New Era of Networking: Next-Generation Cisco Catalyst 9000 Series Against Yesterday's Competition

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About Cisco Catalyst 9000 Series Switches

Cisco Catalyst® 9000 Series Switches are built for the new era of networking. Today's competitive switches for the campus are no match and are unsuitable for customers in this new era of networking.

Today's networks demand a rich of set hardware and software services to address business scale and complexity. These networks require campus switches built for longevity to meet ongoing and evolving industry trends. With the dramatic growth of the Internet of Things (IoT) and increased wireless speeds, today's wiring-closet switches need to support secure and scalable port densities with the ability to transition to port speeds beyond traditional gigabit access. For wiring closets requiring greater than 144 ports, customers may choose to deploy a modular access switch.

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Cisco's modular access switches are built from the ground up to fulfill high-availability requirements. These switches provide customers the option to satisfy mission-critical deployments, where network uptime is paramount. Whether the operations are planned or unplanned, Cisco's modular access switches can provide software patching, full software upgrades, and hardware redundancy.

Today's new era of networking requires embedded security at the edge. With enterprise IoT projected to grow to 7.5 billion things, these "things" are not always manufactured with sophisticated software stacks and can be reduced to vulnerable endpoints, which are later compromised as entry points to a network. The network needs to protect itself from these advanced persistent threats. Securing these devices introduces a new set of challenges. The network needs to offer an extended trust domain, with scalable device classification and policy.

Unfortunately, today's attackers are smarter and are now encrypting malware to remain hidden. Large-scale DDoS attacks from hacked IoT devices are already a reality. In summary, today's networks need to address the challenges of the forever-changing security landscape.

Customers need to procure a campus switch equipped with robust hardware architecture to satisfy today's requirements for security, mobility, and agility. The software stack for these switches should complement the hardware's programmability and offer simple, open, and standards-based mechanisms to allow customers to enable new services without complexity and compromise.

Cisco Catalyst 9000 Series switches are built for the new era of networking. Today's competitive switches for the campus are no match and are unsuitable for customers in this new era of networking. The Cisco Catalyst 9000 Series switches form the foundational building block for Cisco® Software Defined Access (SD-Access), Cisco's lead enterprise architecture. The Cisco Catalyst 9000 Series is a single family with a coherent set of features and purpose.

Cisco Catalyst 9300 Series Switches are Cisco's lead stackable enterprise switching platform built for security, IoT, mobility, and cloud, and are the next generation of the industry's most widely deployed switching platform.

The Cisco Catalyst 9300 Series is the industry's first optimized platform for IEEE 802.11ac Wave2 with support for 2.5-gigabit and multigigabit downlinks and support for UPoE and PoE+. It provides support for the highest density of IEEE 802.11ac Wave2 (48 access points) in a single Rack-Unit (RU) box. The Cisco Catalyst 9300 Series has the most flexible uplink architecture with support for 1 Gbps, multigigabit, 10 Gbps, and 40 Gbps and is 25 Gbps ready. The platform offers choice of multigigabit, 2.5-Gbps, and 1-Gbps copper Ethernet switches with 80-Gbps uplink bandwidth and the industry's highest 480-Gbps stacking bandwidth solution. Cisco StackWise® virtual technology provides exceptional scale (448 ports per stack) and flexibility of deployment for the platform with support for the best NSF/SSO resiliency architecture for a stackable solution (sub-50 ms). Cisco Catalyst 9300 Series is the only switching platform in the industry with support for front- and back-panel stacking, optimizing it for a variety of deployments.

Cisco Catalyst 9300 Series also has a highly resilient and efficient power architecture with StackPower that delivers high density of UPoE and PoE+ ports. Cisco Catalyst 9300 Series provides unmatched PoE resiliency capabilities such as Perpetual and Fast PoE optimizing it for IoT deployments. It has support for the most efficient power supplies in the industry.

Cisco Catalyst 9400 Series Switches are Cisco's lead modular enterprise switching access platform built for security, IoT, and cloud.

The platform provides exceptional investment protection with a chassis architecture that is capable of supporting up to 8-Tbps system bandwidth (IEEE 802.11ax ready) and outstanding power delivery that is IEEE 802.3BT (100W PoE) ready. Redundancy is now a table-stakes feature across the portfolio, and the Cisco Catalyst 9400 Series delivers state-of-the-art HA with capabilities like ISSU, NSF/SSO, uplink resiliency, N+1/N+N redundancy for power supplies, perpetual PoE, and fast PoE. The platform is enterprise optimized with an innovative dual serviceable fan-tray design and side-to-side airflow and is a closet friendly ~16-inch depth. A single system can scale up to 384 access ports (768 with StackWise virtual) with a choice of multigigabit, 1-Gbps copper/SFP, 10-Gbps SFP+, UPoE, and PoE+ options.

