

Converging Campus Networks

Comparison of Aruba Networks®, Cisco®, HP® and Ruckus Wireless® Solutions

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Executive summary

This Porter Consulting report analyzes enterprise campus networking solutions from Aruba Networks, Cisco, HP and Ruckus Wireless. The paper examines key business and technology trends affecting enterprises with 500-5000 employees. We identify fundamental requirements IT decision makers should consider when evaluating campus networking solutions including:

- Ensuring simple, secure and cost-effective user access
- Supplying adequate bandwidth and quality of service
- Streamlining deployment and operations
- Supporting emerging standards and technology requirements

Each vendor's solution portfolio is evaluated using public data gathered from vendor websites, marketing materials and product documentation. Portfolio elements examined include:

- Wireless LAN controllers and access points
- L2/L3 switches
- Integrated wired/wireless access solutions
- Network and system management applications
- Licensing strategies, professional services, and global support, distribution and warranty
- Support for open solutions and emerging standards

Our goal is to provide business and technical decision makers with a guide to the key players and their strengths. The campus network refresh brought on by mobility and the cloud is forcing organizations to take a fresh look at architectures and vendor assumptions. Porter believes IT organizations can best address emerging business and technical requirements by implementing converged campus networks that eliminate cost and complexity. By consolidating infrastructure and unifying management, **converged campus networks** help enterprises reduce TCO and accelerate the pace of innovation.

Each vendor's campus networking portfolio is analyzed and scored using clearly defined evaluation criteria. Table 1 summarizes the evaluation results. Generally speaking, Aruba and Ruckus focus on WLAN access solutions, while Cisco and HP offer more extensive product portfolios that include integrated wired and wireless LAN access platforms, campus switches and unified management. Cisco tends to promote a single-vendor solution. HP offers a more open portfolio with multivendor management and support for open standards like OpenFlow for emerging SDN architectures.

Table 1: Summary Scorecard

				
Overall	●	◐	◑	◒
Ensuring simple & secure access to resources	●	◐	◑	◒
Supplying adequate bandwidth & QoS	◐	◐	◑	◒
Streamlining deployment & operations	●	◐	◑	○
Global consulting & support services; warranty & licensing	●	◐	◑	◒
Supporting emerging SDN standards	●	◐	◑	◒
Expertise & value to business	●	◐	◑	◒

After considering each vendor's ability to deliver as well as its alignment with customer requirements, Porter believes HP offers the best fit for enterprises with 500-5000 employees (See Table 2).

Table 2: Porter Market View



Why focus on converged campus networks?

Rapid advancements in technology—the explosion of mobile devices, the advent of cloud-based services and the adoption of unified communications solutions—are profoundly impacting campus networking decision makers. In today's difficult economic climate, IT organizations are challenged to keep pace with innovation. Porter believes enterprise IT planners should pursue converged campus networking solutions to contain TCO and accelerate new technology rollouts and network expansions. Converged networks reduce cost and complexity by consolidating equipment, unifying administration systems and practices, and eliminating overhead and inefficiencies. Best-of-breed solutions support industry standards and multivendor management to enable the graceful adoption of new technologies.

Converged campus network attributes

The key attributes of a converged campus networking solution include:

- **Unified networking product family**—a cohesive portfolio of L2/L3 campus access, distribution and core switches that support industry standards and common administration
- **Integrated wired/wireless LAN controllers**—a unified controller family that supports flexible deployment options including integrated wired/wireless LAN controllers as well as overlay wireless controllers that deliver unified policy across wired and wireless networks
- **Integral intrusion detection/prevention capabilities**—integrated security to protect the network and safeguard enterprise assets
- **Common access control systems**—a unified administrative system for onboarding users and instituting consistent authentication and authorization policies across wired and wireless domains
- **Unified multivendor management**—single pane-of-glass fault, configuration, accounting, performance and security (FCAPS) management for all network elements

Converged campus network benefits

The key benefits of a converged campus networking solution include:

- **Lower operating expenses**—common operating systems and unified administration and management solutions streamline ongoing operations
- **Better user experiences and improved worker productivity**—unified access control systems and integrated controllers ensure consistent user experiences (security credentials, access rights, QoS profiles) across wired and wireless domains
- **Risk mitigation**—integral intrusion detection and prevention capabilities reduce vulnerabilities and contain security threats
- **Straightforward technology adoption**—multivendor management platforms and standards-based network elements prevent disruptive and costly “rip-and-replace” network upgrades
- **Lower equipment costs**—integrated wired/wireless controllers reduce upfront capital expenditures for expansions and refreshes

Typical converged campus networking customer profile

This Porter Consulting report examines campus networking products aimed at enterprises with 500-5000 employees. The organizations covered span industries and geographies, and include unilingual and multinational companies. The products discussed might be deployed in a single site or scattered across a number of geographically distributed campuses. While the report focuses on campus networking products, it is important to note that most enterprises will also leverage datacenter networking and branch office networking solutions. Campus networking products that adhere to industry standards and support end-to-end security and multivendor management can deliver consistent user experiences, seamless interoperability and unified operations across the entire extended enterprise.

Current environment

A typical enterprise employs a mix of wired and wireless access solutions and campus L2/L3 core and distribution switches. Many IT organizations must cope with siloed, multivendor network architectures. It is not unusual for an enterprise to standardize on one vendor for wired infrastructure and a second vendor for wireless infrastructure. As a result, many network operations teams rely on multiple independent management solutions to onboard users, monitor services and troubleshoot problems.

Challenges

Mobility and cloud-based services are transforming IT and represent two of the biggest networking investment drivers for 2015. Most existing campus networks are optimized for wired PCs and conventional client-server applications. The influx of smartphones, tablets and multimedia communications applications and the advent of cloud-based services pose a variety of traffic management and network engineering challenges. IT organizations must upgrade WLAN infrastructure to support skyrocketing mobile traffic, re-design campus networks to enable cloud connectivity, and implement QoS measures to ensure high service quality for delay-sensitive voice, video and collaboration traffic. And IT organizations must expand security systems and practices to safeguard IT assets and protect confidential data as predominantly closed/wired networks transition to more open, mobile oriented, cloud-centric systems.

