

How to Make Smarter Choices for Data Center Network Architecture

Important technological and operational shifts are changing the very nature of the data center of today ... and tomorrow. But not every network technology provider has a clear, comprehensive architectural blueprint for new data center requirements. Here are some tips on how to evaluate and select the right data center network architecture.

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These are times of dizzying changes in the data center. In just a few short years, this nexus of enterprise computing has morphed from a single, monolithic, on-site collection of predominantly homogeneous network infrastructure to a multisite, heterogeneous mix of physical and virtual resources. This transformation is revolutionary both in its speed and its impact on how applications, data and IT services are provisioned, deployed and delivered to users inside and outside the enterprise.

The reasons for this dramatic change are numerous and well established:

- Applications such as social media and big data, combined with platforms such as cloud computing and mobility, are rewriting the rules of business.
- Compliance, stepped-up security requirements and distributed, virtual workforces are placing huge new pressures on data centers to do more than ever—often in the face of flat or even declining budgets.
- Most enterprises have supplemented their initial on-premise data center with one or more additional centers set in different locations for reasons of workload partitioning, security, disaster recovery or reducing the cost of data center real estate. This makes seamless, multi-site connectivity critically important.
- Data center applications and resources are increasingly becoming virtualized.
- Cloud computing's growth is both explosive and accelerating. Consultancy HIS Technology predicts that global spending on cloud infrastructure and services will reach \$235 billion by 2017, three times greater than the amount spent in 2011.¹
- Advanced analytics requirements associated with big data are putting tremendous pressure on data centers', impacting their ability to quickly and efficiently access and manage increasingly growing data volumes from diverse sources.



¹ "The Cloud: Redefining the ICT Industry," HIS Technology, January 2014.

As a result, IT directors and network managers are under tremendous pressure to redefine how to build and manage network infrastructure that is more powerful, more intelligent and more secure than ever. Doing so, experts agree, requires a different network architecture for the data center—one that is agile enough to keep up with tremendous change in technology and business processes, but at the same time offers a comprehensive, end-to-end approach that takes advantage of a growing palette of physical and virtual networking technologies.

What's Standing in the Way?

For many organizations, the traditional data center is undergoing a metamorphosis due to shifting business requirements. You can't talk to business executives these days without getting the idea that they want their organizations to become more agile and rapidly take advantage of new business opportunities while reducing operating costs. That means technologies such as cloud computing, virtualization, server consolidation and multivendor infrastructures have to be factored into long-term data center design and management.

Other data center challenges have arisen due to new business realities. Heightened requirements surrounding compliance, e-discovery and security mandate the evolution away from single-site, on-premise data centers in favor of distributed, redundant and virtual data centers to mitigate risk and improve prospects for business continuity.

Many traditional data center networks are getting in the way of achieving the goal of agility that all organizations crave and must take great pains to plan for. Why? Traditional network architectures are often designed in rigid, inflexible ways that inhibit a business' ability to rapidly expand. This can result in an overly complex infrastructure, which involves many manual configuration processes. It also often uses proprietary interfaces and protocols that limit an organization's ability to be dynamic and responsive with new and innovative open interfaces and protocols.

As a result, IT organizations often are faced with the unenviable task of ripping out legacy equipment and replacing it with new infrastructure. This is certainly

expensive, time-consuming and complex—hardly a recipe for agility.

Meeting these and other challenges now requires that IT leaders think in dramatic new ways about their data center network architecture. Instead of the patchwork, ad hoc approach to network architecture that has organically developed in many data centers over the past several years, IT organizations are looking for comprehensive, strategic frameworks that reduce complexity, increase infrastructure design flexibility and automate previously labor-intensive processes.

Building the Ideal Network Architecture for Today's Data Centers

There's no doubt that the data center of today—and beyond—is far more complex than ever. That's due, at least in part, to an impressive array of new technology options—physical, virtual, cloud-based—deployed in data centers to meet the increasingly complex requirements of cloud, mobility, big data and social media, as well as traditional enterprise applications.