The platform also supports advanced routing and infrastructure services, SD-Access border capabilities, and network system virtualization with StackWise virtual technology, enabling optional placement of the platform in the core/aggregation layers of small-to-midsize campuses.

Cisco Catalyst 9500 Series Switches are Cisco's lead purpose-built fixed core/aggregation enterprise switching platform built for security, IoT, and cloud. The Cisco Catalyst 9500 Series is the industry's first purpose-built 40-Gbps switch targeted for enterprise campus, delivering exceptional table scales (MAC/route/ACL) and buffering for enterprise applications.

The platform offers nonblocking 40-Gbps (QSFP) and 10-Gbps (SFP+) switches with granular port densities that fit diverse campus needs. The Cisco Catalyst 9500 Series supports advanced routing/infrastructure services (MPLS L2/L3 VPNs, MVPN, NAT), SD-Access border capabilities (host tracking database, cross-domain connectivity, and VRF-aware Cisco Locator/ID Separation Protocol [LISP]), and network system virtualization with StackWise virtual technology that are critical for its placement in the campus core.

The platform also supports all the foundational HA capabilities like patching, GIR, NSF/SSO, and redundant Platinum-rated power supplies and fans.

Additionally, all Cisco Catalyst 9000 Series switches:

- Support advanced security capabilities like ETA, MacSec-256, and TrustWorthy Systems capabilities like PNP SUDI and Trusted Anchor
- Deliver IoT convergence with industry-leading scale and capabilities like AVB/1588, service discovery, and "thing" classification
- Run a modern operating system, open Cisco IOS® XE Software, that supports model-driven programmability, streaming telemetry, and patching
- Use x86-based CPUs and pluggable local for third-party container-based app hosting
- Provide outstanding application visibility and control with Cisco Network-Based Application Recognition 2 (NBAR 2)

Competitive comparison

Table 1 compares the Cisco Catalyst 9000 Series with products from competing vendors.

Table 1. New era of networking campus switching metrics

	Cisco Catalyst 9000 Series Switch Family	Aruba Mobile First Campus Switches	Huawei Agile Switches	Juniper EX Switch Family
Advanced Security Capabilities Encrypted Threat Analytics (ETA), MACsec 256-bit, Cisco Trustworthy Systems, Full NetFlow	Yes	No	No	No
Enterprise IoT Convergence 1588/AVB/UPoE/Fast PoE/Perpetual PoE/CoAP (RFC 7252), SD-Bonjour, IoT device profiling	Yes	No	No	No
Future Proofed with industry-leading, optimized for Wave 2, mGig density, next-gen Wi-Fi (IEE802.11ax) 100W PoE (IEEE 802.3bt)	Yes	No	No	No
First in Enterprise x86 CPU, 100% model-driven, software patching, graceful insertion and restart, secure container-based app hosting, ISSU	Yes	No	No	No
Application-Based Visibility for Wired and Wireless NBAR, AVC, Full NetFlow, streaming telemetry	Yes	No	No	No

HPE Aruba

HPE is taking a ride on Aruba's Mobile First voyage, but overlooks Aruba was originally a wireless vendor before a switching vendor. Aruba's retired MAS (Mobility Access Switch) family was marketed as "wired" access points. The Aruba wireless folks are managing the campus switching/branch business while the older ProCurve team takes a back seat and holds on for the ride. The Aruba-branded switch family is basic at best.

The Aruba Mobile First switches are unable to provide end-to-end security: a strict requirement for the new era of networking. The Cisco Catalyst 9000 Series switches are secure by design. Each class of switch delivers a product set capable of using Cisco Trustworthy Systems. Trustworthy Systems are built for today's threats with embedded security across multiple Cisco platforms.

HPE/Aruba switches are subject to sophisticated attacks within the enterprise network. These so-called "good enough" switches lack advanced security mechanisms to detect malware using encrypted traffic. The Cisco Catalyst 9000 Series provides X-ray vision for encrypted traffic with its Enhanced Threat Telemetry and Analytics (ETA).

The generations of the Cisco Unified Access Data Plane (UADP) ASIC have offered customers features and services that can be enabled concurrently. On the contrary, the HPE Provision ASIC is strictly limited. It globally limits the number of Aruba features customers can enable. For customers wanting to migrate to a unified wired and wireless offering, Aruba recommends their Tunneled-Node feature.

