The Forrester Wave™: Open, Programmable Switches For A Businesswide SDN, Q3 2020

The 12 Providers That Matter Most And How They Stack Up

by Andre Kindness
July 28, 2020

Why Read This Report

In our 32-criterion evaluation of open, programmable switching solutions, we identified the 12 most significant ones — Arista Networks, Cisco IOS-XE, Cisco NX-OS, Dell EMC, Extreme Networks, H3C, Huawei, Juniper Networks, NVIDIA Cumulus, NVIDIA Mellanox, Pica8, and Pluribus Networks — and researched, analyzed, and scored them. This report shows how each solution measures up and helps infrastructure and operations (I&O) professionals select the right one for their needs.

Key Takeaways

Arista Networks, Juniper Networks, Huawei, And NVIDIA Cumulus Lead The Pack

Forrester's research uncovered a market in which Arista Networks, Juniper Networks, Huawei, and NVIDIA Cumulus are Leaders; Pluribus Networks, Cisco IOS-XE, and H3C are Strong Performers; Cisco NX-OS, NVIDIA Mellanox, Dell EMC, and Extreme Networks are Contenders; and Pica8 is a Challenger.

Key Differentiators Include A Single OS And Extensible And Programmable Switching

As command-line interface (CLI) technology becomes outdated and less effective, improved open, automated, and programmable switching will dictate which providers lead the pack. Vendors that can provide switching fabric position themselves to successfully deliver a businesswide, standard, extensible, and programmable switching fabric to their customers.

The Forrester Wave™: Open, Programmable Switches For A Businesswide SDN, Q3 2020

The 12 Providers That Matter Most And How They Stack Up

by Andre Kindness
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July 28, 2020

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An Open, Programmable Switching OS Is Key To Your Network

Firms need the flexibility to distribute applications and data across private cloud, public cloud, and edge compute areas.[1] This trend erases the distinction of traditional network segments — campus LAN, data center LAN, or branch office LAN — that defined specific areas for users, applications, and data. A single, businesswide switching fabric will become the de facto architecture, built on Forrester's five tenets of virtual network infrastructure (VNI) to create a businesswide software-defined network (SDN).[2] Although I&O professionals won't find an off-the-shelf solution that meets all five tenets, networking teams are under pressure to create a dynamic, agile network. However, the industry still doesn't quite understand the definition of a next-generation network.[3] Facebook, Google, and Microsoft, for example, have very different open, programmable switching fabrics.[4]

Influenced by these trends, customers looking for open, programmable SDN switches should seek solutions that:

- **Evolve in a linear transition, not a step function, no matter the starting point.** Many organizations want to start automating the network, but there's not a single starting point.[5] Switching solutions must be open and flexible to replace the current equipment at each stage in evolution and be able to evolve in linear fashion over the next five to seven years. Businesses and I&O organizations can't afford step-function changes when it comes to adopting unproven new infrastructure technology; because it takes time to evolve skills, metrics, and processes, they don't fully utilize the value of new technology for up to two years.[6] As a rule, technology adoption happens in baby steps, not big leaps.
- **Standardize operations across hardware and virtual environments.** Don't think of networks as a bunch of physical switches segregated in a data center, campus, cloud, or remote office. A businesswide network interweaves applications, data, and microservices across data centers, cloud platforms, and edge compute locations. I&O pros, orchestration and automation software, and monitoring systems all require virtual and physical switch features and interfaces that are consistent. The one-offs are automation and efficiency killers.
- **Set up with the least amount of risk and the most options.** Network abstraction, rapid developers, coders, and DevOps bring different requirements, goals, and expectations when controlling or leveraging the network resources.[7] Multiple programming languages, modeling approaches, and protocols become an essential ingredient to link networking components. Switching hardware should be open and flexible to allow I&O teams to maximize switching functionality and interface with as many controllers, management systems, and networking services as possible. Many clients tell us that their networking teams aren't ready for all-in-one packages such as Cisco's Application Centric Infrastructure.

Evaluation Summary

The Forrester Wave™ evaluation highlights Leaders, Strong Performers, Contenders, and Challengers. It's an assessment of the top vendors in the market and doesn't represent the entire vendor landscape. You'll find more information about this market in "Now Tech: Virtual Network Infrastructure Switching Fabric, Q2 2020," "Jump-Start Your Network Automation," and "Emerging Technology Spotlight: Businesswide Networking Fabric."

