibility, and automatic storage traffic optimization.
- **Pervasive visibility**—Network and virtualization admins have complete end-to-end network visibility of connective of hosts, virtual machines, VLANs, services, and workloads to simplify troubleshooting of connectivity and performance problems. It automatically detects and dynamically solves network issues before your business is impacted. Integration with advanced AMD Pensando stateful services provides not just visibility into the network and compute but also extends to services allowing customers to utilize flow logging, understand communication patterns in the data center, and more accurately segment and firewall application tiers, workloads, and services.

**HPE Aruba Networking Central, cloud-based network management**

Flexible cloud-based or on-premises management for unified network operations of wired, WLAN, SD-WAN, and public cloud infrastructure; designed to simplify Day zero through Day two operations with streamlined workflows; switch management capabilities include configuration, onboarding, monitoring, troubleshooting, and reporting.

An HPE Aruba Networking Central Advanced license expands these capabilities with premium security and AIOps, including the HPE Aruba Networking Central NetConductor Fabric Wizard and global policy manager to enable Dynamic Segmentation and distributed enforcement at a global scale.

The HPE Aruba Networking Central Advanced license now comes with all HPE Aruba Networking Central Advanced features so there is no need to purchase an HPE Aruba Networking Central Advanced license.

This streamlines operational efficiency, reducing the need for IT teams to keep track of multiple licenses, active terms, and renewal dates. For more information on HPE Aruba Networking Central licensing, see the HPE Aruba Networking Central SaaS Subscription ordering guide.

## Product capabilities

**Performance**

**High-speed fully distributed architecture**

- Provides 3.6 Tbps for bidirectional switching and 2000 Mpps for forwarding; all switching and routing are wire-speed to meet the demands of bandwidth-intensive applications today and in the future
- 800G of stateful services performance through dual AMD Pensando DPUs

**Scalable system design**

- Provides investment protection to support future technologies and higher-speed connectivity

**Connectivity**

**High-density port options**

Compact, high port density 1U switch with airflow direction flexibility includes a model with 48 ports of 1GbE/10GbE/25GbE (SFP/SFP+/SFP28) (1GBASE-T and 10GBASE-T transceiver support) + 6 ports of 40GbE/100GbE (QSFP+/QSFP28) (optional 4x10 and 4x25 breakout)

**Jumbo frames**

- Allows high performance backups and disaster- recovery systems; provides a maximum frame size of 9K bytes

**Unsupported Transceiver Mode (UTM)**

- Allows ability to insert and enable unsupported 1G and 10G transceiver and cable
- No warranty nor support for the transceiver/cable when used

**Loopback**

- 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

**Packet storm protection**

- Protects against unknown broadcast, multicast, or unicast storms with user-defined thresholds

### QoS

**Strict priority (SP) queuing and Deficit Weighted Round Robin (DWRR)**
- Enables congestion avoidance

**Data center bridging (DCB)**—Supports lossless Ethernet networking standards to help eliminate packet loss due to queue overflow

- Priority flow control (PFC) 7 priorities per port
- Enhanced transmission service (ETS)
- DCB exchange protocol (prestandard Link Layer Discovery Protocol [LLDP] DCBX IEEE 1.01 version)

**Flow-control guard**
- Prevents accumulation of excessive congestion with periodic flushing; avoids packets buffering for an extended time period

**ECN with slope**
- Marks packets as ECN-congestion experienced (CE) Helps Transmission Control Protocol (TCP) to reduce receive window size during congestion

**Dynamic pool configuration**

- Enables lossless pool configuration without switch reboot

**Storage solution support**
- iSCSI, lossless iSCSI, RDMA over Converged Ethernet version 2 (RoCE v1 and v2) and nonvolatile memory express over fabrics (NVMe-oF)

### Resiliency and high availability

**Redundant and load-sharing fans and power supplies**
- N+1 fans and power supplies provide redundancy

**Hot swappable power supply and fan modules**
- Allows replacement of accessory modules without operationally impacting other modules or switch operations

**Separate data and control paths**
- Separates control from services to keep service processing isolated and increases security and performance

**HPE Aruba Networking Virtual Switching Extension**
- HPE Aruba Networking Virtual Switching Extension enables a distributed and redundant architecture by deploying two switches with each maintaining independent control yet staying synchronized during upgrades or failover. Also, it supports upgrades during live operation.