Many IT teams lack the funding and expertise to keep pace with innovation. Technology is constantly evolving and today's IT executives are hampered by flat budgets and high attrition rates. Worse still, disjointed campus network architectures—-independent wired and wireless access solutions and administrative systems—often stand in the way of progress. Introducing a new solution into the mix—regardless of vendor—can be a drawn out process requiring extensive interoperability testing and integration work. Troubleshooting problems and administering users, policies and services across vendors and technologies can be a manually intensive and error-prone proposition.

Investment strategies

Tasked with doing more with less, many IT planners are looking to consolidate operations and bring in outside expertise. Porter believes multivendor network-wide management platforms can help accelerate new technology initiatives, streamline onboarding and eliminate ongoing administrative cost and complexity.

With a unified management system in place IT organizations can gradually introduce new vendors and technologies—refresh WLAN infrastructure, rollout a new UC solution, or migrate applications to the cloud—while largely preserving existing administrative practices. This approach enables more flexible investment strategies. Rather than instituting wholesale network upgrades, IT planners can evolve portions of the network over time to satisfy evolving business requirements and align technology improvements with available financial resources.

Many IT executives are also turning to external professional services organizations to assist with strategic analysis and planning. And many are employing third-party network monitoring and management services to augment overstretched network operations teams. When evaluating networking solutions it is important to consider the vendor's ability to deliver in these areas.

Macro business and technology trends

Enterprise IT organizations must evolve campus networking infrastructure to meet the increased price-performance, reliability and security demands of today's cloud first, mobile-first workplace. A variety of business and technology trends are impacting networking planners and driving requirements for converged campus networks.

Business usage trends

- **Proliferation of mobile devices**—smartphones and tablets are overwhelming campus wireless networks. Many enterprises still rely on legacy 802.11 a/b/g networks designed for an era of occasional or light-weight wireless access. IT organizations must upgrade campus wireless infrastructure to support ever-expanding performance, capacity and resiliency requirements.
- **Advent of cloud-based services**—many enterprises are migrating applications to the cloud to contain costs and boost business agility. Cloud-based services fundamentally reshape enterprise traffic flows. IT planners must re-engineer campus networks to support new traffic patterns.
- **Unified communications and collaboration**—many enterprises are introducing unified communications (UC) solutions such as Microsoft® Lync® to improve collaboration and productivity. Most existing campus networks were designed to support conventional client/server applications. High capacity, low-latency connectivity is required to support bandwidth intensive, delay sensitive, real-time IP communications traffic.
- **Location-based services**—industries like retail are looking to location-based services to monetize assets, drive revenue and improve business intelligence. IT planners must introduce intelligent next-generation WLAN controllers that offer built-in location technologies to support these location-aware applications.

Technology trends

- **802.11ac and Wave 2 rollouts**—businesses are taking advantage of the latest wireless technologies to improve Wi-Fi coverage and performance. Next-generation 802.11ac and emerging 802.11ac Wave 2 access points (APs) can help address the influx of smartphones, tablets, and bandwidth-hungry apps. Enterprises may need to expand campus backbone capacity to support increased WLAN traffic.
- **Consumerization of IT**—cloud-based applications and services purchased tactically at the business unit or departmental level are creating traffic management and service quality challenges for IT administrators. Better network monitoring, analysis and security tools are required to manage and control unsanctioned applications.
- **IPv6 and the Internet of Things**—enterprises are slowly but surely making the move to IPv6. The Internet of Things (IoT) will consume address space and continue to drive IPv6 adoption. Many IT groups are leveraging outside consultative services to ease the IPv6 transition. IoT will also consume bandwidth and drive 802.11ac adoption and campus backbone capacity expansions in 2015 and beyond.
- **Move to SDN and more intelligent networks**—following the lead of communications service providers, forward-looking enterprises are evaluating software-defined networking (SDN) to increase service agility and accelerate the pace of innovation. IT planners must identify OpenFlow-compliant network elements and controllers to support emerging standards-based SDN architectures.

Financial trends

- **Under investment during economic downturn**—the global recession took a toll on IT. Many enterprises delayed critical network build-outs and upgrades and are now suffering the consequences. Aging campus networks can't meet ever-increasing performance and resiliency demands imposed by mobile devices, UC and the cloud.
- **Ongoing budget constraints**—many organizations are hampered by limited IT resources and challenged by competing priorities and initiatives. Even with the economy improving in some parts of the world, many businesses face flat budgets for 2015 and many IT organizations are under pressure to do more with less.

Operations trends

- **Need for simplification**—networking is becoming increasingly complex. Supporting multiple vendors, technologies and management systems is costly, inefficient and time-consuming. Many IT organizations are looking to consolidate network operations and unify network administration to eliminate cost and complexity, accelerate the pace of innovation and improve end-user and customer satisfaction.
- **Increasing security threats**—security threats from both inside and outside the campus network continue to grow both in terms of frequency and complexity. Extending consistent security policies and access controls across wired and wireless networks is a challenge for many IT organizations. Many simply open up guest networks for employees, exposing the business to security risks.

Converged campus networking solution evaluation model

Porter reviewed the enterprise campus networking portfolios of Aruba Networks, Cisco, HP and Ruckus Wireless to help enterprise IT decision makers understand the strengths and weaknesses of each vendor's offering. Some businesses are making calculated short-term decisions to upgrade WLAN infrastructure to support skyrocketing tablet and smartphone traffic. To that end, we evaluated popular wireless vendors such as Aruba and Ruckus, as well as leading end-to-end networking portfolio vendors such as Cisco and HP. This approach allows customers to compare tactical and strategic investment options.