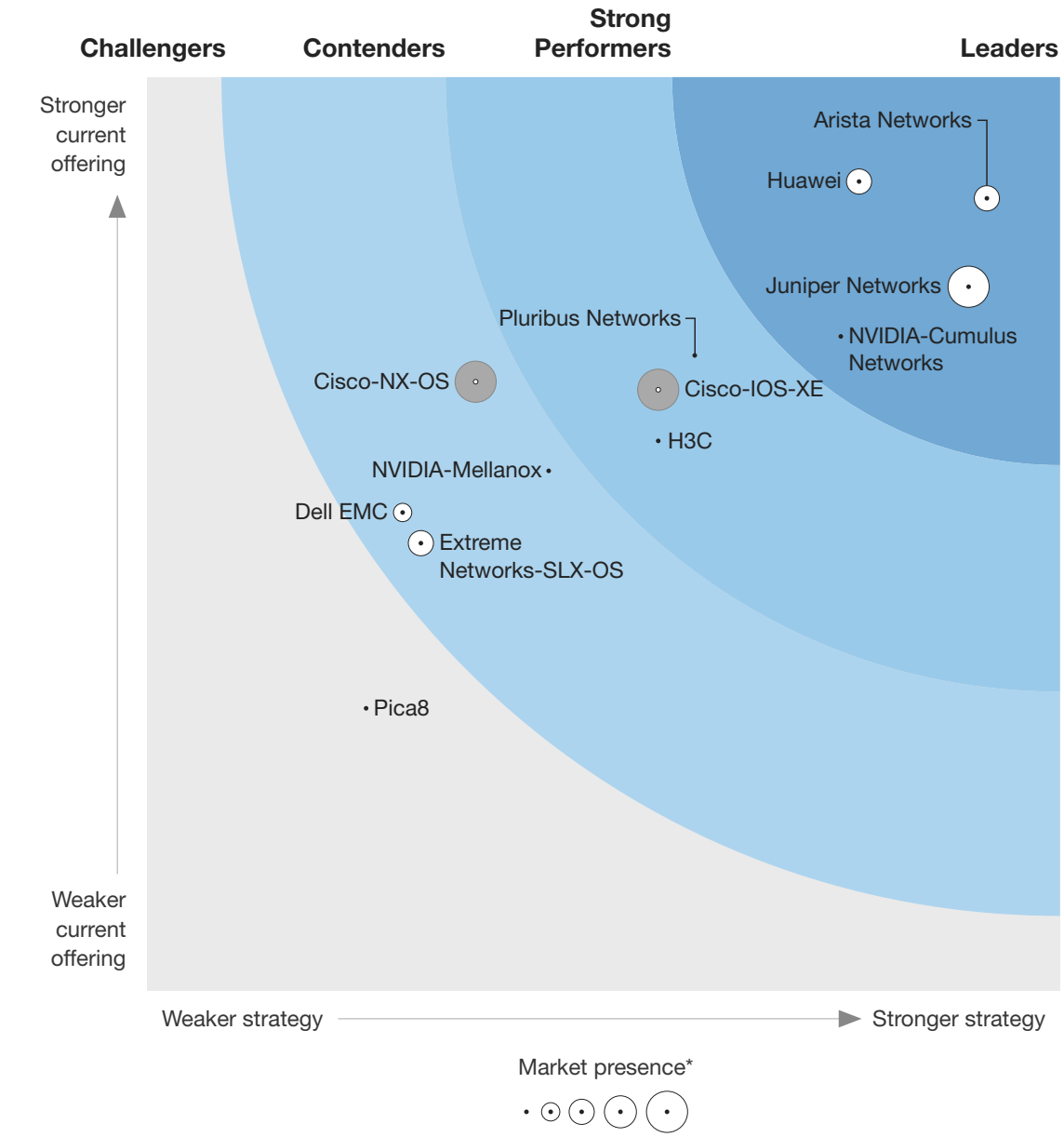
We intend this evaluation to be a starting point only and encourage clients to view product evaluations and adapt criteria weightings using the Excel-based vendor comparison tool (see Figure 1 and see Figure 2). Click the link at the beginning of this report on Forrester.com to download the tool.