**Virtual Router Redundancy Protocol (VRRP)**
- VRRP allows a group of switches to dynamically back up each other to create highly available routed environments

**Bidirectional Forward Detection (BFD)**
- Enables sub-second failure detection for rapid routing protocol rebalancing

**Ethernet RING Protection Switching (ERPS)**
- Supports rapid protection and recovery in a RING topology

**Unidirectional Link Detection (UDLD)**
- Monitors link connectivity and shuts down ports at both ends if unidirectional traffic is detected, preventing loops in Spanning Tree Protocol (STP)-based networks

**Bidirectional Forward Detection (BFD)**
- Enables sub-second failure detection for rapid routing protocol re-balancing

**Ethernet Ring Protection Switching (ERPS)**
- Supports rapid protection and recovery in a ring topology

**Unidirectional Link Detection (UDLD)**
- Monitors link connectivity and shuts down ports at both ends if unidirectional traffic is detected, preventing loops in STP-based networks

**IEEE 802.3ad LACP**
- Supports up to 54 LAGs, with up to 16 members per LAG (32 for an HPE Aruba Networking Virtual Switching Extension pair), with a user-selectable L1-4 hashing algorithm

### Management

In addition to the HPE Aruba Networking CX mobile app, HPE Aruba Networking Switch Multi-Edit Software and HPE Aruba Networking CX Network Analytics Engine, the HPE Aruba Networking CX 10000 Switch Series offers the following capabilities:

**REST API**
- Built-in programmable and easy to use

**Management interface control**
- Enables or disables the console port or reset button, depending on security preferences

**Industry-standard CLI with a hierarchical structure**
- Reduces training time and expenses, and increases productivity in multivendor installations

**Management security**
- Restricts access to critical configuration commands
- Offers multiple privilege levels with password protection
- Provides SNMP access with access control lists (ACLs)
- Local and remote syslog capabilities allow access logging

**IPSLA**
- Monitors network for degradation of various services, including voice
- Enables monitoring through the HPE Aruba Networking CX Network Analytics Engine for history and for immediate automated gathering of additional information when anomalies are detected

**SNMP v2c/v3**
- Provides SNMP read and trap support of industry-standard Management Information Base (MIB) and private extensions

**sFlow® (RFC 3176)**
- Provides scalable ASIC-based wire speed network monitoring and accounting with no impact on network performance, allowing network operators to gather a variety of sophisticated network statistics and information for capacity planning and real-time network monitoring purposes

**Remote monitoring (RMON)**
- Uses standard SNMP to monitor essential network functions and 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 File Transfer Protocol (TFTP) allows bidirectional transfers over a TCP/IP network
- Secure File Transfer Protocol (SFTP) runs over a Secure Shell (SSH) tunnel to provide additional security

**Debug and sampler utility**
- Supports ping and trace route 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
- Can serve as the NTP server in a customer network

**IEEE 802.1AB LLDP**
- Advertises and receives management information from adjacent devices on a network, facilitating easy mapping by network management applications

- **LACP-fallback**—Enables Zero Touch Provisioning over link aggregation groups

**Dual images**
- Provides independent primary and secondary operating system files for backup while upgrading

**Multiple configuration files**
- Stores files easily to the flash image

## Layer 2 switching

**VLAN**
- Supports up to 4018 port-based or IEEE 802.1Q-based user configurable VLANs

**VLAN translation**
- Remaps VLANs during transit across a core network

**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 local or remote monitoring port
- Supports four mirroring groups, with an unlimited number of ports per group

**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)

**Rapid Per-VLAN Spanning Tree Plus (RPVST+)**
- Allows each VLAN to build a separate Spanning Tree to improve link bandwidth usage in network environments with multiple VLANs

**Internet Group Management Protocol (IGMP)**
- Controls and manages the flooding of multicast packets in a Layer 2 network

**Static VXLAN**
- Allows operators to manually connect two or more VXLAN tunnel endpoints (VTEP)

**Dynamic VXLAN with BGP-EVPN**
- Deep segmentation for spine-leaf data center networks or Layer 3 campus designs with centralized gateway and symmetric Integrated Routing and Bridging (IRB) based distributed gateways VXLAN tunnels

**IPv4 multicast in VXLAN/EVPN overlay**
- Enables Protocol Independent Multicast (PIM)-SM/ IGMP snooping in the VXLAN overlay

**IPv6 VXLAN/EVPN overlay support**
- Enables IPv6 traffic over the VXLAN overlay

**VXLAN distributed anycast gateway**
- Addressing mechanism that enables the use of the same gateway IP addresses across all the leaf switches part of a VXLAN network

**VXLAN ARP/ND suppression**
- Allows minimization of Address Resolution Protocol (ARP) and ND traffic flooding within individual VXLAN segments, thus optimizing the VXLAN network

