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# GigaOm Radar for Data Center Switching v3.0

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## 1. Executive Summary

The market for data center switching has seen multiple transformations over the last decade due to the consolidation of data center operations into a smaller set of service providers and a subsequent reorientation toward hybrid environments. In the early 2010s, most large enterprises and even mid-sized businesses handled their workloads on-premises or in their own data centers. Since the mid 2010s, these workloads have slowly been migrated to data centers hosted by third-party providers.

As we progress into the mid 2020s, organizations are deliberately opting for hybrid environments. This shift is the result of cloud-first approaches displaying their own set of challenges, mainly related to cost. The deliberate choice of the hybrid approach is important because often organizations unwillingly find themselves in a hybrid environment anyway when employing cloud services while still running on-premises workloads.

Today's "application-first" orientation positions networks as a support function, reframing the approach from a bottom-up view—network to application—to a top-down view—application to network. Combining development operations (DevOps) principles with network operations (NetOps), [NetDevOps](#) entails remote provisioning, configurations, and networking policies that support application performance.

The latest trend that affects data center network architectures and target customers is AI workloads. These workloads behave differently from other enterprise applications and will need to find a home in cloud-native environments, in colocation environments, or in on-premises data centers. This requirement positions infrastructure service providers, colocation providers, and large organizations as the main buyers of new data center switching solutions.

To respond to this need, data center switches are evolving to enhance their capabilities around three main themes:

- Hardware switching performance with respect to throughput and port speeds
- Software advancements for network operating systems (NOSs) to handle larger volumes and bursty traffic
- Tools for managing the design, deployment, and operations of new and larger data center networks

This evolution includes the deployment and management of switches using modern techniques targeted toward application performance.

This is our third year evaluating the data center switching space in the context of our Key Criteria and Radar reports. This report builds on our [previous analysis](#) and considers how the market has evolved over the last year.

This GigaOm Radar report examines nine of the top data center switching solutions and compares offerings against the capabilities (table stakes, key features, and emerging features) and non-functional requirements (business criteria) outlined in the companion Key Criteria report. Together, these reports provide an overview of the market, identify leading data center switching offerings, and help decision-makers evaluate these solutions so they can make a more informed investment decision.

## GIGAOM KEY CRITERIA AND RADAR REPORTS

The GigaOm Key Criteria report provides a detailed decision framework for IT and executive leadership assessing enterprise technologies. Each

report defines relevant functional and non-functional aspects of solutions in a sector. The Key Criteria report informs the GigaOm Radar report, which provides a forward-looking assessment of vendor solutions in the sector.

## 2. Market Categories and Deployment Types

To help prospective customers find the best fit for their use case and business requirements, we assess how well data center switching solutions are designed to serve specific target markets and deployment models (**Table 1**).

For this report, we recognize the following market segments:

- **Cloud service provider:** These can be either public or private cloud service providers that operate large data centers and offer infrastructure-, platform-, and software-as-a-service products.
- **Communications service provider:** These are telecommunications service providers that offer connectivity and other IT services, often operating their own data centers for their internal use cases or to sell cloud-like services.
- **Colocation services provider:** These offer data center space and power for organizations to run their hardware appliances. Colocation providers need to provide networking services such as direct internet access and cross-connects to help organizations communicate between racks of servers.
- **Edge service provider/content delivery network (CDN):** These organizations host hundreds of small data center-like points of presence closer to end users, increasingly offering compute and storage capabilities.
- **Small-to-medium business (SMB):** Smaller organizations have different switching requirements, often needing smaller and cheaper appliances with less complexity to manage.
- **Large enterprise:** Larger organizations typically require support for large and business-critical projects in complex architectures.

In addition, we recognize the following deployment models:

- **Bare-metal hardware:** These are just hardware appliances with no NOS installed, and customers are able to bring their own NOS.
- **NOS:** Some vendors can offer their NOS separately, and customers are able to supply their own bare-metal hardware.
- **Proprietary hardware and NOS:** These appliances are made up of a vendor's proprietary hardware running a proprietary NOS, which creates an integrated appliance.
- **Proprietary hardware and third-party NOS:** This model includes vendors that offer their proprietary hardware running a prepackaged third-party NOS.
- **Third-party hardware and proprietary NOS:** This model includes vendors that use third-party bare metal hardware and run their own NOS on top.

Table 1. Vendor Positioning: Target Market and Deployment Model

|                             | TARGET MARKET           |                                  |       |
|-----------------------------|-------------------------|----------------------------------|-------|
|                             | Cloud Services Provider | Communications Services Provider | C : I |
| <b>Arista</b>               | ✓                       | ✓                                |       |
| <b>Cisco</b>                | ✓                       | ✓                                |       |
| <b>Dell Technologies</b>    | ✓                       | ✓                                |       |
| <b>Extreme Networks</b>     | ✓                       | ✓                                |       |
| <b>Fortinet</b>             | ✓                       | —                                |       |
| <b>HPE Aruba Networking</b> | —                       | ✓                                |       |
| <b>Juniper</b>              | ✓                       | ✓                                |       |
| <b>Nokia</b>                | ✓                       | ✓                                |       |
| <b>NVIDIA</b>               | ✓                       | —                                |       |

Source: GigaOm 2024

**Table 1** components are evaluated in a binary yes/no manner and do not factor into a vendor’s designation as a Leader, Challenger, or Entrant on the Radar chart (**Figure 1**).

“Target market” reflects which use cases each solution is recommended for, not simply whether it can be used by that group. For example, if it’s possible for an SMB to use a solution but doing so would be cost-prohibitive, that solution would be rated “no” for that market segment.

### 3. Decision Criteria Comparison

All solutions included in this Radar report meet the following table stakes—capabilities widely adopted and well implemented in the sector:

- Managed switches

- Support for 100 G ports
- Full API access
- Integrated hardware-software solutions
- High availability and fault tolerance
- Switching and routing functionality

**Tables 2, 3, and 4** summarize how each vendor included in this research performs in the areas we consider differentiating and critical in this sector. The objective is to give the reader a snapshot of the technical capabilities of available solutions, define the perimeter of the relevant market space, and gauge the potential impact on the business.

- Key features differentiate solutions, highlighting the primary criteria to be considered when evaluating a data center switching solution.
- Emerging features show how well each vendor is implementing capabilities that are not yet mainstream but are expected to become more widespread and compelling within the next 12 to 18 months.
- Business criteria provide insight into the non-functional requirements that factor into a purchase decision and determine a solution's impact on an organization.