FIGURE 1 Forrester Wave™: Open, Programmable Switches For A Businesswide SDN, Q3 2020

THE FORRESTER WAVE™

Open, Programmable Switches For A Businesswide SDN

Q3 2020



*A gray bubble indicates a nonparticipating vendor.

FIGURE 2 Forrester Wave™: Open, Programmable Switches For A Businesswide SDN Scorecard, Q3 2020

	Forrester's weighting	Arista Networks	Cisco IOS-XE*	Cisco NX-OS*	Dell EMC	Extreme Networks	H3C
Current offering	50%	4.34	3.29	3.33	2.62	2.45	3.01
Hardware support	20%	5.00	1.66	1.66	3.66	2.34	3.66
Operating system	20%	3.68	3.68	3.00	2.32	1.00	3.68
Features	20%	4.20	3.40	3.80	1.40	2.60	2.20
OS programmability	20%	3.80	3.20	3.70	2.20	1.80	2.00
Monitoring and visibility	20%	5.00	4.50	4.50	3.50	4.50	3.50
Strategy	50%	4.60	2.80	1.80	1.40	1.50	2.80
Switch hardware and OS strategy	20%	5.00	1.00	1.00	1.00	1.00	3.00
Next-gen networking infrastructure strategy	20%	5.00	3.00	1.00	1.00	1.00	3.00
Businesswide fabric	15%	5.00	3.00	1.00	1.00	1.00	5.00
Automation and programmability strategy	15%	5.00	3.00	1.00	1.00	3.00	3.00
Corporate strategy	5%	5.00	1.00	1.00	1.00	3.00	1.00
Evolution training	10%	3.00	5.00	5.00	1.00	1.00	1.00
Open networking	5%	5.00	1.00	1.00	5.00	3.00	3.00
Key technology partners	10%	3.00	5.00	5.00	3.00	1.00	1.00
Market presence	0%	3.00	5.00	5.00	1.80	3.00	1.00
Installed base	60%	3.00	5.00	5.00	1.00	3.00	1.00
Engineers	20%	3.00	5.00	5.00	3.00	3.00	1.00
Partners	20%	3.00	5.00	5.00	3.00	3.00	1.00

All scores are based on a scale of 0 (weak) to 5 (strong).

*Indicates a nonparticipating vendor

FIGURE 2 Forrester Wave™: Open, Programmable Switches For A Businesswide SDN Scorecard, Q3 2020 (Cont.)

	Forrester's weighting	Huawei	Juniper Networks	NVIDIA Cumulus	NVIDIA Mellanox	Pica8	Pluribus Networks
Current offering	50%	4.43	3.85	3.58	2.84	1.54	3.48
Hardware support	20%	5.00	4.32	3.68	3.66	1.66	4.34
Operating system	20%	4.34	4.34	2.32	0.66	1.66	3.64
Features	20%	4.60	3.40	4.20	3.00	1.80	2.60
OS programmability	20%	4.20	3.70	3.70	3.40	2.60	3.80
Monitoring and visibility	20%	4.00	3.50	4.00	3.50	0.00	3.00
Strategy	50%	3.90	4.50	3.80	2.20	1.20	3.00
Switch hardware and OS strategy	20%	5.00	5.00	5.00	3.00	1.00	3.00
Next-gen networking infrastructure strategy	20%	3.00	3.00	3.00	1.00	1.00	3.00
Businesswide fabric	15%	3.00	5.00	5.00	1.00	1.00	3.00
Automation and programmability strategy	15%	5.00	5.00	5.00	3.00	1.00	5.00
Corporate strategy	5%	1.00	3.00	5.00	1.00	5.00	5.00
Evolution training	10%	5.00	5.00	1.00	1.00	1.00	1.00
Open networking	5%	5.00	5.00	5.00	3.00	1.00	3.00
Key technology partners	10%	3.00	5.00	1.00	5.00	1.00	1.00
Market presence	0%	2.60	5.00	1.00	1.00	1.00	1.00
Installed base	60%	1.00	5.00	1.00	1.00	1.00	1.00
Engineers	20%	5.00	5.00	1.00	1.00	1.00	1.00
Partners	20%	5.00	5.00	1.00	1.00	1.00	1.00

All scores are based on a scale of 0 (weak) to 5 (strong).