The Tunneled-Node feature affects performance and prevents customers from enabling:

- IP Multicast Routing
- OpenFlow
- VxLAN

This is not the case with the Cisco Catalyst 9000 Series UADP ASIC. Customers can enable services concurrently for various applications, services, and roles the switch is designated for in the new era of networking. Programmable hardware makes programmable networks more powerful because the functions of the physical infrastructure can evolve over time.

The Cisco Catalyst 9000 Series is built to see you through the next decade. Built on the foundation of the UADP 2.0 ASIC, the switches provide a programmable pipeline and flexible hardware tables for future innovation and scale. The Cisco Catalyst 9000 Series promotes standards leadership for IEEE 802.3bz Density (mGig), 802.11ax Optimized (5G), and 802.3bt Scale (60/100W).

How Cisco Catalyst 9000 Series wins against Aruba's Mobile First Campus Switches

- The Cisco Catalyst 9000 Series family is built to see you through the next decade. Built on the foundation of the UADP 2.0 ASIC, the Cisco Catalyst 9000 Series switches provide a programmable pipeline and flexible hardware tables for future innovation and scale. The Cisco Catalyst 9000 Series promotes standards leadership for IEEE 802.3bz Density (mGig), 802.11ax Optimized (5G), and 802.3bt Scale (60/100W).
- Aruba switches lack functionality for the future: Only one SKU from their 3810M family supports mGig (8 ports); PoE: No support for more than 30W (UPoE) across the Aruba Campus portfolio.
- Features like Aruba's homegrown Tunneled-Node impacts performance and is mutually exclusive of other features (e.g., IP Multicast Routing, OpenFlow, VXLAN). This forces customers to dedicate their switch as a specific appliance versus a flexible means of connectivity. Highlight the flexibility of UADP 2.0 ASIC and the openness and feature richness of Cisco IOS XE Software.
- Aruba offers poor man's visibility with sFlow-only support across their campus switching portfolio. With sFlow-only support, network operations are subject to false alarms, blurred analysis, and missed packets, leaving the network vulnerable and exposed to advanced threats within the network perimeter.
- Aruba lacks a modern software stack for the new era of networking. Standards-based YANG models and NETCONF are missing and limit the ability to deliver infrastructure abstraction and prevent the pushing of holistic configurations across the campus.

HPE/Aruba weaknesses

- Limited scale for access ports beyond gigabit speeds (mGig)
- Age-old switches with no support for devices requiring PoE beyond 30W
- HPE ProVision ASIC extremely limited and does not allow enabling concurrent services (Tunneled-Node, OpenFlow, VXLAN, IP Multicast)
- One size fits all? Hardware forwarding table for IP routing same size across low-end 2930F switch and HPE 5400R modular switch?
- Not built for the future

Huawei

Huawei has a broad portfolio of access switches, both chassis and fixed, which up until recently have been based on merchant silicon. Traditionally a "fast follower" in terms of platform features and functionality, the value proposition that Huawei based their platforms and solution on was one of "good enough, at a cheaper purchase price than Cisco."

Recently Huawei embarked on developing its own custom silicon, which it has used in line cards for its chassis switches and as the basis for some of its fixed switches, in an effort to differentiate and innovate with its switch offerings.

This has been Cisco's strategy since the inception of the Cisco Catalyst switching platform, and Huawei's decision to design its own custom silicon, while still a long way behind Cisco in terms of capability and maturity, nonetheless endorses that.

The net result of Huawei's effort has been their Ethernet Network Processor (ENP), which has been used in their X1E series line cards for the S12700/S9700/S7700 chassis switches and the S5720-HI fixed switch. The second generation of this network processor (ENP 2.0) has been used in the X2S/X2E/X2H line cards in their chassis switches.

The Huawei ENP still lags behind Cisco's custom switching silicon: the Unified Access Data Plane, or UADP, processor.

Huawei has used the ENP to develop their Super Virtual Fabric (SVF): a converged wired/wireless solution that scales to over 6000 satellite switches and AP nodes, or at least that's Huawei's marketing claim. In reality, and by their own admission, this "fabric" scales to no more than 1000 switches and AP nodes, and when DTLS (CAPWAP) encryption is enabled between the SVF parent and satellites, the scale plummets to less than 100 nodes on the S12700 and less than 50 nodes on the S7700 and S5720-HI switches. This limitation applies equally when the Huawei ENP-enabled switches are just being used as WLAN controllers, without the SVF functionality.

The Cisco UADP ASIC was designed with encryption in mind, and is equipped with embedded co-processors or microengines to help ensure that encrypted traffic can be supported at the same performance and scale as nonencrypted traffic.