These decision criteria are summarized below. More detailed descriptions can be found in the corresponding report, [“GigaOm Key Criteria for Evaluating Data Center Switching Solutions.”](#)

## Key Features

- **Switching and routing optimization:** In addition to the switching and routing protocols required as part of the table stakes, which include STP, OSPF, and IS-IS, solutions are also evaluated in terms of whether they can leverage routing optimization techniques and algorithms to improve performance.
- **Network design tooling (Day 0):** This key feature assesses the vendor's capabilities to support network design for capacity increases and greenfield and brownfield deployments. This criterion can include features such as automated device discovery and mapping, testing, and validation of simulated instances.
- **Deployment and provisioning (Day 1):** This criterion evaluates the solution's capabilities for streamlining new deployments, using techniques such as zero-touch provisioning (ZTP) to remotely and automatically onboard new devices by loading startup configuration files, adding the devices into a system database, and propagating policy changes to relevant devices, all with the potential to be automated.
- **Network operations and management (Day 2+):** Carrying forward from the Day 0 and 1 activities, this criterion evaluates the switching solution's capabilities to enable operations, or Day 2+ activities. This consideration includes ongoing support activities, such as reporting, performance assurance, troubleshooting, and diagnostics. Just as with design and

deployment, Day 2 activities also can be automated to achieve no-touch or light-touch network management.

- **Hardware portfolio:** This key feature evaluates vendors' range of hardware and the devices' physical capabilities. A high score indicates a wide range of physical formats as well as varied performance features across the whole portfolio.
- **Traffic security:** This feature evaluates a switching solution's capabilities with respect to traffic security. These include features that can help with traffic filtering, policies, encryption, inspection, and analysis.
- **NetDevOps suitability:** NetDevOps combines DevOps with NetOps practices and brings the network even closer to the application by integrating network provisioning and configuration into software development lifecycle (SDLC) and CI/CD pipelines.

Table 2. Key Features Comparison


|                             |                | KEY FEATURES  |                                  |                                |
|-----------------------------|----------------|---------------|----------------------------------|--------------------------------|
|                             |                | AVERAGE SCORE | Switching & Routing Optimization | Network Design Tooling (Day 0) |
|                             |                |               | ↕                                | ↕                              |
| ★★★★★                       | Exceptional    |               |                                  |                                |
| ★★★★                        | Superior       |               |                                  |                                |
| ★★★                         | Capable        |               |                                  |                                |
| ★★                          | Limited        |               |                                  |                                |
| ★                           | Poor           |               |                                  |                                |
| –                           | Not Applicable |               |                                  |                                |
| <b>Arista</b>               |                | <b>3.7</b>    | ★★★★                             | ★★★★                           |
| <b>Cisco</b>                |                | <b>4.1</b>    | ★★★★★                            | ★★★★★                          |
| <b>Dell Technologies</b>    |                | <b>3.6</b>    | ★★★★★                            | ★★★★★                          |
| <b>Extreme Networks</b>     |                | <b>2.9</b>    | ★★★                              | ★★★                            |
| <b>Fortinet</b>             |                | <b>2.3</b>    | ★★★★                             | –                              |
| <b>HPE Aruba Networking</b> |                | <b>3.7</b>    | ★★★★★                            | ★★★★                           |
| <b>Juniper</b>              |                | <b>3.9</b>    | ★★★★★                            | ★★★                            |
| <b>Nokia</b>                |                | <b>4.4</b>    | ★★★★★                            | ★★★★★                          |
| <b>NVIDIA</b>               |                | <b>3.7</b>    | ★★★★★                            | ★★★★★                          |

Source: GigaOm 2024

## Emerging Features

- Large language model (LLM) integrations:** LLMs can be integrated in data center switching solutions to surface information about the state of the network in natural language rather than through command line interface (CLI) commands or by navigating user interfaces. LLMs can be consumed through the CLI, where administrators can issue commands without needing to know vendor-specific syntax.
- AI workload support:** Compared to traditional traffic flows, AI workloads entail “elephant flows” that transfer large amounts of data in bursts. As data passes from one cluster of processing units to another, the cluster requires all the data before it can move forward with its own tasks, which results in little to no tolerance for missing data, and any latency has a knock-on effect on the overall job completion time.
- 800 G and 1.6 T port speeds:** As 400 G port speeds are becoming commonplace with most data center switching vendors, new hardware developments are bringing 800 G port speeds to the market, with 1.6 T speeds on the horizon.
- Microservices-based NOS:** A microservices-based architecture approach refers to building the NOS using containerized microservices that fulfill network functions, often using Kubernetes for orchestration. This approach breaks down a traditional monolithic NOS into separate containerized network functions like routing, policy, and telemetry.

Table 3. Emerging Features Comparison

|  |                | EMERGING FEATURES COMPARISON |                  |                     |
|---|----------------|------------------------------|------------------|---------------------|
|   |                | EMERGING FEATURES            |                  |                     |
|   |                | AVERAGE SCORE                | LLM Integrations | AI Workload Support |
|   |                |                              | ↕                | ↕                   |
| ★★★★★   | Exceptional    |                              |                  |                     |
| ★★★★  | Superior       |                              |                  |                     |
| ★★★   | Capable        |                              |                  |                     |
| ★★  | Limited        |                              |                  |                     |
| ★   | Poor           |                              |                  |                     |
| –   | Not Applicable |                              |                  |                     |
| <b>Arista</b>   |                | <b>1</b>                     | ★★               | ★                   |
| <b>Cisco</b>  |                | <b>1.5</b>                   | –                | ★★★★                |
| <b>Dell Technologies</b>  |                | <b>1.3</b>                   | –                | ★★                  |
| <b>Extreme Networks</b>   |                | <b>0.3</b>                   | –                | ★                   |
| <b>Fortinet</b>   |                |                              |                  |                     |

|                      |                | EMERGING FEATURES |                  |                     |
|----------------------|----------------|-------------------|------------------|---------------------|
|                      |                | AVERAGE SCORE     | LLM Integrations | AI Workload Support |
|                      |                |                   | ↕                | ↕                   |
| ★★★★★                | Exceptional    |                   |                  |                     |
| ★★★★                 | Superior       |                   |                  |                     |
| ★★★                  | Capable        |                   |                  |                     |
| ★★                   | Limited        |                   |                  |                     |
| ★                    | Poor           |                   |                  |                     |
| –                    | Not Applicable |                   |                  |                     |
| Fortinet             |                | –                 | –                | –                   |
| HPE Aruba Networking |                | 1.8               | –                | ★★★★                |
| Juniper              |                | 2.5               | ★                | ★★                  |
| Nokia                |                | 2.5               | ★★★★★            | ★★                  |
| NVIDIA               |                | 1.5               | –                | ★★★★★               |