Vendor Offerings

Forrester included 12 open, programmable switching solutions in this assessment: Arista Networks, Cisco IOS-XE, Cisco NX-OS, Dell EMC, Extreme Networks, H3C, Huawei, Juniper Networks, NVIDIA Cumulus, NVIDIA Mellanox, Pica8, and Pluribus Networks (see Figure 3). We invited Alcatel Lucent Enterprise to participate in this Forrester Wave, but it chose not to participate, and we couldn't make enough estimates about its capabilities to include it in the assessment as a nonparticipating vendor.

FIGURE 3 Evaluated Vendors And Product Information

Vendor	Product evaluated	Product version evaluated	Version release date
Arista Networks	Arista switches loaded with Extensible Operating System (EOS)	4.23	March 10, 2020
Cisco IOS-XE	Cisco switches loaded with IOS XE	17.1	November 30, 2019
Cisco NX-OS	Cisco switches loaded with NX-OS	13.2	January 26, 2020
Dell EMC	Dell EMC switches loaded with OS 10	10.5	March 6, 2020
Extreme Networks	SLX switches loaded with SLX-OS	20.1.1	March 3, 2020
H3C	H3C switches loaded with Comware	V710	January 19, 2019
Huawei	Huawei switches loaded with V200R019C10	V200R019C10	January 1, 2020
Juniper Networks	Juniper switches loaded with JunOS	20.1	March 3, 2020
NVIDIA Cumulus	Cumulus Linux	4.0	November 19, 2019
NVIDIA Mellanox	Mellanox switches loaded with Onyx	v3.9.0300	March 2, 2020
Pica8	Pica8 switches loaded with PicOS	3.5	October 19, 2019
Pluribus Networks	Pluribus switches loaded with Netvisor ONE Network Operating System	R5.20	March 2, 2020

Vendor Profiles

Our analysis uncovered the following strengths and weaknesses of individual vendors.

Leaders

- **Arista Networks provides an open, programmable switching fabric.** In 10 years, Arista Networks has grown into one of the largest suppliers of data center networking switches in the market and has recently expanded its switching portfolio to include campus and branch offices. The company's growth is due to Arista's EOS Operating System and its focus on delivering an open, programmable switching platform. Tier 1 cloud providers have built their networking infrastructure on this type of platform. Besides enabling customers to choose multiple paths of automation, Arista Networks allows them to deploy EOS on third-party hardware, cloud platforms, and inside containers. This ensures that customers can create a fabric across private data centers, cloud platforms, and edge compute locations.

  Beyond the switches, the company has invested resources in two important areas: monitoring and integration with other tools. Until recently, most of the networking market didn't realize that monitoring data is an essential ingredient to a closed-loop system. Arista Networks recognized the need long ago with the release of its DANZ, LANZ, and telemetry features. In parallel, the company spent time working with hypervisor companies to ensure seamless interactions among the networking, server, and virtual worlds. I&O teams that are looking to start their automation journey or that have a deep programming skill set and are already well on their way should look into Arista Networks.

- **Juniper Networks offers a comprehensive, businesswide networking platform.** Juniper Networks has a strong presence in both the telecommunications industry and enterprise space, with a product portfolio based on a single OS, JunOS. The OS supports switching hardware from the data center to the campus edge and delivers some of the most robust and sophisticated sets of switching and routing features. Its FreeBSD-based operating system is disaggregated and runs on a virtualized Linux environment. To help manage the JunOS infrastructure, the company has cloud-based and onsite management solutions. Juniper Networks developed the Contrail product line for customers needing virtual network functions (VNFs).

  Juniper Networks recognizes that customers need more than technology and products and has developed various resources to educate customers on laying out their automation journey, increased the amount of education classes around programming, and led various open standards efforts to create open networking fabrics. Customers that want to automate the entire network with a consistent OS, from the data center to the business edge, should look to Juniper Networks.

- **Huawei builds an open, programmable approach into the largest switching portfolio.** The fastest-growing networking vendor in our evaluation, Huawei has trimmed its product line down to the CloudEngine series. Huawei positions the CloudEngine family as its main switch series,

designed exclusively for a data center running Huawei's V200R019 CloudEngine OS. The company rebuilt the firmware after VRP v8 to enable support for third-party functions and also rebuilt the Agile management system, now called iMaster NCE, to combine separate Agile modules into a single software package. Huawei has one of the largest data networking portfolios across networking enterprise networking vendors and retains the largest networking market share in China, with a strong presence in Africa, Asia, Europe, and South America.