We established a set of evaluation criteria based on the aforementioned business and technology trends. In particular, we examined the ability of each vendor to address emerging campus networking price-performance, resiliency, security and manageability requirements by:

- Ensuring simple, secure, and cost-effective user access
- Supplying adequate bandwidth and quality of service
- Streamlining deployment and operations
- Supporting emerging standards and technology requirements
- Expertise and value to business

We evaluated each vendor's entire converged campus product portfolio including:

- Wireless LAN controllers and access points
- L2/L3 campus access, distribution and core switches
- Integrated wired/wireless access solutions
- Network and system management applications
- Intrusion detection/intrusion prevention systems

Using public data gathered from vendor websites, marketing materials and product documentation, we examined the breadth and depth of each vendor's portfolio, as well as vendor licensing strategies, product warranties and global distribution and support capabilities. We also evaluated each vendor's professional services capabilities and their demonstrated commitment to openness and industry standards. We assigned scores to each portfolio element and calculated a total score for each vendor. Table 3 summarizes evaluation criteria for each portfolio area.

Scoring system

- 5 – Best in class, clearly exceeds other competitive offerings currently available
- 4 – Exceeds, in some aspects, the other competitive products
- 3 – Can achieve expected results
- 2 – Meets expectations with some deficiencies
- 1 – Does not meet expectations or is not part of vendor's offering

Table 3: Evaluation criteria

Category	Criteria
Ensuring simple, secure, cost-effective user access	
Unified wired / wireless access	Integrated portfolio of wired and wireless networking products with common management for ultimate TCO. Simplifies authentication and authorization policy management for network administrators. Enables seamless connectivity and consistent experiences across the enterprise for end-users.
Network security	Real-time threat detection and prevention to mitigate endpoint-based security risks. Includes identity-based access and secure on-boarding, provisioning and monitoring of mobile devices.
Supplying adequate bandwidth and quality of service	
Wireless LAN controllers	Highly scalable and reliable 802.11n/ac WLAN controllers to accommodate skyrocketing smartphone and tablet growth. Client load balancing, RF optimization and interference mitigation capabilities to improve capacity and coverage. Best-of-breed WLAN controllers support centralized and distributed forwarding architectures for ultimate flexibility, integral Ethernet switching functions for better economics and advanced capabilities like location-awareness to enable emerging roaming-oriented applications.
Wireless LAN access points	Range of high-performance 802.11n/ac APs with advanced radio resource management, MIMO (multiple input multiple output), channel bonding, beamforming and band steering capabilities to improve coverage, reliability and capacity. Best-of-breed APs provide integral intrusion detection/prevention systems (IDS/IPS) support for better economics and advanced QoS capabilities to ensure high service quality for VoIP and IP video.
L2/L3 switches	Range of high-performance 10/40/100GbE switches for campus access and backbone networks. Support for a wide range of standards-based layer 2 switching protocols and layer 2.5/3 routing protocols as well as standards-based QoS and security capabilities. Best-of-breed platforms support high availability capabilities including fully redundant components, hot-swappable modules and in-service software upgrades.
Streamlining deployment and operations	
Integrated management across all aspects of network	Single pane-of-glass fault, configuration, accounting, performance and security (FCAPS) management for all network elements, services and users. Best-of-breed management solutions support modular architectures for ultimate flexibility and scalability, and support multivendor management to eliminate operations expense and complexity.
Unified control across wired and wireless networks with SDN	Uniform management across wired and wireless domains. SDN-based network architecture with distinct application, control and data forwarding planes.
Global consulting and support services; warranty and licensing	Vendor offers extensive product warranty coverage, flexible software maintenance and upgrade policies, and global product support services. Best-of-breed vendors avoid software-based licensing schemes (i.e. imposing right-to-use (RTU) software license fees for hot/cold standby components) and deliver lifetime product warranties with no-cost software upgrades. Best-of-breed vendors also offer a range of global professional services to assist with network planning and implementation (i.e. IPv6 adoption) as well as optional remote network monitoring and management services.
Supporting emerging requirements	
Commitment to new technologies and standards (SDN, OpenFlow etc.)	Vendor demonstrates commitment to openness by supporting emerging industry standards. Best-of-breed vendors have embraced standards-based software-defined networking and offer OpenFlow-compliant network elements and controllers, as well as vendor-supplied and third-party SDN applications.
Expertise and value to business	
Align technology to business	Improves business outcomes by optimizing worker productivity, improving collaboration, containing OPEX and CAPEX and mitigating risks. Includes product considerations as well as support and technology services considerations.
Integrate with existing infrastructure	Standards-based solutions that interoperate with a wide range of network elements, systems (i.e. RADIUS AAA servers) and endpoints. Does the vendor offer a documented, well thought out approach on how to integrate new technologies from both a functional and operational perspective?
Investment protection	Protects and extends previous investments. Avoids forklift upgrades.

Vendor analysis

HP

HP offers a comprehensive converged campus networking product portfolio that includes wired and wireless LAN access platforms, campus switches, and a unified management solution. (HP calls the complete solution HP Converged Campus Network). HP products are covered by extensive product warranties and are backed by a worldwide support organization. HP also offers a wide array of professional services through its global technology consulting services group, as well as optional support services such as remote multivendor network monitoring.

Several portfolio capabilities and philosophies set HP apart from the other vendors examined in this report:

- **Converged wired and wireless solutions**—HP offers a unified wired/wireless campus access solution with integrated hardware and common administration. The converged product portfolio reduces CAPEX and OPEX and simplifies ongoing user onboarding and policy management. The unified portfolio enables consistent user experiences—common security credentials and privileges and uniform service quality—across the wired and wireless campus network as well as the extended enterprise network.
- **Single pane-of-glass multivendor management**—HP’s Intelligent Management Center (IMC) software contains operations expense and complexity by unifying management across vendors and technologies. The solution eliminates “swivel chair” management, streamlines configuration and troubleshooting functions, accelerates service velocity and user provisioning, and improves service quality and user satisfaction. The multivendor platform helps IT organizations improve the operation of heterogeneous networks and avoid disruptive and costly wholesale network upgrades.
- **Strong edge security**—HP offers comprehensive identity management and endpoint security capabilities. HP unified wired/wireless switches and WLAN APs feature integrated intrusion detection and prevention capabilities, pushing security enforcement to the edge of the network, while eliminating the need for special-purpose security appliances. The product portfolio’s unified management capabilities make it easy for administrators to define uniform security policies across wired and wireless domains.
- **Commitment to SDN and OpenFlow**—HP is on the forefront of standards-based software-defined networking. The company offers a software-based OpenFlow-compliant controller (HP Virtual Application Networks SDN Controller), OpenFlow-compliant switches and other network elements, and several SDN applications including a network optimization solution for Microsoft Lync and a security application called Network Protector.
- **Product warranties and software licensing terms**—HP offers generous product warranties and software licensing terms that reduce upfront costs and ongoing operations expenses. While other vendors offer limited lifetime hardware warranties, many HP campus networking products come with a limited lifetime product warranty that includes software fixes and software updates, telephone support and next-business-day advanced hardware replacement. In terms of software licensing, unlike other vendors examined in the report, HP does not charge separately for individual product features, or impose licensing fees based on capacity, nor does HP impose software license fees for standby platforms.
- **Product support and professional services capabilities**—HP offers 7x24 global support and extensive on-line support resources. The company also offers a variety of managed service offerings for customers who wish to outsource certain aspects of network operations. In addition, HP offers a wide range of professional services to assist customers with network design, planning, migration, and implementation tasks.