Source: GigaOm 2024

## Business Criteria

- **Flexibility:** A solution’s flexibility is dictated by factors such as the availability of deployment models and interoperability with other networking solutions.
- **Scalability:** As a crucial element of data center switching solutions, scalability must be assessed with two aspects in mind: raw switching power and management features.
- **Reliability:** This criterion assesses the solution’s capabilities for failovers, traffic rerouting, troubleshooting and repairs, and disaster recovery in case of hardware failures or other incidents.
- **Partner ecosystem:** Partner ecosystem refers to the vendors’ relationships with hardware and software providers, channels to market, managed service providers, and out-of-the-box integrations.
- **Support:** In addition to the hardware and software solutions, vendors also provide a set of services—professional, managed, and technical support—to help customers deploy and operate the networking solution.
- **Cost and licensing:** When assessing cost and licensing, consider that the initial price of the solution will be dictated by the cost of purchasing the hardware, the license for the software (either perpetual or one-time), and any support fees. Further costs for deploying and operating the switches will depend on the network team’s learning curve, power consumption, and



automation capabilities.

Table 4. Business Criteria Comparison

|                             |                | BUSINESS CRITERIA |             |             |
|-----------------------------|----------------|-------------------|-------------|-------------|
|                             |                | AVERAGE SCORE     | Flexibility | Scalability |
|                             |                | ↕                 | ↕           | ↕           |
| ★★★★★                       | Exceptional    |                   |             |             |
| ★★★★                        | Superior       |                   |             |             |
| ★★★                         | Capable        |                   |             |             |
| ★★                          | Limited        |                   |             |             |
| ★                           | Poor           |                   |             |             |
| –                           | Not Applicable |                   |             |             |
| <b>Arista</b>               | <b>3.7</b>     | ★★★               | ★★★★★       |             |
| <b>Cisco</b>                | <b>4.2</b>     | ★★★★              | ★★★★★       |             |
| <b>Dell Technologies</b>    | <b>3.8</b>     | ★★★★★             | ★★★★        |             |
| <b>Extreme Networks</b>     | <b>3.3</b>     | ★★★★★             | ★★★★        |             |
| <b>Fortinet</b>             | <b>2.7</b>     | ★★                | ★★          |             |
| <b>HPE Aruba Networking</b> | <b>4.2</b>     | ★★★★              | ★★★★★       |             |
| <b>Juniper</b>              | <b>3.5</b>     | ★★★★              | ★★★★★       |             |
| <b>Nokia</b>                | <b>4.3</b>     | ★★★★★             | ★★★★★       |             |
| <b>NVIDIA</b>               | <b>3.2</b>     | ★★★★★             | ★★★★★       |             |

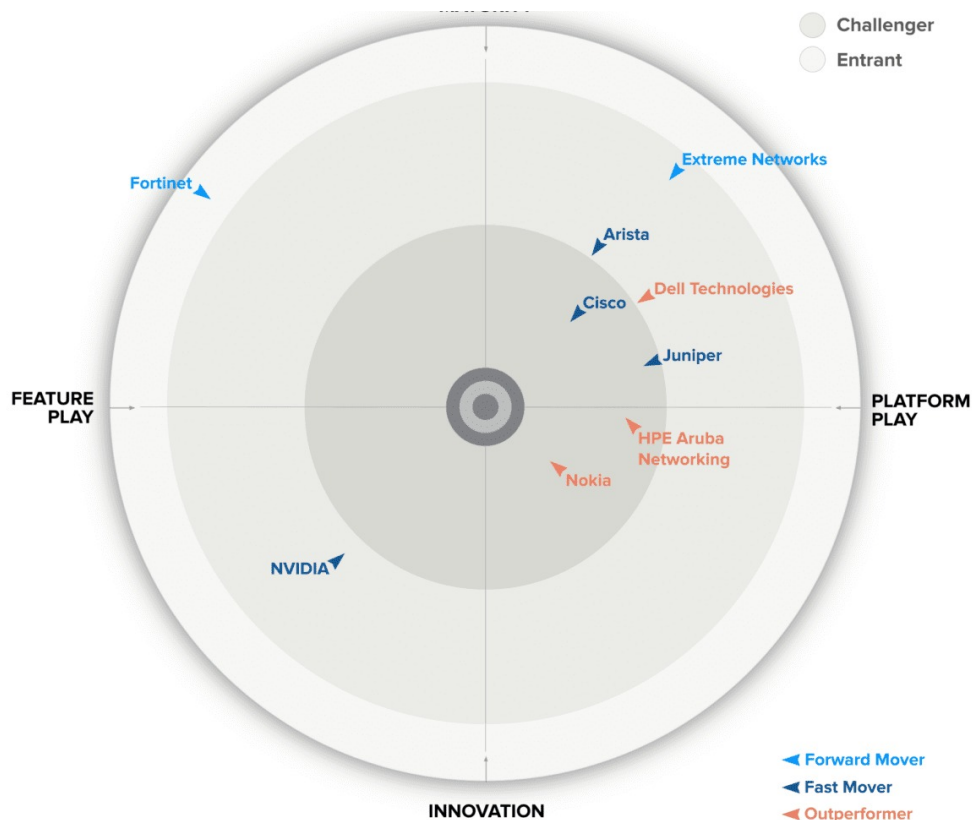
Source: GigaOm 2024

#### 4. GigaOm Radar

The GigaOm Radar plots vendor solutions across a series of concentric rings with those set closer to the center judged to be of higher overall value. The chart characterizes each vendor on two axes—balancing Maturity versus Innovation and Feature Play versus Platform Play—while providing an arrowhead that projects each solution’s evolution over the coming 12 to 18 months.