## Layer 3 services

**ARP**
- Determines the MAC address of another IP host in the same subnet and supports static ARPs
- Gratuitous ARP allows detection of duplicate IP addresses
- Proxy ARP allows normal ARP operation between subnets or when subnets are separated by a Layer 2 network

**IP directed broadcast**
- Supports directed broadcast on configured network subnets

**Dynamic Host Configuration Protocol (DHCP)**
- DHCP services are offered within a client network to simplify network management
- DHCP relay enables DHCP operation across subnets

**DHCP server**
- Supports DHCP Smart Relay services (for IPv4 and IPv6) in customer networks

**Domain name system (DNS)**
- Provides a distributed database that translates domain names and IP addresses, which simplifies network design
- Supports client and server

**Generic Routing Encapsulation (GRE)**
- Enables tunneling traffic from site to site over a Layer 3 path

## Layer 3 routing

**Static IPv4 routing**
- Provides simple, manually configured IPv4 routing

**Open shortest path first (OSPF)**
- Delivers faster convergence
- Uses link-state routing Interior Gateway Protocol (IGP), which supports Equal-Cost Multipath (ECMP), NSSA, and MD5 authentication for increased security and graceful restart for faster failure recovery

**Border Gateway Protocol 4 (BGP-4)**
- Delivers an implementation of the Exterior Gateway Protocol (EGP) utilizing path vectors
- Uses TCP for enhanced reliability for the route discovery process
- Reduces bandwidth consumption by advertising only incremental updates
- Supports extensive policies for increased flexibility
- Dynamic BGP peering—simplifies BGP configuration for ZTP scenarios and enables CX for Azure Stack integration
- Scales to very large networks

**Routing Information Protocol version 2 (RIPv2)**
- Easy to configure routing protocol for small networks relying on User Datagram Protocol (UDP)

**Routing Information Protocol next generation (RIPng)**
- Extension of RIPv2 for support of IPv6 networking

**Multiprotocol BGP (MP-BGP) with IPv6 address family**
- Enables sharing of IPv6 routes using BGP and connections to BGP peers using IPv6

**Policy-based routing (PBR)**
- Enables using a classifier to select traffic that can be forwarded based on policy set by the network administrator

**6in4 tunnels**
- Supports the tunneling of IPv6 traffic in an IPv4 network

**IP performance optimization**
- **IP sub-interface**—Enables IP sub-interface for ingress and egress ACL/policies, routing, HPE Aruba Networking Virtual Switching Extension-keep alive
- Provides a set of tools to improve the performance of IPv4 networks
- Includes directed broadcasts, customization of TCP parameters, support of ICMP error packets, and extensive display capabilities

**Static IPv6 routing**
- Provides simple, manually configured 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

**OSPFv3**
- Provides OSPF support for IPv6

**ECMP**
- Enables multiple equal-cost links in a routing environment to increase link redundancy and scale bandwidth
- 32-way ECMP

**GRE**
- Enables tunneling traffic from site to site over a Layer 3 path

## Security

**TAA and FIPS 140-2 compliance**

- The HPE Aruba Networking CX 10000 with HPE Aruba Networking CX Switch Operating System, uses FIPS 140-2 validated cryptography for protection of sensitive information
- TAA compliant models available

**Payment Card Industry Data Security Standard (PCI DSS) v4.0 compliance**

- Includes many security features that are important for support of PCI DSS v4.0 compliance

**Stateful firewall features**

Provides hardware-based stateful firewall inspection and secure segmentation

- Protection from DDoS attacks
- Application layer gateway (ALG) support

**ACL features**

- Supports powerful ACLs for both IPv4 and IPv6.
- Supports creating object groups representing sets of devices
- Protects control plane services such as SSH, SNMP, NTP, or web servers

**Dynamic policy refresh**

- Enforce policy changes immediately to terminate malicious flows

**Enrollment over Secure Transport (EST)**

- Enables secure certificate enrollment, allowing for easier enterprise management of PKI

**Remote Authentication Dial-In User Service (RADIUS)**

- Eases security access administration by using a password authentication server

**Terminal Access Controller Access-Control System (TACACS+)**

- Delivers an authentication tool using TCP with encryption of the full authentication request, providing additional security

**RadSec**

- Enables RADIUS authentication and accounting data to be passed safely and reliably across insecure networks such as the internet

**Management access security**

- HPE Aruba Networking CX Switch Operating System provides both on-box as well as off-box authentication for administrative access.
- RADIUS or TACACS+ can be used to provide encrypted user authentication
- TACACS+ can also provide user authorization services
- Secure port access—802.1x, Mac-auth, LUR, DUR, port access policy, static port filtering