Table 4: HP scorecard

Category	Comments	Score
Ensuring simple, secure, cost-effective user access		
Unified wired / wireless access	HP offers a tightly integrated portfolio of wired and wireless access solutions with integrated hardware, a single operating system and uniform management. HP's Intelligent Management Console (IMC) software provides single-pane-of-glass multivendor management for all HP wired and wireless networking products including device onboarding, provisioning and monitoring for mobile devices. Onboarding is supported via device identity (device location, time, security health) as well as 802.1x network access. The unified portfolio eliminates cost and administrative complexity and ensures consistent user experiences and seamless connectivity across the enterprise.	5
Network security	HP offers robust identity management and endpoint security functionality. HP unified wired/wireless switches and WLAN APs feature integrated intrusion detection (WIDS) and prevention (WIPS) capabilities, pushing security enforcement to the edge of the network, while eliminating the need for dedicated IDS/IPS appliances. Three distinct IDS/IPS deployment modes are supported to meet diverse customer requirements. Secure identity-based access is simplified through device onboarding and provisioning using IMC.	4
Supplying adequate bandwidth and quality of service		
Wireless LAN controllers	HP unified controllers include the HP 850 Unified Wired-WLAN controller (up to 512 APs), HP 870 Unified Wired-WLAN controller (up to 1536 APs) and the HP 10500/7500 Unified Wired-WLAN controller module (up to 1024 APs). The products support centralized and distributed data forwarding (to minimize choke points at the controller). Comprehensive Radio Resource Management functions adjust AP power, channel and client load as well as airtime fairness for clients. All HP controllers accommodate N+1, N+N and 1+1 high availability configurations with seamless client failover.	4
Wireless LAN access points	HP's 560 802.11 ac Wave1 access point provides high throughput (up to 1.3 Gbps in 5 GHz band) utilizing 3 spatial stream MIMO and 80 MHz channels. Built-in spectral analysis scans both 2 and 5 GHz band for harmful RF interference and mitigates as necessary. The HP 560 is available with internal antennas. The 802.11ac product line also includes cloud managed, wall mount and bridge AP products. 802.11n outdoor APs are available. OpenFlow support is planned for a future release.	3
L2/L3 switches	HP FlexCampus switches (10500 Switch Series and 7500 Switch Series) provide high-performance connectivity for campus core/distribution networks. The 7500 series offers high-density 10/40GbE connectivity while the 10500 series provides high-density 1/10/40/100GbE connectivity with up to 11.52 Tbps switching capacity and up to 13.72 Tbps switching fabric capacity. Both support a full complement of standards-based layer 2 switching protocols and layer 2.5/3 routing protocols as well as standards-based QoS and security capabilities. Both series support high availability features including fully redundant components, hot-swappable modules and in-service software upgrades. The SDN-ready HP 5400R Switch Series provides resiliency and flexibility, scalability, and ease of use at the campus edge. The 5400R supports demanding network features such as hitless failover, power supply and management redundancy, QoS, and security with full L3 features. The switch product line also includes fixed-port models like the HP 2920 Switch Series and HP 3800 Switch Series for right-size deployment.	4
Streamlining deployment and operations		
Integrated management across all aspects of network (single pane of glass, multivendor management)	IMC provides single pane-of-glass full FCAPS management for all aspects of campus networking. The solution supports all HP networking products plus 6000 third-party devices from 220 manufacturers. IMC supports a number of optional modules that simplify campus network management including access policy management tools, WLAN optimization tools and RF planning tools. IMC supports up to 50,000 managed devices.	5
Unified control across wired and wireless networks with SDN	IMC provides unified managed of wired and wireless domains. HP's network architecture is SDN-based with distinct application, control and data forwarding planes.	5

Category	Comments	Score
Global consulting and support services; warranty and licensing	<p>HP offers comprehensive product warranty coverage and global product support capabilities. Of all the vendors examined only HP offers a limited lifetime warranty—including software fixes and updates—across a range of wired and wireless campus networking products.</p> <p>HP's technology services group offers a wide variety of network strategy, planning and deployment services and can assist with technology transitions such as IPv6 migrations. The company also offers environmental support as well as remote network monitoring and management services including the ability to provide first-line support for third-party networking gear. HP also boasts a global network of channel and technology partners.</p>	5
Supporting emerging requirements		
Commitment to new technologies and standards (SDN, OpenFlow etc.)	<p>HP offers a variety of OpenFlow-compliant network elements including OpenFlow-ready APs, plus the software-based Virtual Application Networks (VAN) SDN Controller. The company is shipping several SDN applications including the Net Protector security application and the Network Optimizer for Microsoft Lync. By decomposing the network into distinct data forwarding, control and application layers HP's SDN-based solutions help IT organizations unify and streamline operations.</p>	5
Expertise and value to business		
Align technology to business	<p>HP's strong multivendor management and unified wired/wireless access capabilities reduce TCO and improve IT team productivity. The product line mitigates risks by pushing security to the edge of the network. Network Optimizer for Lync improves worker productivity and collaboration by ensuring high service quality for real-time communications traffic.</p> <p>Extensive support capabilities and consulting services help customers set strategies and improve business outcomes.</p>	5
Integrate w/ existing infrastructure	<p>HP offers standards-based solutions that interoperate with a wide range of network elements, systems, and endpoints. With IMC, businesses can gradually introduce new vendors and technologies to expand capacity or support new business requirements, while preserving existing management systems and practices.</p> <p>HP's multivendor network support services simplify operations for heterogeneous networks.</p>	5
Investment protection	<p>HP's standards-based solutions and IMC multivendor management platform help customers protect and extend previous investments and avoid forklift upgrades. The platform is ideal for simplifying the administration of heterogeneous networks.</p> <p>HP's OpenFlow-enabled components protect new technology investments. HP's extensive product warranties also protect customer investments.</p>	5
HP TOTAL SCORE		55