MATURITY

● Leader



| MATURITY   | INNOVATION  | FEATURE PLAY   | PLATFORM PLAY   |
|--|---|--|---|
| Emphasis on stability and continuity; may be slower to innovate. | Flexible and responsive to market; may invite disruption. | Offers specific functionality and use case support; may lack broad capability. | Offers broad functionality and use case support; may heighten complexity. |

Source: GigaOm 2024 ©GigaOm

Figure 1. GigaOm Radar for Data Center Switching

As you can see in the Radar chart in **Figure 1**, the highest concentration of vendors appears in the Maturity/Platform Play quadrant, featuring all the household names in the networking space, namely Arista, Cisco, Dell Technologies, Extreme, and Juniper. Below, in the Innovation/Platform Play quadrant, we feature HPE Aruba Networking, whose solution can now be consumed in an as-a-service model, and Nokia, a newer player in the data center switching market. NVIDIA is positioned in the Innovation/Feature Play quadrant as the vendor having a distinct focus on catering to AI workload networking. Lastly, Fortinet’s tight integration with its established security portfolio positions it alone in the Maturity/Feature Play quadrant.

With the acquisition of Juniper by Hewlett Packard Enterprise (HPE), we expect the next iteration of this report to include only HPE, whose portfolio will likely be a consolidation of the existing Aruba product suite and the Juniper data center switching solution.

For this year’s evaluation, we limited the scope of the report to European and North American vendors. So while Huawei was included last year, it is not evaluated in this year’s report.

In reviewing solutions, it's important to keep in mind that there are no universal "best" or "worst" offerings; there are aspects of every solution that might make it a better or worse fit for specific customer requirements. Prospective customers should consider their current and future needs when comparing solutions and vendor roadmaps.

## INSIDE THE GIGAOM RADAR

To create the GigaOm Radar graphic, key features, emerging features, and business criteria are scored and weighted. Key features and business criteria receive the highest weighting and have the most impact on vendor positioning on the Radar graphic. Emerging features receive a lower weighting and have a lower impact on vendor positioning on the Radar graphic. The resulting chart is a forward-looking perspective on all the vendors in this report, based on their products' technical capabilities and roadmaps.

Note that the Radar is technology-focused, and business considerations such as vendor market share, customer share, spend, recency or longevity in the market, and so on are not considered in our evaluations. As such, these factors do not impact scoring and positioning on the Radar graphic.

For more information, please visit our [Methodology](#).

## 5. Solution Insights

### Arista, DCS-7000 Series

#### **Solution Overview**

Founded in 2004, Arista is a key player in the data center switching space, delivering an open, standards-based, elastically scalable automated switching solution. Arista's data center switching portfolio includes the 7000 series switches and the Extensible Operating System (EOS).

CloudVision is Arista's single point of control for the data center switching hardware and EOS. It enables automated provisioning, change management, and compliance, as well as network-wide telemetry data capture, analysis, and recording. Arista offers CloudVision as an on-premises virtual or physical appliance or as a cloud-hosted service.

The solution's switching series offers a number of programming and automation interfaces. These include CLIs, eAPI, OpenConfig, and YANG models with gNMI, RESTCONF, and NETCONF support. Further, there is an EOS software development kit (SDK) for native-component development, which lets customers program hardware directly for traffic engineering purposes and monitoring.

Arista has well-defined and comprehensive capabilities for both hardware and software. With respect to hardware, the DCS-7000 series switch portfolio includes

both fixed and modular systems with port speeds ranging from 1 to 400 GbE, supporting leaf-spine, top-of-rack, and end-of-row architectures.

In addition to the integrated hardware and software, Arista also offers EOS for use on a select range of bare-metal switches from Quanta Technologies (QCT), EdgeCore, and Celestica in 10/25/40/100 GbE connectivity options. CloudEOS can be deployed both as a virtual instance and in a container environment.

### **Strengths**

Arista ranks high on network operations and management, offering a variety of features, such as real-time state streaming for network telemetry and analytics; cognitive analytics using machine learning (ML) models to generate network recommendations and insights; turnkey automation for Day 2 configuration management and network-wide change control, such as automated upgrades, network rollback, and network snapshots; and NetDevOps workflows to integrate into a broader continuous integration (CI) pipeline.

The vendor's solution is highly interoperable and open as its switching series offers a number of programming and automation interfaces.

### **Challenges**

Arista's advanced automation and management capabilities are provided by the CloudVision platform, which must be purchased as a subscription per device or based on volume licensing. This may constitute a considerable increase in the overall price of the solution.

### **Purchase Considerations**

The vendor has an extensive portfolio of networking products that goes beyond data center switching. CloudVision and EOS, which are main components of the data center switching solution, can also be used for cloud networking, which can help enterprises unify on-premises and cloud workloads.

Arista's data center switching solution is suitable for a range of use cases, including greenfield and brownfield deployments for multiple types of verticals, including cloud services providers, colocation providers, and large enterprises.

### **Radar Chart Overview**

Arista is positioned in the Maturity/Platform Play quadrant because the vendor is an established player in the data center switching market with a comprehensive portfolio of hardware and software solutions. Arista is a Challenger and Fast Mover with a steady cadence of developments.

## **Cisco Systems, Nexus Series**

### **Solution Overview**

Cisco continues to be a household name in the networking space, and its data center networking solution displays comprehensive capabilities across all decision criteria defined in this report.

The Cisco Nexus platform consists of fixed and modular switches, delivering automation, programmability, and real-time visibility. Switches from Cisco's Nexus 3000, 7000, and 9000 series are deployed according to standard architectural

guidelines ranging from one to 800 GbE. As such, Cisco ranks high on the hardware portfolio key feature.

Nexus series switches can operate in either of two modes—Cisco Application Centric Infrastructure (ACI) or Cisco NX-OS. The ACI is a software-defined networking solution for data centers that provides centralized automation and policy-driven application profiles. The vendor ranks high on network design tooling automation because Cisco ACI supports a declarative control system through which end users can state their preferred configuration while the platform creates adequate infrastructure policies. The solution also offers a network simulation environment.

NX-OS is Cisco's NOS, which provides the capability to use foundational Layer 2 and 3 technologies as well as modern technologies such as VXLAN, with a Border Gateway Protocol—Ethernet VPN (BGP-EVPN) control plane, segment routing, Multiprotocol Label Switching (MPLS), and automation.

### **Strengths**

To support holistic management of NX-OS deployments, Cisco offers the Nexus Dashboard Fabric Controller (NDFC), which reduces provisioning and deployment times through automation and offers graphical operational visibility of topology, network fabric, and infrastructure to reduce troubleshooting time and effort. Further, it can eliminate configuration errors and automate ongoing changes in a closed loop with templated deployment models and configuration compliance alerting with automatic remediation. It also provides a real-time summary of the health and topology of fabrics and switches.