With a large number of engineers and support staff, the company has been working on new ASICs and advanced monitoring solutions to develop an autonomous driving network, in conjunction with ensuring that the switching platform and operating system support a wide range of tools, hypervisors, and cloud platforms. Reference customers told Forrester that Huawei provides a lot of support deployment and guidance on what the organization should be doing. Firms looking for a vendor with wide global reach and leaning on a deep product portfolio rather than developing their configuration tools should put Huawei on their shortlists.

› **NVIDIA Cumulus brings an app-dev perspective to data center networks.** In 2015, Cumulus Networks entered the networking market with a Linux-based networking OS that customers could load onto whitebox switches from the likes of Delta and Edgecore. I&O professionals can configure and manage the network using Linux commands similar to those they use with servers. In 2016, Cumulus Networks moved away from offering software only to offering its own branded switching hardware, Cumulus Express switches, loaded with its operating system. The company has now ventured into offering solutions for the campus environment.

With Cumulus' heritage in the server and Linux world, customers can expect access to a wide range of scripting and configuration tools. Reference customers indicated that the Cumulus approach makes it easier to accelerate networking automation initiatives, as networking teams can expand how they find staff with extensive automation experience. Cumulus now has its own cloud network management solution, NetQ, that customers can use immediately if the resources aren't ready. Enterprises with copious automation occurring in other areas and with an aim toward a unified software-defined data center (SDDC) should look to Cumulus.[8]

Strong Performers

› **Pluribus Networks simplifies data center networks and injects true multitenancy.** Pluribus Networks entered the market and redefined what customers should get from a single hardware switch by introducing switching hardware that could host multiple instances of virtual switches, similar to server virtual machines (VMs). For example, customers can break a single 24-port switch into multiple switches. Groups of virtual switches across multiple physical devices can be federated as a single underlay and overlay switch fabric within a single site or across geographically distributed sites. This is similar to the hive concept that has appeared in wireless LANs, but without the need for a controller. Customers can issue commands to a single instance of the Pluribus Netvisor ONE Network OS, and it will distribute policies to all the switches, or they can manage the fabric through Pluribus UNUM, a graphical management and analytics platform.

The company offers a few Pluribus Networks-branded hardware switches loaded with Pluribus NOS. In addition, customers can choose to load Netvisor onto third-party ONIE hardware. Pluribus Networks has developed deep integration with fabric-attached VMware ESX server clusters — vCenter integration with "seamless orchestration." Pluribus Networks could be a good fit for lean I&O organizations that need a networking fabric to support a VMWare-centric data center or for organizations looking to create fabrics within private data centers.

- **Cisco IOS-XE injects programmability and automation into the campus.** The largest networking vendor in the space offers wide-ranging networking and other infrastructure solutions across many industries. Cisco's IOS-XE, a modular OS, is the next generation of the company's OS for Catalyst 9000 series switches and some ARS/ISR/CRS routers. Cisco still offers switches on its price list that run the legacy IOS; however, some of those switches, such as Catalyst 3850, support IOS-XE. The company is putting future development into IOS-XE to support the ever-increasing need for advanced services and programmability outside of the data center. IOS-XE offers a robust set of programming interfaces, but many advanced software features are tied to the company's Digital Network Architecture (DNA) and supporting software solutions.

  The company's strategy is to unify campus wired and wireless products as opposed to creating a unified businesswide open, programmable fabric. Customers that want a unified switching fabric will need to do this through the company's management and controller systems for the respective product lines. To help facilitate interactions between system APIs, Cisco has built out DevNet, a networking development community with a dedicated website, support center, and education platform. Enterprises that want a single supplier of networking and adjacent technologies from one vendor should keep Cisco IOS-XE on their shortlist. Cisco declined to participate in the full Forrester Wave evaluation process.