Cisco

Like HP, Cisco offers an extensive campus networking product portfolio that includes wired and wireless LAN access platforms, campus switches and a unified network management solution. Cisco offers comprehensive global support capabilities through its Technical Assistance Center as well as a wide range of optional professional services and managed service offerings.

The strengths of the Cisco portfolio include:

- **Product portfolio breadth**—Cisco offers a complete end-to-end campus networking product portfolio that includes a wide range of WLAN controllers and access points, and campus LAN core and distribution switches. The widely deployed product family addresses enterprise customers of virtually any size or composition.
- **Software and feature depth**—Cisco IOS® networking software provides extensive L2 switching capabilities and supports a broad set of features and options. IOS provides all the capabilities needed to support a typical enterprise campus network including a wide array of QoS, security, resiliency, and embedded management features.
- **Unified management for all-Cisco networks**—The Cisco Prime™ Infrastructure network management application provides single-pane-of-glass FCAPS management for campus networks composed of Cisco networking equipment. The application simplifies configuration, provisioning, monitoring and troubleshooting across wired and wireless domains reducing administration cost and complexity for homogenous Cisco networks.

- **Vast professional network**—Cisco customers can tap into a worldwide ecosystem of Cisco certified professionals to assist with all aspects of network planning and operations. Across the globe over 500,000 individuals have been trained and certified on Cisco equipment.
- **Product support and professional services capabilities**—Cisco offers extensive on-line support resources as well as round-the-clock TAC staffed by thousands of service engineers across the globe. In addition, the company offers a variety of managed services for customers who wish to outsource certain aspects of network operations. Cisco also offers a variety of professional services to assist customers with design, planning, migration, and implementation tasks.

Table 5: Cisco scorecard

Category	Comments	Score
Ensuring simple, secure, cost-effective user access		
Unified wired / wireless access	<p>Cisco offers an integrated family of premises-based wired and wireless access products. They share a single management platform, Prime, through which all networking functions are managed. Wired and wireless device onboarding requires a separate platform, ISE (identity services engine). Cisco's solution is comprehensive, but not fully integrated, requiring additional servers and appliances to achieve basic functionality.</p> <p>Cisco also offers cloud-managed Meraki wireless solutions. The Meraki solutions are not integrated with the rest of the Cisco product family and don't support unified wired/wireless access.</p>	4
Network security	<p>Cisco supports basic WIDS/WIPS on its Prime management platform. Adaptive WIPS provides more robust intrusion detection against a wider range of threats, but requires a separate Mobility Service Engine (MSE) appliance.</p> <p>Access points support both overlay and time-sliced air monitoring. Secure device onboarding is provided through a separate ISE (identify services engine) component.</p>	3
Supplying adequate bandwidth and quality of service		
Wireless LAN controllers	<p>The Catalyst® 3850 Wired/WLAN switch along with the 8500 controller comprise Cisco's unified controllers. Cisco's product line addresses the needs of small to large enterprises, supporting up to 6000 APs per controller. Data packets from AP's are forwarded centrally through the controller. Local forwarding is also supported for branch offices.</p> <p>Fast Layer 3 roaming and comprehensive radio resource management are supported. Cisco controllers support high availability including stateful failover with SSO (single sign on), for fast controller switchover in case of failure. Location services require an additional MSE appliance.</p>	3
Wireless LAN access points	<p>Cisco's premium 802.11ac access point is the AP3700. It provides high-throughput (up to 1.3 Gbps in 5 GHz band) utilizing 3 spatial stream MIMO and 80 MHz channels with 4 antennas (which increase coverage area for high throughput rates). Spectrum intelligence classifies a wide range of RF interferers in both 2 and 5 GHz bands. A modular slot accommodates an optional third radio (3G cellular radio or air monitoring modules available). The AP2700 model is a cost-effective version of the AP3700, without the modular slot. Both models are available with internal and external antennas. The 802.11ac product line also includes the AP1700 (low-cost enterprise), teleworker and wall-plate products. Highly configurable 802.11ac outdoor access points are also available.</p> <p>Cisco CleanAir technology uses silicon-level intelligence to create a spectrum-aware, self-healing, and self-optimizing wireless network that mitigates the impact of wireless interference and offers performance protection.</p> <p>Cisco also offers the Meraki family of cloud-managed APs.</p>	5