The vendor ranks high on the NetDevOps suitability key feature because the data center switching solution provides automation via an application-driven policy model, including centralized visibility with real-time application health monitoring and support for automation tools such as Chef, Ansible, and Puppet. The NX-API supports a common programming language across Nexus switches. Python scripts, Bash shells, and Linux containers can also be used to develop customer applications.

### **Challenges**

Many of Cisco's advanced capabilities are delivered through applications such as the NDFC and ACI. These products are complex and comprehensive, requiring long learning curves or support from third parties.

### **Purchase Considerations**

Cisco has an extensive portfolio of networking products that goes beyond data center switching. Products such as Cisco ACI are also used for cloud networking, which can help enterprises unify on-premises and cloud workloads.

Cisco offers a range of data center networking software subscriptions—three-, five-, and seven-year term subscriptions in three tiers—so prospective customers can choose the model that best meets their needs.

Cisco's solutions are highly scalable and suitable for a wide range of target customers, including infrastructure service providers, colocation providers, and

large enterprises. The solutions are suitable for both greenfield and brownfield deployments.

### **Radar Chart Overview**

Cisco continues to be a Leader in the data center switching market and demonstrates a steady flow of developments and investments in its hardware and software portfolio. Its solutions are widely deployed and stable, being able to cater to a large number of use cases, earning a position in the Maturity/Platform Play quadrant.

## **Dell Technologies, PowerSwitch Series**

### **Solution Overview**

Dell Technologies has long been prominent in the enterprise IT space, catering to the data center switching market through the PowerSwitch S and Z series.

Dell's data center switching appliances can be deployed as integrated hardware and software solutions, standalone NOSs, or bare-metal appliances. PowerSwitch Open Networking switches represent Dell's latest disaggregated hardware and software solutions for data centers.

The PowerSwitch product offers a wide range of hardware formats, with the data center solutions offering 10/25/40/50/100/400 GbE deployments in top-of-rack, middle-of-row, and end-of-row architectures. With high-density ports ranging from 25 to 400GbE and a broad array of Layer 2 and 3 features, the S and Z series meet the growing needs of today's data centers.

With respect to software, the PowerSwitch series can be operated using Dell's own networking OS10, which provides scalable Layer 2 and Layer 3 Ethernet switching capabilities with quality of service (QoS) guarantees and a full complement of standards-based features. Dell Technologies also offers a finely-tuned, enterprise ready and globally supported distribution of open source NOS, called Enterprise SONiC Distribution by Dell Technologies.

### **Strengths**

Dell Technologies is highly interoperable and open as the PowerSwitch series supports alternate operating systems, such as VMware NSX. While most other vendors focus on proprietary integrated appliances, Dell's solution leverages the Open Network Install Environment (ONIE) in PowerSwitch for zero-touch installation of alternate NOSs. Dell also offers the Enterprise SONiC Distribution, a commercial version of the open source software with management enhancements, testing, and validation across select PowerSwitch models. A wide range of open source and Linux-based applications and tools enable customers to optimize and manage their network more effectively. Dell also began supporting select third party hardware switches with the Enterprise SONiC solution to provide customers full control over their technology stack, which includes hardware, software, and the associated ecosystem of management tools.

The vendor scores high on the network design tooling and provisioning key features because the Fabric Design Center (FDC) is a cloud-based application that automates the planning, design, and deployment of network fabrics that power

Dell compute, storage, and hyperconverged infrastructure solutions. The FDC translates business intent into network designs and switch configurations; generates logical and physical network views for network planning and topology decisions; provides PowerSwitch distinguishing details such as a bill of materials, network diagrams, and cabling diagrams; and simplifies and automates new fabric deployments.

### **Challenges**

While Dell offers some security features such as port security, SSH, and access controls, the solution does not currently support features such as IPSec, MacSec, secure FTP, or integrated firewalls..

### **Purchase Considerations**

Dell's networking solutions are particularly suitable for brownfield deployments and heterogeneous environments as the vendor's products are highly interoperable, flexible, and support a variety of deployment models. Dell caters to large enterprises, colocation providers, infrastructure service providers, telecommunications services providers, and content delivery networks.

### **Radar Chart Overview**

Dell Technologies is positioned in the Maturity/Platform Play quadrant as the vendor is an established player in the data center switching market and its solution has been widely deployed. Dell is a Fast Mover because it continues developing a good portfolio of software solutions to support data center switching use cases.

## **Extreme Networks, SLX Series**

### **Solution Overview**

Extreme Networks is a networking equipment and software company focused on supporting enterprise, data center, and cloud environments, delivering end-to-end hardware and software solutions including switches, wireless access points, network management software, analytics platforms, automation tools, and edge-to-cloud solutions.

Extreme Networks' data center switching solution includes the SLX switching series, which is capable of supporting data center designs for leaf, spine, border routing, and data center interconnect (DCI). The SLX 9150 with 1/10/25/40/100 GbE is ideal for leaf deployments, while the high-density 100 GbE SLX9250 with 100/40 GbE is most suitable for spine deployments. Further, the ultra-high-density 100 GbE SLX9740 switch supports up to 80 x 100 GbE ports. However, Extreme Networks does not currently support 400 GbE ports, which are becoming readily available from multiple other vendors featured in this report.

The SLX switches can be managed using multiple methods, including REST, the NETCONF management interface, and a CLI for manual configuration. In terms of centralized management, the ExtremeCloud IQ Site Engine (XIQ-SE) offers a comprehensive unified management solution for managing users, devices, and applications.

Extreme's SLX series runs SLX-OS, a Linux-based virtualized operating system with advanced switching features and support for the REST API with the YANG data

model, Python, and NETCONF. Based on Ubuntu Linux, it comes with all the advantages of open source and provides access to commonly used Linux tools. Thus, the vendor ranks high on the NetDevOps suitability key feature.

Extreme Fabric Automation is able to provision data center fabrics based on BGP, EVPN, and VXLAN, the application validating the network topology before configuration to ensure accuracy. For Day 0 activities, the solution can configure a management IP address per switch manually or automatically via ZTP. For Day 1 activities, the solution can provision a fabric with the assets that need to be included (VLANs, VRFs, port channels, ports) and endpoint groups (EPGs).

### **Strengths**

Extreme Networks scores high on the deployment and provisioning key feature because the solution enables automated configuration and services provisioning, such as creating databases, provisioning the IP network fabric, and adding assets into the fabric. The Extreme Fabric Automation solution streamlines and accelerates the deployment of an IP fabric. The application runs as a service on the Integrated Application Hosting (IAH) environment of SLX switches and uses open API-based programmable interfaces to make provisioning, deployment, and automation of IP fabric networks easy.