- **H3C continues a strong history of delivering an open, single OS across its portfolio.** This Chinese vendor is owned by two other companies — Hewlett Packard Enterprise (HPE) holds a 49% stake; Unisplendour owns 51%. H3C was once the supplier to HPE's data center networking business. Now, the company focuses on delivering its own networking solutions for the data center, campus, and remote office. All H3C switches run on H3C's Comware v7 modular and multiprocessor firmware. Most H3C sales centers are in China, and the rest are primarily in Asia.

  Comware v7 has a deep set of interfaces and supports multiple configuration management tools that can be used on any part of the network. Reference customers indicated that they tend to lean on H3C's iMC unified network management and automatic configuration software to manage their networks instead of using configuration management tools and scripts. Companies with Asia-based networking infrastructures should evaluate H3C's product lines to fulfill their requirements for a businesswide networking fabric.

Contenders

› **Cisco NX-OS provides a deep and wide range of DC switching capabilities.** Cisco's Nexus operating system and enhanced Cisco NX-OS define its two types of data center networking solutions. NX-OS controls the Nexus 7000, 5000, 4000, 2000, and 1000V series switches. The Nexus 9000 series switches can support either NX-OS or enhanced NX-OS, the latter of which requires Cisco's own Application Policy Infrastructure Controller (APIC). NX-OS has a rich set of APIs and features to support all aspects of data center needs. While the company has a strategy and plans for both OSes, most of its long-term investments center on its proprietary application-centric infrastructure (ACI) architecture, which we didn't review in this Forrester Wave evaluation.

Many Cisco customers told Forrester that they continue to purchase Nexus series switches with just NX-OS for several reasons. Some customers feel they aren't ready to head down the controller path and want to maintain a traditional data center network. Other customers think they'll make the transition but aren't quite ready to do it just yet. They believe that if the hardware supports ACI mode, they can leverage NX-OS in its current mode. When they're ready, they can make the move. Customers looking for a well-established operating system with a rich set of features, deep monitoring capabilities, and programmable interfaces should consider Cisco NX-OS. Cisco declined to participate in the full Forrester Wave evaluation process.

› **NVIDIA Mellanox offers a complete networking fabric across storage and servers.** Nvidia acquired Mellanox Technologies in 2020. The vendor is known for its focus on high-speed and low-latency data center connectivity products, such as Ethernet Storage Fabric (ESF), network interface cards (NICs), and Ethernet Cloud fabric switches. Designed by the company's own hardware and ASIC engineers, the ethernet switches can run either Mellanox's Onyx OS or third-party firmware, such as SONiC. The company's strategy centers on creating networking fabrics within private data centers.

Customers can manage the switches through the Mellanox NEO network management solution and tune the network based on monitoring information from the What Just Happened (WJH) telemetry feature in Onyx. Reference customers told Forrester that the single connectivity fabric they can create between the server and storage environment is a major value proposition from Mellanox. Forrester also ran across other customers that were using Mellanox hardware but with an OS from another company because of the hardware's low-latency capabilities, large forwarding tables, and deep dynamic buffers. Customers needing a high-performance data center should review Mellanox's product line.[9]

› **Dell EMC's platform supports a wide variety of OSes.** Dell EMC's businesswide network portfolio includes switching solutions that range from data center to campus to branch office. The company focuses on an open platform model using ONIE that supports OS6, OS9, OS10, or a third-party OS. The data-center-oriented hardware can be loaded with OS10, which has

programmable interfaces, or OS9, which provides a more traditional set of DC features. Dell EMC positions OS6 for campus switching. All of Dell EMC's OS versions can be managed by SmartFabric Director, the company's traditional FCAPS network management solution.

The company's networking strategy centers on enabling customers with the largest selection of OSes to implement on Dell EMC's switching hardware. In particular, the company has prioritized investments in enhancing, shaping, and supporting SONiC as the preferred OS rather than its own. This falls in line with the company's server business. Reference customers highlighted the low-cost hardware portfolio and the multiple software options as the main drivers for their organizations' adoption of Dell EMC's networking switches. I&O professionals looking for a single company to provide data center infrastructure — networking, servers, and storage — should consider Dell EMC.