While Huawei has embarked down the custom silicon path with their latest switching platforms, they still lag behind in terms of innovation, lacking what are now "tablestakes" features such as:

- 256-bit MACsec
- 90W PoE/PoE++/IEEE 802.3bt
- NBASE-T or IEEE 802.3bz
- High-speed and flexible stacking

How Cisco Catalyst 9000 Series wins against Huawei's Agile Switches and Super Virtual Fabric

- The Cisco Catalyst 9000 Series is built to see you through the next decade. Built on the foundation of the UADP 2.0 ASIC, the Cisco Catalyst 9000 Series switches provide a programmable pipeline and flexible hardware tables for future innovation and scale. The Cisco Catalyst 9000 Series promotes standards leadership for IEEE 802.3bz Density (mGig), 802.11ax Optimized (5G), and 802.3bt Scale (60/100W).
- Huawei still lags well behind Cisco's functionality with their custom ENP silicon, lacking key capabilities such as encryption, NetFlow, and high-performance stacking.
- Huawei's access switch portfolio is still predominantly based on merchant silicon, lacking any true innovation and investment protection. Their premium, ENP-based platforms still lack functionality such as UPoE, mGig, and 256-bit MACsec.
- Huawei's product portfolio is an eclectic mix of platforms that lacks basic uplink modules, power supply and stacking compatibility, and architectural consistency.
- Huawei offers limited traffic visibility with only sFlow support on most, and NetStream on some of their campus-switching portfolio. With either option, visibility is limited, leading to false positives and a blurred view of behavior and attacks from within.

Huawei ENP	Cisco UADP
• Claimed to be programmable via microcode • Support for POF • No encryption co-processors • Initial switching capacity of 80 Gig… Enhanced to 320 Gig with ENP 2.0 • No stacking interface* • NetStream only (sampled) • Reduced buffering with ENP 2.0	• Microcode programmable pipeline with Flexparser • 240-Gbps stacking interface integrated in the ASIC • On-chip microengines (frag, reassembly, encryption) • High-performance recirculation path • Integrated on-chip NetFlow (line rate)

Huawei weaknesses

- Large portfolio – lack of consistency and (hardware) interoperability: e.g., modules/PSUs, stacking
- Non-Chinese documentation and support
- Lack of innovation
- Lack of key enterprise functionality

Juniper

Juniper continues to present its EX Series of merchant-silicon based switches for the campus, and its QFX line of switches for the data center. In recent years, the EX series has been neglected, as the company focuses more in data center infrastructure. Moreover, the company has failed to solidify a partnership or presence in the wireless space in recent years.

Juniper's switching value proposition continues to be based on its Virtual Chassis technology, attempting to centralize both management and control plane of switches. The full campus solution can be managed via their traditional network management platform called Junos Space Network Director. However, there are significant gaps in increased efficiencies and future proofing of the network.

Juniper campus switches do not support the latest Power over Ethernet standards like UPoE, or multirate ports (e.g., mGig). Moreover, security is provided as an over-the-top solution via Juniper's security products, yet not integrated into the fabric. Capabilities like line-rate flexible NetFlow, for the use case of network-as-a-sensor, are not present given Juniper has only sampled sFlow.

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Because Juniper has embarked down the merchant silicon path with their switching platforms, they lag behind in innovation, lacking what are now "table-stakes" features such as:

- 256-bit MACsec
- 90W PoE/PoE++/IEEE 802.3bt
- NBASE-T or IEEE 802.3bz
- High-speed and flexible stacking

And also hampers their ability to extend the life of their products to offer a low long term TCO.

How Cisco Catalyst 9000 Series wins against Juniper EX Series

- The Cisco Catalyst 9000 Series is built to see you through the next decade. Built on the foundation of the UADP 2.0 ASIC, the Cisco Catalyst 9000 Series switches provide a programmable pipeline and flexible hardware tables for future innovation and scale. The Cisco Catalyst 9000 Series promotes standards leadership for IEEE 802.3bz Density (mGig), 802.11ax Optimized (5G), and 802.3bt Scale (60/100W).
- Juniper switches lack functionality for the future: No support for mGig or even UPoE. No more than 30W across the portfolio.
- Lack of modular campus switch for the closet. EX6200 discontinued.
- Poor-man's visibility with sFlow-only support across their campus switching portfolio. With sFlow-only support, network operations are subject to false alarms, blurred analysis, and missed packets, leaving the network vulnerable and exposed to advanced threats within the network perimeter.

Juniper weaknesses

- Lack of innovations and investment in switching
- More data center infrastructure–specific focus than what matter to the enterprise
- Lack of integrated security features such as NaaS/NaaE and policy insertion
- Lack of full architecture view for the campus: no wireless solution, isolated over-the-top security offers only