**SSHv2**

- Uses external servers to securely log in to a remote device
- Protects against IP spoofing and plain-text password interception with authentication and encryption
- Increases the security of SFTP transfers

## Multicast

**IGMP**

- Enables establishing multicast group memberships in IPv4 networks
- Supports IGMPv1, v2, and v3

**Multicast Listener Discovery (MLD)**

- Enables discovery of IPv6 multicast listeners
- Supports MLDv1 and v2

**PIM Multicast Boundary (v4)**

- HPE Aruba Networking Virtual Switching Extension graceful shutdown for IGMP/MLD Multicast NSF

**Multicast Service Delivery Protocol (MSDP) for anycast RP**

- MSDP used for anycast RP is an intradomain feature that provides redundancy and load-sharing capabilities.

**MSDP mesh groups**

- Avoids SA messages flooding to other mesh group peers.

**PIM-dense mode**

- Floods multicast traffic to every corner of the network (push-model). The method is for delivering data to receivers without receivers requesting the data, which can be efficient in certain deployments in which there are active receivers on every subnet in the network
- Branches without downstream receivers are pruned from the forwarding trees

**Fast-leave (FL) and forced fast-leave (FFL)**
- FL and FFL for IGMP/MLD speed up the process of blocking unnecessary multicast traffic to a switch port that is connected to end nodes for IGMP. They help to eliminate the CPU overhead of having to generate an IGMP/MLD group-specific query message

Support for Microsoft Network Load Balancing (NLB) for server applications

**Microsoft NLB**
- Supports server applications

**PIM**
- PIM for IPv4 and IPv6 supports one-to-many and many-to-many media casting use cases such as IPTV over IPv4 and IPv6 networks
- Supports PIM sparse mode (PIM-SM, IPv4 and IPv6)

**Additional information**
- Green initiative support
- Provides support for RoHS (EN 50581:2012) regulations

**Customer first, customer last support**

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

HPE Aruba Networking Foundational Care support services include priority access to HPE Aruba Networking technical assistance center (TAC) engineers 24x7x365, flexible hardware and on-site support options, and total coverage for HPE Aruba Networking products. HPE Aruba Networking switches with assigned HPE Aruba Networking Central subscriptions have the added benefit of additional hardware support only.

HPE Aruba Networking Pro Care adds fast access to senior 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 HPE Aruba Networking Foundational Care and HPE Aruba Networking Pro Care, visit HPE Aruba Networking Services .

**Warranty, services, and support 1 year warranty**

See Support Center for warranty and support information included with your product purchase.

Reference the following web pages for more detailed information—HPE Aruba Networking CX Switch Operating System software releases and features:

HPE Aruba Networking CX Switch Operating System software documentation portal

HPE Aruba Networking Switch Feature Navigator

For support and services information, visit HPE Aruba Networking Support Services

**Table 1.** Technical specifications for HPE Aruba Networking CX 10000 Switch Series bundles

| | **R8P13A 10000 48Y 6C Front-to-back switch bundle (S0F97A HPE ANW 10000 48Y 6C FB 6Fs TAA Bdl)** | **R8P14A 10000 48Y 6C Back-to-front switch bundle (S0F98A HPE ANW 10000 48Y 6C BF 6Fs 2PS TAA Bdl)** |
|---|---|---|
| **Description** | R8P13A HPE Aruba Networking 10000 48Y 6C bundle includes: 48 x 25 Gb ports (SFP/+/28), 6 x 100 Gb ports (QSFP+/28)<br>• 6xR8R53A front-to-back fan<br>• 2xR8R51A front-to-back 800W 100–240 VAC power supply | • R8P14A HPE Aruba Networking 10000 48Y 6C bundle includes: 48 x 25 Gb ports (SFP/+/28), 6 x 100 Gb ports (QSFP+/28)6xR8R54A back-to-front fan<br>• 2xR8R52A back-to-front 800W 100–240 VAC power supply |
| **Power supplies** | Field-replaceable, hot-swappable, and up to two power supplies. | |
| **Fans** | Field-replaceable, hot-swappable, and up to six fans. | |
| **Physical characteristics** | | |
| **Dimensions** | (H) 4.44 cm x (W) 43.82 cm x (D) 51.1 cm (1.75" x 17.25" x 20.12") | (H) 4.44 cm x (W) 43.82 cm x (D) 51.1 cm (1.75" x 17.25" x 20.12") |
| **Full configuration weight** | 9.75 kg (21.45 lb) | 9.75 kg (21.45 lb) |
| **Additional specifications** | | |
| **CPU** | Intel® Xeon® CPU D-1637 6 cores @ 2.90 GHz | |
| **Memory, drive, and flash** | 32 GB RAM, 64 GB SSD | |
| **Packet buffer** | 32 MB | |
| **Performance**[1] | | |
| **Switching capacity** | 3.6 Tbps (bidirectional) | |
| **Latency (LIFO)** | <1 uSec (without redirect)<br><5 uSec (with redirect) | |
| **IPv4 host table** | 120,000 | |
| **IPv6 host table** | 52,000 | |
| **IPv4 unicast routes** | 131,072 | |
| **IPv6 unicast routes** | 32,732 | |
| **MAC table size** | 98,304 | |
| **IGMP groups** | 8000 | |
| **MLD groups** | 8000 | |
| **IPv4 multicast routes** | 8000 | |
| **IPv6 multicast routes** | 8000 | |
| **Environment** | | |
| **Operating temperature** | 0°C to 40°C (32°F to 104°F) up to 3.0 km (10,000 ft.) | |
| **Operating relative humidity** | 10% to 85% at 40°C (104°F) noncondensing | |
| **Nonoperating** | –40°C to 70°C (–40°F to 158°F) up to 4.6 km (15,000 ft.) | |