› **Extreme Networks offers a low-cost programmable switching fabric.** Extreme Networks has a diverse networking portfolio built on technology acquisitions from Aerohive, Avaya, Brocade Communications, Enterasys, and Zebra Technologies. The company continues to offer the OSes and hardware from these acquisitions. Extreme Networks positions the hardware with SLX-OS as the best solution for customers that want an open, programmable switching fabric. Enterprises that haven't started the automation journey can use Extreme Management Center for traditional network management and Extreme Workflow Composer, built on StackStorm, for event-driven automation. Those further along can leverage work done by Extreme Networks and others that have built various runbooks on StackStorm's site.

Reference customers pointed to Extreme Networks' service and low-cost solutions as the top considerations in their purchase of the company's products. Enterprises with tight budgets should consider Extreme Networks.

Challengers

› **Pica8 provides a solid offering for managed services providers (MSPs).** Once a data-center-centric whitebox vendor, Pica8 has moved into the enterprise campus with OpenFlow. The company's PICOS Linux-based network OS can act as a heavy layer 2/3 routing switch, a light OpenFlow switch, or a combination of the two modes within a single switch. In OpenFlow mode, customers can use a variety of controllers, such as OpenStack Neutron ML2, ONOS, Open Daylight (ODL), NEC's Programmable Flow Controller, and Ryu. For those wanting to approach network automation in a traditional manner, Pica8's AmpCon automation framework software can automate, configure, and perform other lifecycle network management functions. AmpCon comes with ready-to-use playbooks to automate common tasks such as turning up switches, configuring VLANs, and running health checks. The company bundles its networking operating system (NOS) and management capabilities under what it describes as an enterprise reference architecture called Threshold.

Reference customers highlighted the dramatic decrease in the time it takes them to deploy products. This is especially important for organizations that have to deploy a lot of switches, such as MSPs or other organizations that change out the hardware at higher frequency. MSPs should investigate Pica8 and consider adding the company to their service portfolios.

Evaluation Overview

We evaluated vendors against 32 criteria, which we grouped into three high-level categories:

- **Current offering.** Each vendor's position on the vertical axis of the Forrester Wave graphic indicates the strength of its current offering. Key criteria for these solutions include hardware offerings across the business network, extensibility and portability of the switch OS, OS features, OS programmability, monitoring features, and visibility capabilities.
- **Strategy.** Placement on the horizontal axis indicates the strength of the vendors' strategies. We evaluated vendors' abilities to create a standardized businesswide fabric, an open and programmable strategy addressing Forrester's five VNI tenets to guide teams along the automation journey, and technology partnerships.
- **Market presence.** Represented by the size of the markers on the graphic, our market presence scores reflect each vendor's customer base and number of engineers dedicated to the development of switching solutions.

Vendor Inclusion Criteria

Forrester included 12 solutions in the assessment: Arista Networks, Cisco IOS-XE, Cisco NX-OS, Dell EMC, Extreme Networks, H3C, Huawei, Juniper Networks, NVIDIA Cumulus, NVIDIA Mellanox, Pica8, and Pluribus Networks. Each of these solutions has:

- **Switching hardware and OS.** Each vendor offers switching hardware and an OS and had one hardware offering with its product number on its public price list as of March 11, 2020.
- **Programmable capabilities built into switching hardware.** Forrester didn't evaluate the hardware based on CLI configuration but rather on programmability with higher-level coding capabilities. At a minimum, the switches must support XML for configuration.
- **Switching OS that doesn't depend on a controller.** The switch's operating system must function as a standalone product and not be dependent on a controller from the vendor or third party. For example, we didn't include Cisco's ACI because it requires Cisco's APIC controller and doesn't allow options outside of that ACI ecosystem.
- **A solution available for purchase by March 11, 2020.** Any feature or product released after March 11, 2020, wasn't part of the product evaluation, but we did consider them in the strategy portion of the evaluation.

› **Significant market adoption and interest.** We needed to see evidence of significant adoption and interest among Forrester's enterprise clients, as demonstrated by customer numbers, surveys, and client inquiry calls.

Supplemental Material

Online Resource

We publish all our Forrester Wave scores and weightings in an Excel file that provides detailed product evaluations and customizable rankings; download this tool by clicking the link at the beginning of this report on Forrester.com. We intend these scores and default weightings to serve only as a starting point and encourage readers to adapt the weightings to fit their individual needs.

The Forrester Wave Methodology

A Forrester Wave is a guide for buyers considering their purchasing options in a technology marketplace. To offer an equitable process for all participants, Forrester follows The Forrester Wave™ Methodology Guide to evaluate participating vendors.