Even as data centers need to become more agile, powerful and secure, they also become more challenging to deploy and scale without a comprehensive approach to the underlying network architecture. This requires an architectural philosophy steeped in three key principles:

- **Simple.** Data center networks must be simple to procure, deploy, manage and maintain, regardless of the mix of infrastructure brands and applications.
- **Open.** The days of single-vendor networks—either through procurement policies or vendor-specific technologies that encourage lock-in—are gone. The ability to support vendor-agnostic infrastructure is paramount, in order to ensure flexibility for data center architects and to protect financial investments made over time.
- **Smart.** Automation and deep analytics are essential elements in helping IT organizations save time and improve overall application as well as

network performance. At the same time, smarter data centers are far better prepared to identify, avoid and remediate potential security problems because of their sophisticated diagnostics capabilities.

Modern data centers also need to support the increasingly frequent requirement for seamless integration and management of multiple cloud computing approaches; it is no longer unusual to find organizations with private, public and even hybrid clouds coexisting in the same organization. Additionally, IT organizations are being called upon to make important decisions about how best to expand support for applications, data and services across geographically dispersed data centers.

When done with a strategic mind-set, these architectural philosophies should result in greater agility, improved user experience and long-term investment protection.

What to Look for in a Network Architecture Provider

Selecting a partner to help design, build and deploy a modernized data center network architecture requires you do your homework, because it's not just about the technology. You want a supplier that has the latest high-performance network technology, with tightly integrated functionality including security, orchestration platforms, virtualization and software-defined networking (SDN).

Today's network technology is more complex than ever when it comes to integration, deployment and ongoing management. Data centers now are strikingly heterogeneous, and integration for many IT organizations has meant a combination of homegrown efforts, third-party solutions and vendor-specific approaches. Undertaking this extensive effort requires not only deep technical skills and a broad and deep choice of infrastructure components, but it will also undoubtedly require a partner with considerable financial resources, a broad and reliable partner ecosystem, and strategic, long-range vision for both the overall data center and the network infrastructure itself. But, perhaps above all else, it requires a partner with a simple, open and smart architectural blueprint to unify all elements of the modern data center.

Supplier Overviews and Comparisons

One of the first things to keep in mind when identifying, evaluating and selecting a potential supplier of data center network architecture is that you're often comparing apples and oranges. Some suppliers are essentially network hardware suppliers who rely on third parties—or your own, already-stretched IT department—to tie it all together. Others may have some elements of an architectural framework, but they may be missing some of the critical components or fall short on such requirements as fully open solutions that avoid vendor lock-in.

Let's consider three suppliers, each with significantly different approaches and philosophies to data center network architecture: Arista Networks, Cisco Systems and Juniper Networks.

Arista Networks

Arista is a relatively young company (launched in 2008); it is currently a privately held company that has attracted considerable private equity funding from a number of leading venture capital firms.

The company says its key vertical market is the financial services industry, where its performance strength in network switches plays well in heavy transaction environments. For the same reason, the company also positions its products in other performance-centric market segments such as cloud service providers.

Industry observers give the company good marks for strong switching technology in industries requiring scalable performance and high reliability. They place considerable emphasis on “open” architecture in the positioning of their solutions, and are said to have strong relationships with other leading technology platforms such as VMware, Red Hat, Intel, Microsoft and EMC.

The company's Arista 7000 family of switches is the company's main hardware focus, which are said to include native support for VMware, network virtualization and a wide array of enterprise-class applications. The company also touts its EOS network operating system as a key enabler in third-party software development. Arista says

EOS is based on a Linux core with a central state-oriented database that promotes self-healing and high reliability.