[1] Some of these scaling numbers assume shared tables.

**Table 1.** Technical specifications for HPE Aruba Networking CX 10000 Switch Series bundles (continued)

| | R8P13A 10000 48Y 6C front-to-back switch bundle (S0F97A HPE ANW 10000 48Y 6C FB 6Fs TAA Bdl) | R8P14A 10000 48Y 6C back-to-front switch bundle (S0F98A HPE ANW 10000 48Y 6C BF 6Fs 2PS TAA Bdl) |
|---|---|---|
| **Environment** | | |
| **Nonoperating/storage relative humidity** | 5% to 95% @ 65°C (149°F) | |
| **Max operating altitude** | Up to 10,000 ft (3.048 km) | |
| **Max nonoperating** | Up to 15,000 ft (4.6 km) | |
| **Primary airflow** | Front-to-back port to PSU or back-to-front PSU to port | |
| **Electrical characteristics** | | |
| **Frequency** | 50–60 Hz | |
| **AC voltage** | 100–240 volts | |
| **Current** | 6A (low voltage)–3A (high voltage) | |
| **Power consumption**[2] | Max: 753W<br>Typical: 550W Idle: 400W<br>Idle: 400W | Max: 753W<br>Typical: 550W Idle: 400W<br>Idle: 400W |
| **Safety** | | |
| | EN/IEC 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013<br>EN/IEC 62368-1, 2nd. & 3rd. Ed.<br>UL 62368–1, 3rd. Ed.<br>CAN/CSA C22.2 No. 62368–1, 3rd. Ed. | |
| **EMC** | | |
| | EN 55032:2015/CISPR 32, Class A<br>FCC CFR 47 Part 15: 2018 Class A<br>ICES-003 Class A<br>VCCI Class A<br>CNS 13438 Class A<br>KS C 9832 Class A<br>AS/NZS CISPR 32 Class A<br>EN 55035, CISPR 35, KS KS C 9835 | |
| **Lasers** | | |
| | EN 60825-1:2014 / IEC 60825-1: 2014 Class 1<br>Class 1 Laser Products/Laser Klasse 1 | |
| **Management** | | |
| | CLI<br>REST API SNMP<br>HPE Aruba Networking Fabric Composer<br>HPE Aruba Networking Switch Multi-Edit Software<br>HPE Aruba Networking Central. HPE Aruba Networking Central support will come with HPE Aruba Networking Central 2.5.6 (not currently supported) RJ-45 serial<br>USB micro USB console RJ-45 Ethernet port AMD Pensando PSM | |
| **Mounting and enclosure** | | |
| | Mounts in an EIA standard 19-inch rack or other equipment cabinet; horizontal surface mounting only; order 2-post or 4-post mounting kit separately | |

[2] Max measurement is collected under 100% line rate network traffic running, with all ports populated with SFP and QSFP modules. Typical measurement is collected under 50% line rate network traffic running, with all ports populated with SFP and QSFP modules. Idle measurement is collected with no network traffic or modules.

## Standards and protocols

The following standards and protocols are supported.