In our review, we conduct primary research to develop a list of vendors to consider for the evaluation. From that initial pool of vendors, we narrow our final list based on the inclusion criteria. We then gather details of product and strategy through a detailed questionnaire, demos/briefings, and customer reference surveys/interviews. We use those inputs, along with the analyst's experience and expertise in the marketplace, to score vendors, using a relative rating system that compares each vendor against the others in the evaluation.

We include the Forrester Wave publishing date (quarter and year) clearly in the title of each Forrester Wave report. We evaluated the vendors participating in this Forrester Wave using materials they provided to us by May 20, 2020, and did not allow additional information after that point. We encourage readers to evaluate how the market and vendor offerings change over time.

In accordance with The Forrester Wave™ Vendor Review Policy, Forrester asks vendors to review our findings prior to publishing to check for accuracy. Vendors marked as nonparticipating vendors in the Forrester Wave graphic met our defined inclusion criteria but declined to participate in or contributed only partially to the evaluation. We score these vendors in accordance with The Forrester Wave™ And The Forrester New Wave™ Nonparticipating And Incomplete Participation Vendor Policy and publish their positioning along with those of the participating vendors.

Integrity Policy

We conduct all our research, including Forrester Wave evaluations, in accordance with the Integrity Policy posted on our website.

Endnotes

[1] See the Forrester report "A Decoder Ring For Edge Computing."

[2] The five tenets of VNI include the ability to: 1) leverage virtualized and physical infrastructure; 2) act as a vertically integrated layer 2 to layer 7 module within the infrastructure; 3) create a fabric of horizontally interwoven networking components; 4) automate and orchestrate the infrastructure to deliver the right services for each user; and 5) allow management by business units. See the Forrester report "Five Tenets Define Virtual Network Infrastructure, A Bold New Business Network."

A combination of network components interweaves layer 1 through layer 7 network hardware, software, and services to interconnect users, data, and applications throughout the entire business, based on business policies through a networking orchestration system. See the Forrester report "Emerging Technology Spotlight: Businesswide Networking Fabric."

[3] The networking market doesn't offer an off-the-shelf, enterprise-ready data center virtual network strategy or solution. Instead, it has leaders touting dissimilar open, programmable networking strategies — a confusing set of terms and definitions, poor vendor support, lack of programmability and automation standards, vendors playing catch-up, and overlays that don't solve every challenge. See the Forrester report "The Forrester Wave™: Hardware Platforms For Software-Defined Networking, Q1 2018."

[4] Facebook has been pushing FBOSS, ONIE, and whitebox switches. Google has built its approach on OpenFlow concepts. Microsoft has been building its network on SONiC and whitebox switches.

[5] See the Forrester report "Jump-Start Your Network Automation."

Forrester categorizes the various strategies into four unique categories: 1) enhancing existing resources, with no intent to provide self-service access; 2) allowing self-service access to development resources so they don't use a public cloud; 3) enabling a greenfield development environment for new applications; and 4) transforming the entire environment while also providing self-service access, in the classic journey-to-cloud approach. See the Forrester report "Adoption Profile: Private Cloud In North America, Q1 2017."

[6] Instead of wasting value for that period of time on something teams may never use, enterprises should invest in technology that provides value along the entire product lifecycle.

[7] For more information on the personas of rapid developers, coders, and DevOps, see the Forrester report "How And Why Customers Choose Public Cloud Platforms."

[8] Nvidia completed the acquisition of Cumulus Networks on June 16, 2020. The company announced it was acquiring Cumulus Networks on May 20, 2020. Source: Amit Katz, "Programming the Modern Data Center: Cumulus Joins NVIDIA's Networking Group," NVIDIA blog, June 16, 2020 (https://blogs.nvidia.com/blog/2020/06/16/cumulus-programming-networks/).

[9] Nvidia completed the acquisition of Mellanox on April 27, 2020. Source: "NVIDIA Completes Acquisition of Mellanox, Creating Major Force Driving Next-Gen Data Centers," NVIDIA press release, April 27, 2020 (https://nvidianews.nvidia.com/news/nvidia-completes-acquisition-of-mellanox-creating-major-force-driving-next-gen-data-centers).

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