Certainly, a key reason for Arista's strength to date has been its tight focus on its core mission to be a leading-edge supplier of network switching solutions. However, that narrow focus has meant the company has yet to develop its own comprehensive network architecture. Instead, Arista solutions typically are integrated by internal IT groups or third-party solutions providers that create data center network architecture by piecing together hardware and software from a wide variety of sources. For instance, Arista doesn't currently offer its own routing solutions to tie together its switches, and has to team with third parties to make that connection. Also, while the company's switches are said to offer solid hooks from physical infrastructure to virtual environments, they aren't perceived to offer the same kind of links from private, on-premises data centers to public cloud infrastructure.

Arista's focus on developing best-of-breed switching solutions means it has to partner with third-party technology vendors for security, because it doesn't currently offer its own security framework. For IT organizations with tight resources or limited familiarity with building and deploying heterogeneous network security, that's likely to result in higher costs in hiring third-party experts for integration, testing and deployment.

Finally, Arista's ability to offer a comprehensive framework for network architecture is compromised by its reliance on third parties for many architectural elements. Its product portfolio currently lacks routing and security functionality that have become increasingly important in today's modern data centers. It also lacks an SDN controller, choosing to rely solely on partnerships and/or application programming interfaces from third parties, and doesn't currently offer a consistent, centralized management platform that can be utilized across the network infrastructure of today's data centers.

Cisco Systems

For a long time, Cisco was the default option in most areas of data center networking. Founded in 1984 to develop routers that linked disparate local-area networks, Cisco

became a network hardware juggernaut and the early leader in networking infrastructure through a combination of in-house development and an extremely aggressive program of acquiring small companies in different networking market segments.

That corporate philosophy served Cisco well, eventually growing to a multibillion-dollar company offering a wide range of network hardware and software solutions. Cisco supplements its own product offerings with a number of strategic partnerships for virtualization, security, cloud services and other data center requirements.

However, one significant obstacle that enterprise IT leaders face with Cisco centers on the company's internal challenges with managing and integrating the various product lines and technologies that have come with the dozens of companies Cisco has acquired in the past two decades. As the company has sought to integrate acquired product lines at the same time it has introduced many of its own products, it has been difficult at times for IT organizations to understand Cisco's overall strategic vision for network infrastructure. In particular, IT organizations at times have struggled to understand how Cisco seeks to provide a singular, overarching framework for data center networking as its library of products and technologies has rapidly changed.

As Cisco has introduced new infrastructure and software, the new solutions haven't always been fully backward compatible with legacy equipment. That has made for some difficult and expensive decisions by IT organizations about whether and how to migrate away from long-installed Cisco solutions. One of Cisco's perceived strengths—a broad and deep product portfolio—also acts as a limitation for many enterprises because they can face a confusing array of hardware families, software versions and architectures that seek to tie it all together.

Late in 2013, Cisco brought out its Cisco Application Centric Infrastructure, designed to help tie together its hardware and software with centralized management of physical and virtual infrastructure, as well as a policy-driven automation solution for data center applications. While Cisco received some positive feedback for acknowledging the need for

comprehensive network architecture, there have been concerns that the solution is largely proprietary and serves to lock in customers to Cisco equipment.

Another key point revolves around Cisco's Application Policy Infrastructure Controller, which allows application network profiles to be configured through the API or graphical user interface and enables a single pane of glass for application-centric network policies. However, the controller is neither an SDN controller nor a management/orchestration platform, making it very different from popular competitive management platforms offered by companies such as IBM or VMware.

Also, Cisco's approach to network virtualization is important to note because it doesn't appear to have consistently tight ties to the leading virtualization hypervisor, VMware. Instead, Cisco has often pushed competitive virtualization platforms such as Hyper-V. That is likely to create certain integration challenges to IT organizations that have made strategic commitments to VMware, which accounts for about one half of all virtualization installations.

The net result is that, while Cisco continues to benefit from having a very large installed base and an extremely broad and deep product line, its commitment to maintaining numerous technology families has created some confusion for IT organizations. Also, its current attempts to create an overall network architecture appear to favor a Cisco-centric infrastructure framework, making it difficult for clients to move away from legacy Cisco gear if they decide to select different brands of equipment.