The solution is highly interoperable and open and can work well with hypervisor providers, storage solutions, and security partners. Extreme Networks can support proprietary or third-party applications to be hosted on its own appliances, which offers better support for security, monitoring, troubleshooting, or extended network functionality, without a separate hardware device.

### **Challenges**

While Extreme Networks offers a comprehensive data center switching solution, the vendor does not currently support 400 G port speeds. Similarly, the vendor could further improve its capabilities around automation for Day 2+ activities.

### **Purchase Considerations**

Extreme offers a wide range of networking products besides data center switching, which are suitable for delivering end-to-end solutions for enterprise networking.

Extreme's solutions are suitable for both greenfield and brownfield deployments for large enterprises, SMBs, cloud service providers, colocation service providers, and edge services providers.

### **Radar Chart Overview**

Extreme inhabits the Maturity/Platform Play quadrant because it is an established player in the data center switching market and its solution has been widely deployed. Extreme is considered a Forward Mover as it does not yet offer 400 G port speeds.

## **Fortinet, FortiSwitch**

### **Solution Overview**

Fortinet is an established security infrastructure provider that offers a data center



switching solution with the FortiSwitch hardware suite.

FortiSwitch provides campus cores and data center switches that support up to 48 ports within a compact one rack unit form factor with speeds of up to 100 G. FortiSwitch appliances integrate with Fortinet's security products and offer a unified management interface to help enterprises establish a robust foundation for data center infrastructure.

FortiSwitch can be managed either as a standalone solution or in FortiLink mode. FortiLink is a proprietary management protocol that integrates and centralizes management between a FortiGate Next-Generation Firewall and the FortiSwitch Ethernet switching platform. With FortiLink, FortiSwitch turns into a logical extension of FortiGate, unifying the management of both the data center switching and security functions.

FortiSwitch is accessible through both FortiCloud and on-premises management, which are centralized management consoles that provide a single view encompassing both the local area network (LAN) and security. The solution can be deployed using zero-touch provisioning.

### **Strengths**

FortiSwitch is controlled by FortiOS, an integrated security-oriented NOS. Rather than offering a traditional network OS delivering mainly infrastructure connectivity services, FortiOS bundles it with advanced capabilities like next-generation firewall, intrusion protection, anti-malware, and virtual private networking with routing, switching, and software-defined wide area network (SD-WAN) overlays. This contributes to a high score for the traffic security key feature.

FortiOS enforces granular security policy control that spans segmentation, access governance, and threat prevention directly into networking platforms deployed at enterprise branches and distributed sites.

### **Challenges**

Fortinet's switching solution plays off the vendor's security capabilities, so its capabilities for network design, deployment, and management are less well developed compared to other vendors featured in the report.

### **Purchase Considerations**

Fortinet's data center switching solution should be a strong consideration for organizations with an existing Fortinet footprint. Strong integrations with other products such as FortiGate and shared management platforms make FortiSwitch a strong contender.

Fortinet's solution is suitable for large enterprises, SMBs, and edge services providers. Organizations can deploy the Fortinet data center switching solution in both greenfield and brownfield scenarios.

### **Radar Chart Overview**

As Fortinet's data center switching solution is tightly integrated with its established security portfolio, the vendor is positioned in the Maturity/Feature Play quadrant of the Radar. The vendor is identified as a Forward Mover because its networking-

specific software features are limited, and the vendor does not currently support 400 G port speeds.

## HPE Aruba Networking, CX Series

### Solution Overview

In 2015, Hewlett Packard Enterprise (HPE) acquired Aruba Networks, a provider of networking infrastructure. In January 2024, HPE announced its plans to acquire Juniper Networks; the acquisition is expected to close in early 2025. This report evaluates HPE Aruba Networking's data center switching solution, which consists of the CX series, separately from that of Juniper Networks.

HPE Aruba's portfolio of switching hardware includes a range of appliances. The portfolio offers CX 8000/9000 series switches providing flexibly sized form factors ranging from 12 to 48 ports of 10/25/100/400 GbE suitable for leaf-and-spine data center networks. The CX 10000 series switch, co-developed with AMD Pensando, is the industry's first system that integrates a hardware-accelerated programmable processor (Pensando P4) to deliver stateful services inline, at scale, with wire-rate performance.

As part of its DC portfolio, HPE Aruba also offers the Fabric Composer, a software-defined orchestration solution for simplifying and accelerating day-to-day operations and for provisioning leaf-spine design across rack-scale compute and storage infrastructure. Using the AOS-CX API, HPE Aruba's Fabric Composer orchestrates the CX series switches into a single entity—the fabric—which significantly simplifies operations and troubleshooting by automating various configuration and lifecycle event processes.

### Strengths

One of HPE Aruba's differentiating features is its Distributed Services Switch, which provides stateful firewall services at every top-of-rack configuration. The firewall service can be managed through Aruba Fabric Composer to configure the firewall and set up segmentation and microsegmentation. Deploying the distributed services architecture CX 10000 switches as top-of-rack, leaf, or access in the data center will enable 800 G stateful services for east-west traffic without needing to route traffic through security appliances. CX 10000 can define network segments and microsegments, and provides IPsec encryption. The CX 10000 can export firewall logs and industry-standard non-sampled IPFIX records. Administrators can set intervals for flow sampling as short as one second.

As a single operating system for all HPE Aruba switches, AOS-CX delivers a consistent operator experience, simplifies network design, and enables management tasks across data centers and remote edge infrastructure. In addition to the standard CLI, AOS-CX has an intuitive WebUI that simplifies and standardizes tasks while shortening the learning curve for network engineers who are new to HPE Aruba DC switches. Aruba also offers the Network Analytics Engine for Day 2+ operations as an integral part of the AOS-CX NOS.

### Challenges

In terms of deployment models, HPE Aruba does not currently offer bare-metal hardware or open integrated appliances. However, AOS-CX is available as a

standalone NOS.

### **Purchase Considerations**

HPE Aruba Networking is currently the only vendor that offers data center switching solutions in an as-a-service consumption model. Purchasing data center switching in a NaaS model can open up possibilities for more flexible and agile solutions.

It's worth noting that upon completion of the Juniper Networks acquisition, the data center switching portfolio of the two vendors will overlap, so we expect a consolidation of the two solutions across the NOS, supporting management software, and hardware products.