Category	Comments	Score
L2/L3 switches	Cisco Catalyst switches provide high-performance connectivity for campus core/distribution networks. The Catalyst 6500 series offers high-density 10/40GbE connectivity while the Catalyst 6800 series provides high-density 1/10/40/100GbE connectivity with up to 11.4 Tbps switching capacity. Both support a full complement of standards-based layer 2 switching protocols and layer 2.5/3 routing protocols as well as standards-based QoS and security capabilities. Both series support high availability features including redundant components, stateful failover and in-service software upgrades.	4
Streamlining deployment and operations		
Integrated management across all aspects of network (single pane of glass, multivendor management)	Cisco's Prime Infrastructure application provides single pane-of-glass FCAPS management for campus networks composed of Cisco gear. The solution supports wireless management capabilities, including RF management, user access visibility, reporting, and troubleshooting. It also supports network infrastructure lifecycle functions such as discovery, inventory, configuration and image management, and compliance reporting. Prime supports up to 10,000 managed devices. The application offers limited support for third-party devices namely Aruba wireless controllers and access points.	3
Unified control across wired and wireless networks with SDN	Prime provides unified managed of wired and wireless domains for all-Cisco networks. Cisco's network architecture is SDN-like with distinct application, control and data forwarding planes.	4
Global consulting and support services; warranty and licensing	Cisco offers comprehensive product warranty coverage and global product support capabilities. Many Cisco campus products come with a limited lifetime hardware warranty. Software maintenance and subscription services are sold separately. Cisco's professional services arm offers a wide variety of network implementation and planning services and can assist with technology transitions such as IPv6 migrations. The company also offers a variety remote network monitoring and management services for customers seeking to out-task certain aspects of network operations.	4
Supporting emerging requirements		
Commitment to new technologies and standards (SDN, OpenFlow etc.)	Cisco has been slow to fully embrace standards-based software-defined networking. Cisco believes it is advantageous to support multiple application deployment models in addition to the OpenFlow controller/application approach. The company's Cisco Open Network Environment (ONE) architecture supports both standards-based protocols such as OpenFlow and proprietary protocols such as OnePK™ that commit customers to Cisco hardware investments.	3
Expertise and value to business		
Align technology to business	Integrated wired/wired LAN access with unified management for all-Cisco networks reduces TCO and improves IT team productivity. Comprehensive product support and professional services offerings help customers improve business results.	4
Integrate w/ existing infrastructure	Cisco offers standards-based solutions that interoperate with a wide range of network elements, systems and endpoints. Certain aspects of the Cisco solution—such as Cisco's proprietary approach for browser-based mobile authentication—preclude multivendor interoperability.	3
Investment protection	Cisco promotes all-Cisco solutions. Cisco Prime management applications offer limited support for third-party devices, namely Aruba wireless gear. Customers must deploy Cisco throughout the enterprise to fully exploit the portfolio's unified management functions.	3
CISCO TOTAL SCORE		43

Aruba

Unlike HP and Cisco, which offer end-to-end campus networking product portfolios, Aruba is primarily focused on the wireless LAN access market. The company offers WLAN controllers, 802.11n/ac APs (controller-managed and controller-less) and two distinct wireless network management applications—one for managing campus network infrastructure and another for controlling network access. Aruba also offers a wired access switch line for campus wiring closet deployments.

The strengths of the Aruba portfolio include:

- **WLAN product portfolio breadth**—Aruba offers a comprehensive WLAN product portfolio that includes high-performance mobility controllers, purpose-built 802.11ac APs, and WLAN management and access control applications. The Aruba product family delivers all the features and capabilities most enterprises would require to support greenfield all-wireless build-outs.
- **Robust WLAN management capabilities**—Aruba's AirWave® application provides multivendor FCAPS management for campus WLAN infrastructure (as well as limited support for wired infrastructure). The separate ClearPass application provides network access control and policy management for mobile devices/users. The applications accelerate onboarding and streamline operations and troubleshooting functions across the extended campus network.

Special Considerations

- **Wireless focus**—Aruba is primarily focused on wireless access solutions. The company does not offer large-scale campus distribution/core network switches and the company's network management offerings provide limited control over multivendor wired LAN and WAN infrastructure. Unlike HP and Cisco, Aruba does not provide global planning, design, implementation and support services that span all aspects of an enterprise network from the campus to the branch to the data center.

Table 6: Aruba scorecard

Category	Comments	Score
Ensuring simple, secure, cost-effective user access		
Unified wired / wireless access	Aruba is primarily focused on the wireless LAN access market. The company offers two distinct network management applications. AirWave™ provides multivendor FCAPS management for campus WLAN infrastructure (as well as limited support for wired infrastructure). The separate ClearPass application provides multivendor network access control and policy management for mobile devices/users.	3
Network security	Aruba's WIDS/WIPS enables robust security enforcement at the edge of the network, including rogue mitigation and overlay or time-sliced air monitoring. A separate software module, RFProtect®, on the controller, enables configuration and enforcement of network/security policies. ClearPass provides secure device onboarding and provisioning.	4
Supplying adequate bandwidth and quality of service		
Wireless LAN controllers	The Aruba 7200 series controllers (three flavors available) provide standalone wireless control for the enterprise, supporting up to 2048 access points. Centralized data packet forwarding through the controller is the primary configuration, although distributed forwarding is also supported. Fast (sub 50 msec) Layer 3 roaming and Client Match ensures robust roaming performance. A comprehensive suite of radio resource management features is provided as well as a wide range of high availability configurations. Both Wi-Fi and Aruba beacon location services are supported by Aruba's Meridian cloud platform.	4
Wireless LAN access points	Aruba's premium 802.11ac indoor access points are the AP224 (internal) and AP225 (external). They can be deployed in instant mode, on-premises with wireless controllers or in the cloud. Both models support high-throughput 3 spatial stream MIMO and 80 MHz channels. Built-in spectral analysis scans both 2 and 5 GHz band for harmful RF interference and mitigates as necessary. The tiered 802.11ac product line includes the AP214/215 and 2 spatial stream AP204/205. An 802.11ac outdoor access point is also offered.	4
L2/L3 switches	Aruba offers the S3500 Mobility Access switch for wired Ethernet access connectivity applications. The platform supports redundant power supplies and modular, hot-swappable components. Aruba does not offer large-scale campus core switches.	2