- IEEE 802.1AB-2009
- IEEE 802.1ak-2007
- IEEE 802.1t-2001
- IEEE 802.1AX-2008 Link Aggregation
- IEEE 802.1p Traffic Class Expediting and Dynamic Multicast Filtering
- IEEE 802.1Q VLANs
- IEEE 802.1s Multiple Spanning Trees
- IEEE 802.1w Rapid Reconfiguration of Spanning Tree
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- IEEE 802.3x Flow Control
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3ae 10 Gigabit Ethernet
- IEEE 802.3by 25 Gigabit Ethernet
- IEEE 802.3ba 40 and 100 Gigabit Ethernet Architecture
- RFC 768 UDP
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 768 User Datagram Protocol
- RFC 813 Window and Acknowledgement Strategy in TCP
- RFC 815 IP datagram reassembly algorithms
- RFC 879 TCP maximum segment size and related topics
- RFC 896 Congestion control in IP/TCP internet works
- RFC 917 Internet subnets
- RFC 919 Broadcasting Internet Datagrams
- RFC 922 Broadcasting Internet Datagrams in the Presence of Subnets (IP_BROAD)
- RFC 925 Multi-LAN address resolution
- RFC 1215 Convention for defining traps for use with the SNMP
- RFC 1256 ICMP Router Discovery Messages
- RFC 1393 Traceroute Using an IP Option
- RFC 1591 Domain Name System Structure and Delegation
- RFC 1657 Definitions of Managed Objects for BGP-4 using SMIv2
- RFC 1772 Application of the Border Gateway Protocol in the Internet
- RFC 1981 Path MTU Discovery for IP version 6
- RFC 1997 BGP Communities Attribute
- RFC 1998 An Application of the BGP Community Attribute in Multi-home Routing
- RFC 2385 Protection of BGP Sessions via the TCP MD5 Signature Option
- RFC 2401 Security Architecture for the Internet Protocol
- RFC 2402 IP Authentication Header
- RFC 2406 IP Encapsulating Security Payload (ESP)
- RFC 2460 Internet Protocol, Version 6 (IPv6) Specification
- RFC 2545 Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
- RFC 2710 Multicast Listener Discovery (MLD) for IPv6
- RFC 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol
- RFC 2918 Route Refresh Capability for BGP-4
- RFC 2934 Protocol Independent Multicast MIB for IPv4
- RFC 3137 OSPF Stub Router Advertisement
- RFC 3176 InMon Corporation's sFlow: A Method for Monitoring Traffic in Switched and Routed Networks
- RFC 3484: Default Address Selection for Internet Protocol version 6 (IPv6)
- RFC 3509 Alternative Implementations of OSPF Area Border Routers
- RFC 3623 Graceful OSPF Restart
- RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6
- RFC 4213 Basic Transition Mechanisms for IPv6 Hosts and Routers
- RFC 4251 The Secure Shell (SSH) Protocol
- RFC 4271 A Border Gateway Protocol 4 (BGP-4)
- RFC 4273 Definitions of Managed Objects for BGP-4
- RFC 4291 IP Version 6 Addressing Architecture
- RFC 4292 IP Forwarding Table MIB
- RFC 4293 Management Information Base for the Internet Protocol (IP)
- RFC 4360 BGP Extended Communities Attribute

- RFC 4486 Subcodes for BGP Cease Notification Message
- RFC 4552 Authentication/Confidentiality for OSPFv3
- RFC 4724 Graceful Restart Mechanism for BGP
- RFC 4760 Multiprotocol Extensions for BGP-4
- RFC 4940 IANA Considerations for OSPF
- RFC 5095: Deprecation of Type 0 Routing Headers in IPv6
- RFC 5187 OSPFv3 Graceful Restart
- RFC 5701 IPv6 Address Specific BGP Extended Community Attribute
- RFC 6987 OSPF Stub Router Advertisement
- RFC 7047 The Open vSwitch Database Management Protocol
- RFC 7059 A Comparison of IPv6-over-IPv4 Tunnel Mechanisms
- RFC 7313 Enhanced Route Refresh Capability for BGP-4
- RFC 8201 Path MTU Discovery for IP version 6

## Bundles and accessories

Note: 4-post mounting kit and console cable are not included in bundles. Order separately. Mounting kit is required.