HPE Aruba Networking's data center switching solutions are suitable for both greenfield and brownfield deployments. The vendor has good support for AI workloads in the data center, and the solution can be deployed by cloud services providers, colocation services providers, large enterprises, and SMBs.

### **Radar Chart Overview**

HPE Aruba Networking is positioned in the Innovation/Platform Play quadrant as the vendor offers some distinctive features, particularly the as-a-service consumption model available through HPE Greenlake.

## **Juniper Networks, EX and QFX Series**

### **Solution Overview**

Founded in 1996, Juniper Networks is one of the household names in the data center networking space, offering a comprehensive portfolio of hardware and software networking products. In January 2024, HPE announced its plans to acquire Juniper Networks; the acquisition is expected to close in early 2025. This report evaluates Juniper Networks' data center switching solution separately from that of HPE Aruba Networking.

Data center switches from Juniper include multiple integrated products, such as the EX, QFX, ACX, and PTX with Broadcom and custom silicon Juniper ASICs, which are designed to meet the needs of data centers, SMBs, large enterprises, cloud providers, and communication service providers. Its hardware portfolio supports data port speeds from 10 to 800 GbE, and can support leaf-spine, core-distribution-access, top-of-rack, and end-of-row architectures.

Switching hardware is powered by the Junos NOS, which can power Juniper's entire portfolio of switching, routing, and security products. The EX, QFX, ACX, and PTX series switches deliver an extensive routing stack. These switches can be deployed in a number of validated network designs and fabrics. These options include IP fabric with EVPN-VXLAN and Juniper MC-LAG for Layer 2 and Layer 3 networks, giving customers complete architectural flexibility. Its multivendor, intent-based networking and automation platform, Juniper Apstra, manages Juniper switches as well as switches from Cisco, Arista, and Dell.

### **Strengths**

Junos is a modular NOS built on the principles of open programmability and

microservices. It provides clear separation among the control, management, and data planes. Junos OS supports a number of open source automation frameworks, including Puppet, Chef, Ansible, and Salt. Furthermore, Junos REST APIs allow users to connect securely to switches and execute remote procedures. By using the REST API Explorer GUI, users can experiment conveniently with any REST API and explore various formats and options, including JSON.

Additionally, Juniper Apstra's intent-based networking software automates and validates data center network design, deployment, and operation from Day 0 through Day 2+. This intent-based solution allows network operators to automate entire data centers from end to end, integrating tasks such as group-based policies and enterprise-scale analytics and operations.

Juniper also provides Juniper Validated Designs (JVDs), comprehensive blueprints providing thoroughly tested configurations and best practices for deploying specific network solutions.

### **Challenges**

While Juniper has comprehensive capabilities for its data center switching solutions, these are achieved using products such as Apstra and Contrail, which must be purchased separately and will impact the solution's initial cost to deploy.

### **Purchase Considerations**

Juniper has a comprehensive networking portfolio, which includes both cloud networking and container networking capabilities. Juniper is one of the only vendors that can deliver end-to-end solutions across enterprise and cloud networks.

It's worth noting that upon completion of the acquisition by HPE, the data center switching portfolio of the two vendors will overlap, so we expect a consolidation of the two solutions across the NOS, supporting management software, and hardware products. The HPE acquisition would provide opportunities for Juniper, given HPE's stronger distribution channels and as-a-service delivery models.

Juniper's solutions can be deployed for large enterprises, colocation providers, infrastructure service providers, and communications services providers. The solutions are suitable for both brownfield and greenfield deployments.

### **Radar Chart Overview**

Juniper is positioned in the Maturity/Platform Play quadrant because it has a comprehensive portfolio of hardware and software solutions that have been widely deployed. With a steady flow of developments, Juniper is a Fast Mover in the data center switching market.

## **Nokia, IXR Series**

### **Solution Overview**

Nokia has been a key provider of telecommunications networking infrastructure, having expanded into the data center networking market with the IXR series, which provides a comprehensive portfolio of integrated hardware and software switching solutions that focuses on NetOps methodology.

Nokia's comprehensive hardware portfolio, the 7250 IXR product suite, consists of high-performance, high-density, modular platforms designed for data center spines and data center wide area network (WAN) connectivity deployments. Similarly, the 7220 IXR suite provides a high-performance, high-density, fixed-configuration platform for leaf-spine deployments in data centers. These two series of hardware products feature multiple chassis variants that support port speeds from 1 GbE up to 800 GbE.

The IXR series runs the Service Router Linux (SR Linux) NOS. SR Linux is an open, extensible, and resilient NOS for data center fabrics and switching, built on an unmodified Linux kernel.

Nokia offers a comprehensive network design tool, which enables network engineers to provide a few parameters, such as the number of racks and the number of servers per rack, and the system autogenerates the rest of the configuration based on Nokia-certified design templates. The result is a standard BGP-based IP fabric design with details such as IPv4/IPv6 addressing, BGP configuration, and cable maps. This design can be validated using the digital sandbox before being deployed to the data center fabric.

The solution offers good network management and operations, with the Fabric Services System constantly monitoring the fabric by leveraging telemetry, comparing it with various intents, and analyzing the results to find configuration inconsistencies, faults, or other deviations that may lead to network issues.

### **Strengths**

The vendor ranks high on the NetDevOps suitability key feature, having designed the Nokia Fabric Services System as an operational toolkit and management system to improve and scale operations across the entire operational lifecycle of the fabric. Due to highly automated design, deployment, and operations processes, Nokia also ranks high on support for Day 0, 1, and 2+ activities.

A differentiating feature is Nokia's NetOps Development Kit (NDK), which enables application developers to take advantage of the underlying model-driven architecture of SR Linux. With the NDK, data center teams can develop new applications and operational tools in the language of their choice and have deep programmatic access to, and control over, the entire interconnect router (IXR) switching system.

### **Challenges**

Compared to other solutions, SR Linux is a newer solution on the market, so we expect its users to require comprehensive training to understand and make use of all the features the product has to offer.

### **Purchase Considerations**

Nokia's solution can be easily integrated into existing heterogeneous deployments, making it easy for organizations to ramp up their Nokia-based data center network deployments.

Nokia's solutions are suitable for both greenfield and brownfield deployments. The solution can be deployed by large enterprises, infrastructure service providers,

colocation providers, and edge service providers.