Category	Comments	Score
Streamlining deployment and operations		
Integrated management across all aspects of network (single pane of glass, multivendor management)	<p>Aruba's AirWave™ provides single-pane-of-glass multivendor management for heterogeneous campus networks. Extensive management capabilities are extended to only a limited set of third-party vendors.</p> <p>The product offers wireless management capabilities including RF heat maps for optimizing coverage and planning capacity. Although WLAN-oriented, the solution does support both wired and wireless networking equipment. Airwave supports up to 100,000 managed devices.</p> <p>Mobile device support (onboarding, access control, policy management, device health checking, etc.) is provided by Aruba ClearPass, which is a separate application.</p>	3
Unified control across wired and wireless networks with SDN	Aruba provides unified management of wired and wireless domains, with limited supported for third-party products. Their network architecture is not SDN-based.	2
Global consulting and support services; warranty and licensing	<p>Aruba offers comprehensive product warranty coverage and product support capabilities. Many Aruba products come with a limited lifetime hardware warranty. Software maintenance and subscription services are sold separately.</p> <p>Aruba's professional services offerings are more modest than those of HP and Cisco, and tend to focus on WLAN design and implementation services. Aruba does not provide managed service offerings for customers wishing to outsource network operations.</p>	3
Supporting emerging requirements		
Commitment to new technologies and standards (SDN, OpenFlow etc.)	<p>Aruba's WLAN solutions are based on industry standards and Aruba regularly performs Wi-Fi interoperability tests against a variety of third-party endpoints and network elements.</p> <p>Aruba's Mobile Virtual Enterprise (MOVE) WLAN architecture is not based on an SDN model and does not currently support OpenFlow. Aruba AirWave and AppRF™ applications do leverage Microsoft Lync's SDN APIs to collect real-time voice/video service quality metrics and configure QoS parameters in real-time to optimize voice and video service quality.</p>	3
Expertise and value to business		
Align technology to business	Aruba's multivendor management capabilities improves IT team productivity. Aruba's strong edge security features help customers mitigate risks. AirWave and AppRF integration with Lync improves worker productivity and collaboration.	3
Integrate w/ existing infrastructure	Aruba offers standards-based Wi-Fi solutions that interoperate with a wide range of network elements, systems and endpoints. AirWave provides limited management for multivendor networks.	3
Investment protection	Aruba's standards-based solutions and AirWave multivendor management platform help customers protect and extend previous investments and avoid forklift upgrades; AirWave offers limited management support for wired/WAN infrastructure.	3
ARUBA TOTAL SCORE		37

Ruckus

Ruckus is a pure-play wireless vendor. The company offers WLAN controllers, 802.11.ac APs and three distinct wireless network management applications—one for network planning, one for managing campus network infrastructure and one for analyzing network trends. At one time Ruckus offered an Ethernet switch (ZoneSwitch™), but the company discontinued the product.

The strengths of the Ruckus portfolio include:

- **WLAN product portfolio breadth**—Ruckus offers a comprehensive wireless product portfolio that includes high-performance mobility controllers (ZoneDirector™), purpose-built 802.11n/ac APs (ZoneFlex™), and WLAN management and access control applications. The Ruckus product family delivers all the features and capabilities most enterprises would require to support greenfield all-wireless build-outs.
- **Comprehensive WLAN management capabilities**—Ruckus offers comprehensive management capabilities for all-Ruckus, wireless-only networks. ZonePlanner™ is a complete RF planning tool for Ruckus networks. FlexMaster™ is a feature-rich FCAPS management platform for configuring, monitoring and controlling Ruckus controllers and APs. SmartCell Insight™ is a data analytics tool for analyzing traffic statistics gathered from Ruckus network elements.

Special Considerations

- **Wireless focus**—Ruckus focuses exclusively on wireless access solutions. The company does not offer L2/L3 switches and the company's network management applications only support Ruckus devices and only manage wireless networks. Unlike HP and Cisco, Ruckus does not provide global planning, design, implementation and support services that span all aspects of an enterprise network from the campus to the branch to the data center.

Table 7: Ruckus scorecard

Category	Comments	Score
Ensuring simple, secure, cost-effective user access		
Unified wired / wireless access	Ruckus is a pure play Wi-Fi vendor with no wired infrastructure or centralized policy management products.	1
Network security	Ruckus provides only limited WIDS capability. Mitigation requires manual intervention from an administrator, once an intruder is detected. Ruckus' approach to secure onboarding and provisioning new wireless devices utilize Dynamic Pre-Shared Keys (DPSK). Each key is paired with a specific device to be managed and monitored. This approach has limitations and can be complex to manage.	2
Supplying adequate bandwidth and quality of service		
Wireless LAN controllers	Ruckus does not offer a unified wired/wireless controller. Its ZoneDirector series of standalone controllers consist of several models, supporting up to 1000 access points. Data forwarding in a Ruckus WLAN is distributed; centralized data forwarding is not supported. Fast layer 3 roaming is only possible within a single controller. A limited set of redundancy modes are provided. SPoT, Smart Positioning Technology is the Ruckus cloud-based location service.	2
Wireless LAN access points	Ruckus provides a high degree of product differentiation with their ZoneFlex access points underpinned by patented Beamflex technology. Beamflex is a beamforming technique based on an array of directional antennas, steered to individual clients to optimize signal strength and downstream data rate. This improvement results in a larger coverage for the AP, less dense AP deployments and cost savings. The R700, Ruckus' premium 802.11ac access point, supports high-throughput 3 spatial stream MIMO and 80 MHz channels. Ruckus utilizes Channel Fly to choose the optimal channel for the AP. A 2 spatial stream model cost effective model is also offered and only internal antenna options are available. A broad range of 802.11ac and 802.11n outdoor products are offered.	4
L2/L3 switches	Ruckus does not offer L2/L3 switches.	1
Streamlining deployment and operations		
Integrated management across all aspects of network (single pane of glass, multivendor management)	Ruckus does not offer multivendor management. Ruckus offers distinct (unintegrated) management applications. Ruckus customers must use distinct tools to manage their wired and wireless infrastructure, and use several different tools to fully manage their Ruckus devices.	1

Category	Comments	Score
Unified control across wired and wireless networks with SDN	Ruckus does not provide unified management of wired and wireless domains.	1
Global consulting and support services; warranty and licensing	Ruckus offers comprehensive product warranty coverage and product support capabilities. Most Ruckus products come with a limited lifetime hardware warranty. Ruckus does not charge separate licensing fees for individual features. Ruckus's professional services offerings are more modest than those of HP and Cisco, and tend to focus on WLAN design and implementation services. Ruckus does not provide managed service offerings for customers wishing to outsource network operations.	3
Supporting emerging requirements		
Commitment to new technologies and standards (SDN, OpenFlow etc.)	Ruckus WLAN solutions are based on industry standards and Ruckus regularly performs Wi-Fi interoperability tests against a variety of third-party endpoints and network elements. Ruckus has not announced an SDN strategy for the enterprise market.	3
Expertise and value to business		
Align technology to business	Ruckus has a niche product offering focused on wireless access.	1
Integrate w/ existing infrastructure	Ruckus offers standards-based Wi-Fi solutions that interoperate with a wide range of network elements, systems and endpoints. Lack of multivendor management capabilities preclude preservation of existing administrative systems and practices.	2
Investment protection	Ruckus' standards-based solutions interoperate with existing network infrastructure. Because Ruckus does not offer a multivendor management solution Ruckus customers are forced to use a collection of disparate administrative interfaces to oversee the extended enterprise network.	3
RUCKUS TOTAL SCORE		24