- R8P13A HPE Aruba Networking 10000 48Y 6C bundle includes: 48 x 25Gb ports (SFP/+/28), 6 x 100Gb ports (QSFP+/28), 6 front-to-back fans and 2 PSUs
- R8P14A HPE Aruba Networking 10000 48Y 6C bundle includes: 48 x 25Gb ports (SFP/+/28), 6 x 100Gb ports (QSFP+/28), 6 back-to-front fans and 2 PSUs

### TAA SKUs

- HPE Aruba Networking CX 10000 48p SFP28 10G/25G 6p QSFP28 100G FB 6 Fans 2 PSU TAA Switch Bundle (S0F97A)
- HPE Aruba Networking CX 10000 48p SFP28 10G/25G 6p QSFP28 100G BF 6 Fans 2 PSU TAA Switch Bundle (S0F98A)

### HPE Aruba Networking CX feature packs

- HPE Aruba Networking CX Software 10xxx Switch Advanced 1-Year E-STU (S0T97AAE)
- HPE Aruba Networking CX Software 10xxx Switch Advanced 3-Year E-STU (S0T98AAE)
- HPE Aruba Networking CX Software 10xxx Switch Advanced 5-Year E-STU (S0T99AAE)
- HPE Aruba Networking CX Software 10xxx Premium 1-Year E-LTU (S0U02AAE)
- HPE Aruba Networking CX Software 10xxx Premium 3-Year E-LTU (S0U03AAE)
- HPE Aruba Networking CX Software 10xxx Premium 5-Year E-LTU (S0U04AAE)
- HPE Aruba Networking CX Soft 10xxx Pre Perpetual E-LTU (R9H26AAE)
- HPE Aruba Networking CX Soft 10xxx Sw Adv Perpetual E-LTU (R9H25AAE)

### Mounting kit (required when ordering a bundle)

- R8R55A HPE Aruba Networking CX 10000 1U 2p Rack Mount Kit
- R8R56A HPE Aruba Networking CX 10000 1U 4p Rack Mount Kit

### Console cable

- HPE Aruba Networking X2C2 RJ45 to DB9 Console Cable (JL448A)
- HPE Aruba Networking CX Switch Bluetooth Adapter (S1H23A)—for use with the CX mobile app

### Accessories

- R8R53A HPE Aruba Networking CX 10000 FB Fan
- R8R54A HPE Aruba Networking CX 10000 BF Fan

### Power supply

- R8R51A HPE Aruba Networking CX 10000 FB AC PSU
- R8R52A HPE Aruba Networking CX 10000 BF AC PSU

### 1G Transceivers[3]

- HPE Aruba Networking 1G SFP LC SX 500m MMF Transceiver (J4858D)
- HPE Aruba Networking 1G SFP LC LX 10km SMF Transceiver (J4859D)
- HPE Aruba Networking 1G SFP LC LH 70km SMF Transceiver (J4860D)
- HPE Aruba Networking 1G SFP RJ45 100m Transceiver (J8177E)

### 10G Transceivers[4] and cables

- HPE Aruba Networking 10G SFP+ LC SR 300m MMF Transceiver (J9150D)
- HPE Aruba Networking 10G SFP+ LC LR 10km SMF Transceiver (J9151E)[5]

[3,4] Consult the HPE Aruba Networking operating system switch and HPE Aruba Networking CX Switch Operating System transceiver guide in the HPE Aruba Networking support portal for the minimum required software releases to support these transceivers.

[5] 10G LR support only for Revision E part, J9151E (Note: Do not use J9151D)

- HPE Aruba Networking 10GBASE-T SFP+ RJ45 30m Transceiver (JL563C)
- HPE Aruba Networking 10G SFP+ LC ER 40km SMF Transceiver (J9153D)
- HPE Aruba Networking 10G SFP+ to SFP+ 1m Direct Attach Copper Cable (J9281D)
- HPE Aruba Networking 10G SFP+ to SFP+ 3m Direct Attach Copper Cable (J9283D)

**25G Transceivers[6] and cables**

- HPE Aruba Networking 25G SFP28 LC SR 100m MMF Transceiver (JL484A)
- HPE Aruba Networking 25G SFP28 LC SR 400m MMF Transceiver (JL485A)
- HPE Aruba Networking 25G SFP28 LC LR 10km SMF Transceiver (JL486A)
- HPE Aruba Networking 25G SFP28 to SFP28 0.65m Direct Attach Copper Cable (JL487A)
- HPE Aruba Networking 25G SFP28 to SFP28 3m Direct Attach Copper Cable (JL488A)
- HPE Aruba Networking 25G SFP28 to SFP28 5m Direct Attach Copper Cable (JL489A)
- HPE Aruba Networking 25G SFP28 to SFP28 3m Active Optical Cable (R0M44A)
- HPE Aruba Networking 25G SFP28 to SFP28 7m Active Optical Cable (R0M45A)
- HPE Aruba Networking 25G SFP28 to SFP28 15m Active Optical Cable (R0Z21A)