### **Radar Chart Overview**

Nokia is an Outperformer positioned in the Innovation/Platform Play quadrant because its data center switching solution is newer on the market and many of its capabilities, including the SR Linux operating system, have been built from scratch using a modern architecture.

## **NVIDIA, Mellanox Spectrum Series**

### **Solution Overview**

Since its inception as a graphics accelerator company specializing in video game development in the 1990s, NVIDIA has evolved into a key player in processing acceleration with composable, disaggregated resources that serve cloud and edge applications. After acquiring Mellanox Technologies and Cumulus Networks, NVIDIA consolidated its place in the data center switching market.

The NVIDIA Spectrum Ethernet switch family includes a comprehensive switch and software portfolio spanning from 1 GbE to 800 GbE. NVIDIA Spectrum switches are ideal for both building AI fabrics connecting NVIDIA GPUs and connecting end-to-end cloud data center networks. The Spectrum switches work in conjunction with NVIDIA Cumulus Linux and NVIDIA Pure SONiC as NOSs, and the NVIDIA NetQ for validation, along with the NVIDIA Air simulation platform.

The NVIDIA Spectrum Platform is an end-to-end data center networking solution, including the NVIDIA ConnectX NICs, Bluefield DPUs, and the SN5000, SN4000, SN3000, and SN2000 series of switch systems, specifically designed for leaf/spine/superspine data center applications. The switches range from 16 to 128 ports, with speeds from 1 to 400 GbE, allowing the construction of any size data center with any desired blocking ratio.

For software, the Spectrum series supports network disaggregation, allowing the use of a variety of NOSs, such as NVIDIA Cumulus Linux, NVIDIA Onyx, SONiC, and native Linux OS. Cumulus Linux, based on Debian Linux, is a principal choice for using the Spectrum range. It is a modern NOS designed to build, automate, and operate web-scale networks both affordably and efficiently.

NetQ is an intelligent network validation tool from NVIDIA that provides real-time visibility and troubleshooting to simplify unit testing development and accelerate adoption. In addition, NetQ provides operational intelligence and insight into the health of data centers—from the container to the switch and port—supporting a NetOps approach.

For Day 2+ activities, NVIDIA NetQ provides real-time data for troubleshooting, visibility, and automated workflows, and a method by which to compare prior network configurations to configurations after network changes are made to eliminate any risk of disruption via preventive validation.

### **Strengths**

An integrated Spectrum hardware switch with Cumulus Linux software can offer advanced network virtualization, including single-pass VXLAN routing and zero-

touch network provisioning. Moreover, it allows users to simulate a multiple-switch configuration in the NVIDIA Air infrastructure simulation platform to verify the choice of hardware purchased before it's installed on-site and to configure an entire network within minutes.

NVIDIA Air is a cloud-hosted network simulation platform that replicates a real-world production environment. NVIDIA Air is used to create a digital twin of your IT infrastructure so that you can use it for running full-scale network architectures with multiple NOSs, and validating configurations, features, and automation code.

### **Challenges**

NVIDIA offers extensive software capabilities, but its portfolio of hardware products does not currently include devices such as modular chassis, WAN routers, and power over Ethernet (PoE) switches.

### **Purchase Considerations**

NVIDIA's extensive portfolio of networking and computing solutions is noteworthy, with the vendor having developed AI-specific chips and infrastructure management solutions. This places NVIDIA in a distinguished position for enterprises looking to support AI workloads in their data centers.

NVIDIA's data center networking solution is suitable for greenfield deployments and is mainly targeted at large enterprises and infrastructure service providers. The vendor has extensive networking capabilities to support AI workloads.

### **Radar Chart Overview**

NVIDIA's focus on catering to the data center networking requirements of AI workloads positions the vendor in the Innovation/Feature Play quadrant. While NVIDIA's data center switching solution is still suitable for traditional enterprise (non-AI) workloads, this positioning highlights the vendor's differentiator for AI workloads.

## **6. Analyst's Outlook**

The data center switching space is mature and features a wide range of vendors with comprehensive capabilities for both hardware and software. Innovations in hardware keep up with the demand for increased data consumption, as most vendors are already providing hardware that supports 400 GbE ports, and some are starting to offer 800 GbE ports. Similarly, most players in the space now offer hardware suitable for supporting architectures used for facilitating east-west data center traffic. With the core switching capabilities at this level of maturity, vendors are now focusing more on automation, orchestration, and interoperability.

Most developments are taking place in the software space around NOSs and with management platforms. Increases in the complexity and number of data centers, as well as the distributed computing infrastructure for edge platforms, require switching solutions to support smooth design, deployment, and operations.

Openness and interoperability are other trends that need to be addressed by switch vendors. While integrated hardware and software solutions have been the norm and offer a consistent experience and a single point of contact, the resulting

solution may be more expensive and may lock in businesses with a single vendor. In contrast, disaggregated solutions may be more flexible and cost-efficient but could initially require additional skills and longer learning curves for the network operations team.

We expect that an increasing number of deployments will feature disaggregated solutions, leading to a more extensive networking ecosystem. Market share will become more evenly distributed among vendors because enterprises will have more opportunities to mix and match solutions depending on their investment capabilities and technical requirements.

All vendors featured in this report can provide reliable and performant data center switching solutions, regardless of whether they offer integrated or disaggregated solutions. The key aspect to consider when selecting a vendor is its capabilities for supporting the deployment and management of increasingly complex environments that are geographically distributed.

Especially when looking at edge deployments, it is important to keep costs manageable. Costs are not associated only with the price of hardware or software licenses but also with the number of network operators required to maintain the network. We therefore expect trends in the data networking space to focus on consistent management platforms and NOSs, while the hardware can be either integrated or bare-metal appliances.

To learn about related topics in this space, check out the following GigaOm Radar reports:

- [GigaOm Radar for Edge and Core Routing](#)
- [GigaOm Radar for Cloud Networking](#)
- [GigaOm Radar for Network Operating Systems: Large Enterprises and SMBs](#)

## 7. Methodology

For more information about our research process for Key Criteria and Radar reports, please visit our [Methodology](#).

## 8. About Andrew Green

Andrew Green is an enterprise IT writer and practitioner with an engineering and product management background at a tier 1 telco. He is the co-founder of [Precision.co](#), where he produces technical content for enterprise IT and has worked with numerous reputable brands in the technology space. Andrew enjoys analyzing and synthesizing information to make sense of today's technology landscape, and his research covers networking and security.

## 9. About GigaOm

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