Conclusion

Of the four vendors analyzed in this report, Cisco and HP by far offer the broadest converged campus networking portfolios. Both offer a wide range of campus networking solutions including integrated wired/wireless access products, L2/L3 core and distribution switches and unified management applications. Cisco tends to favor a single-vendor solution, while HP offers a more open portfolio with multivendor management capabilities and a stronger commitment to open standards like OpenFlow. Both vendors also offer a wide range of global distribution, consulting and support capabilities both directly and through vast partnership networks.

Aruba and Ruckus are more narrowly focused on the wireless access market. Both lack the global consulting and support capabilities HP and Cisco can provide. Aruba and Ruckus both offer feature-rich 802.11n/ac access points for new wireless deployments. Aruba also offers a scalable multivendor management solution that improves the administration of mixed networks.

After examining each vendor's product capabilities, commitment to standards and openness, and global consulting and support offerings, Porter believes HP represents the best fit for enterprises with 500-5000 employees (See Table 2).

Table 2: Porter Market View



Addressing mobility and cloud challenges for 2015 and beyond with converged campus networks

Mobility and the cloud introduce a variety of capacity planning and network engineering challenges for IT organizations. IT planners must expand aging campus networks to support bandwidth intensive, delay-sensitive applications, but they need to be smart about their investment choices in today’s challenging economic climate. Enterprises should avoid across-the-board campus network upgrades and pursue vendors that enable flexible migration strategies. By selecting open and standards-based solutions, IT planners can strategically upgrade portions of the network over time to address emerging business requirements, using the best vendor for a particular technology segment.

Porter believes HP offers a number of unique capabilities to help IT organizations keep pace with innovation and improve business results, while containing costs, including:

- **Unified multivendor management**—HP’s IMC management platform reduces OPEX and accelerates provisioning and troubleshooting by unifying management across the entire heterogeneous enterprise network. With IMC, businesses can gradually introduce new vendors and technologies to expand capacity or support new business requirements, while preserving existing management systems and practices.
- **Unified wired/wireless access**—HP’s integrated wired and wireless access solutions with unified management reduce CAPEX and OPEX while ensuring seamless connectivity and consistent user experiences across the entire enterprise.
- **Integral edge security**—HP switches and APs support integrated IDS/IPS, pushing enforcement to the edge of the network, ensuring end-to-end security. The capabilities reduce TCO by eliminating the need for dedicated security appliances.
- **Strong OpenFlow and SDN support**—HP’s OpenFlow-compliant controller, network elements and SDN applications help futureproof new technology investments while enabling more agile, programmable and extensible networks.
- **Generous product warranties**—many HP campus networking products are backed by a limited lifetime product warranty that includes software fixes and software updates, telephone support and next-business-day advanced hardware replacement. HP’s extensive product warranties reduce OPEX and provide greater investment protection.

- **Favorable software licensing terms**—HP does not charge separately for individual product features, impose licensing fees based on capacity, or impose RTU fees for optional components or capabilities. HP’s favorable licensing terms can significantly reduce TCO for campus network expansions and refreshes.
- **Global support and professional services**—HP offers a wide range of technical support services, consulting services and managed services including the ability to monitor and support multivendor networks on the customer’s behalf.

Table 8: Converged campus networking scorecard summary

Criteria	HP	Cisco	Aruba	Ruckus	Comments
Ensuring simple, secure, cost-effective user access					
Unified wired / wireless access	5	4	3	1	HP and Cisco both offer unified wired/wireless access solutions. HP gets the nod because their product portfolio is more tightly integrated than Cisco’s.
Network security	4	3	4	2	HP and Aruba receive the highest marks with their strong edge security capabilities.
Supplying adequate bandwidth and quality of service					
Wireless LAN controllers	4	3	4	2	Only HP and Aruba can combine centralized and distributed forwarding.
Wireless LAN access points	3	5	4	4	Cisco offers the most complete AP family
L2/L3 switches	4	4	2	1	HP and Cisco both offer a wide range of high-performance L2/L3 switches. Aruba offers a limited set of L2/L3 switches.
Streamlining deployment and operations					
Integrated management across all aspects of network (single pane of glass, multivendor management)	5	3	3	1	HP IMC is the clear leader with unified management across the entire extended enterprise (LAN, WLAN, WAN) and extensive support for 6000 third-party devices.
Unified control across wired and wireless networks with SDN	5	4	2	1	Both HP and Cisco offer unified management across wired and wireless domains, leveraging an SDN-based network architecture with distinct application, control and data forwarding planes.
Global consulting and support services; warranty and licensing	5	4	3	3	HP and Cisco are the leaders in this category with global support and professional services capabilities. HP gets the nod because of a superior lifetime warranty that includes software, as well as more favorable software licensing terms that avoid RTU fees.
Supporting emerging requirements					
Commitment to new technologies and standards (SDN, OpenFlow etc.)	5	3	3	3	HP is the leader in the category. The company is on the forefront of standards-based software-defined networking and offers an OpenFlow-compliant controller, OpenFlow-compliant network elements and several SDN applications.
Expertise and value to business					
Align technology to business	5	4	3	1	HP solutions and services improve business outcomes by enhancing productivity while reducing costs and risks.
Integrate w/ existing infrastructure	5	3	3	2	HP offers standards-based solutions plus multivendor management that preserves existing administrative systems and practices.
Investment protection	5	3	3	3	HP receives the highest score with IMC multivendor management and OpenFlow support.
	HP	Cisco	Aruba	Ruckus	
Total	55	43	37	24	HP receives the highest score.

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