**40G Transceivers[7] and Cables**

- HPE Aruba Networking 40G QSFP+ LC BiDi 150m MMF Transceiver (JL308A)
- HPE X142 40G QSFP+ MPO SR4 Transceiver (JH231A)
- HPE X142 40G QSFP+ MPO eSR4 300M Transceiver (JH233A)
- HPE X142 40G QSFP+ LC LR4 SM Transceiver (JH232A)
- HPE Aruba Networking 40G QSFP+ LC ER4 40km SMF Transceiver (Q9G82A)
- HPE X242 40G QSFP+ to QSFP+ 1m Direct Attach Copper Cable (JH234A)
- HPE X242 40G QSFP+ to QSFP+ 3m Direct Attach Copper Cable (JH235A)
- HPE X242 40G QSFP+ to QSFP+ 5m Direct Attach Copper Cable (JH236A)
- HPE Aruba Networking 40G QSFP+ to QSFP+ 7m Active Optical Cable (R0Z22A)
- HPE Aruba Networking 40G QSFP+ to QSFP+ 15m Active Optical Cable (R0Z23A)
- HPE Aruba Networking 40G QSFP+ to QSFP+ 30m Active Optical Cable (R0Z24A)
- HPE QSFP+ to 4xSFP+ 3m Breakout Direct Attach Cable (721064-B21)

**100G Transceivers[8] and cables**

- HPE Aruba Networking 100G QSFP28 MPO SR4 MMF Transceiver (JL309A)
- HPE Aruba Networking 100G QSFP28 LC CWDM4 2km SMF Transceiver (R0Z30A)
- HPE Aruba Networking 100G DR QSFP28 LC 500m SMF Transceiver (S3N88A)
- HPE Aruba Networking 100G LR QSFP28 LC 10km SMF Transceiver (S3N89A)
- HPE Aruba Networking 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable (R0Z25A)
- HPE Aruba Networking 100G QSFP28 to QSFP28 3m Direct Attach Copper Cable (JL307A)
- HPE Aruba Networking 100G QSFP28 to QSFP28 5m Direct Attach Copper Cable (R0Z26A)
- HPE (HIT) QSFP28 to 4xSFP28 3m Breakout Direct Attach Cable (845416-B21)

## HPE Aruba Networking Fabric Composer

- Product ordering information for HPE Aruba Networking Fabric Composer is available at HPE Aruba Networking Fabric Composer solution overview
- HPE Aruba Networking Fabric Composer Device Management Service Tier 4 Switch 1-Year Subscription E-STU (R7G99AAE)
- HPE Aruba Networking Fabric Composer Device Management Service Tier 4 Switch 3-Year Subscription E-STU (R7H00AAE)
- HPE Aruba Networking Fabric Composer Device Management Service Tier 4 Switch 5-Year Subscription E-STU (R7H01AAE)

[6, 7, 8] Consult the HPE Aruba Networking operating system switch and HPE Aruba Networking CX Switch Operating System transceiver guide in the HPE Aruba Networking support portal for the minimum required software releases to support these transceivers.

## HPE Aruba Networking Central CX switch subscription SKUs

- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Foundational 1-Year Subscription E-STU (R3K03AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Foundational 3-Year Subscription E-STU (R3K04AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Foundational 5-Year Subscription E-STU (R3K05AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Foundational 7-Year Subscription E-STU (R3K06AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Foundational 10- Year Subscription E-STU (R3K07AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Advanced 1-Year Subscription E-STU (JZ540AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Advanced 3-Year Subscription E-STU (JZ541AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Advanced 5-Year Subscription E-STU (JZ542AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Advanced 7-Year Subscription E-STU (JZ543AAE)
- HPE Aruba Networking Central 8xxx/9xxx/10xxx Switch Advanced 10-Year Subscription E-STU (JZ544AAE)
- HPE Aruba Networking Central On-premises 8xxx Switch Foundational 1-Year Subscription E-STU (R6U88AAE)
- HPE Aruba Networking Central On-premises 8xxx Switch Foundational 3-Year Subscription E-STU (R6U89AAE)
- HPE Aruba Networking Central On-premises 8xxx Switch Foundational 5-Year Subscription E-STU (R6U90AAE)
- HPE Aruba Networking Central On-premises 8xxx Switch Foundational 7-Year Subscription E-STU (R6U91AAE)
- HPE Aruba Networking Central On-premises 8xxx Switch Foundational 10-Year Subscription E-STU (R6U92AAE)

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