Juniper Networks

Since its formation in 1996, Juniper Networks has built its reputation around high-performance networks. The company has become a multibillion-dollar major force in data center networking, including offering solutions for mid-sized and large data centers for both enterprises and service providers.

Recently, Juniper made a strategic investment in meeting the rapidly changing needs of data center networks by developing and deploying comprehensive, end-to-end network architecture for modern data centers. As discussed earlier in this piece, data centers have morphed dramatically

into complex, geographically dispersed collections of hybrid physical-and-virtual infrastructure. IT professionals have struggled to manage these increasingly sophisticated and complex data centers, and have been looking for an overall network framework that reduces complexity, avoids vendor lock-in, protects legacy investments and creates a smarter, data-aware architecture.

Juniper's solution for the modernized data center network is the MetaFabric architecture, described as a "simple, open and smart" data center design that accelerates the deployment and delivery of applications within, and across, multiple sites and clouds.

At the heart of MetaFabric is a combination of high-performance, feature-rich switching, routing and security platforms. These platforms are indicative of a simple, streamlined portfolio that steers clear of vendor lock-in and helps ensure investment protection. Another plus is the fact that these platforms all run a single operating system (Junos), which further simplifies deployment, operation and maintenance of the network. Junos uses a single-pane-of-glass management approach to further simplify network operations through improved visualization and automation.

Juniper also has made it easier and safer to deploy various network services through its ongoing investments and innovation in network security. Finally, the Juniper solutions offer full support for data center orchestration through programmability, APIs and support for SDN controllers.

One of the key benefits of MetaFabric, as a simple, open and smart architecture, is its ability to deploy, utilize and manage a unified pool of network resources across geographically dispersed data centers. This—plus the ability to efficiently manage the increasingly commonplace combination of physical and virtual infrastructure—gives organizations a higher level of business agility, greater cost efficiency and vastly improved user experience to turn the data center network into a strategic asset.

A typical example of an organization with rapidly changing and demanding data center requirements is the Lotus F1 Team. "Grand Prix racing is all about fractional improvements over the competition, and [our] team's performance is inherently tied to technology," said

Lotus IT director Graeme Hackland. “The key for our IT operation is flexible provisioning across two data centers, and also ensuring that application agility and performance is optimized. The innovation that Juniper is offering with its MetaFabric architecture promises to take data center capability to a new level for enterprises with fast-moving businesses.”

Juniper’s commitment to its “simple, open, smart” philosophy is a crucial enabler in MetaFabric’s ability to help organizations do more with their data centers, while tightly aligning with most organizations’ desire to aggressively manage capital expenditures and keep data center operating costs as tight as possible. The “open” aspect of MetaFabric allows the integration with any heterogeneous data center environment; this ability to skirt vendor lock-in

situations protects an organization’s financial investments and guards against the need to keep spending more to keep up with new demands. The “simple” mandate is met by MetaFabric’s ability to deploy, operate and manage data center networks without service interruptions. Finally, MetaFabric’s “smart” characteristics include built-in intelligence and analytics that identify, mine, analyze and leverage data insights across all parts of the network, regardless of location or infrastructure type.

Finally, Juniper’s comprehensive approach to network architecture is enhanced by the sophisticated QFX5100, a single switch that can operate in one of multiple switching and fabric architecture environments, depending on your requirements. This further supports Juniper’s efforts to make data center networks open and flexible.

Comparing Data Center Networking Solutions from Arista, Cisco and Juniper at a Glance

	Arista	Cisco	Juniper
Portfolio	• Switching only • EOS network operating system • Merchant silicon-based platforms	• Broad line of switches, routers, and network software • Multiple product families with different operating systems, not always backward compatible	• Broad line of switches, routers, security, management, and software • Single Junos OS
Architectural Philosophy	• Scale-out switching architecture designed for density • Relies on partnerships for other data center infrastructure including routing and security	• Network architecture for greater lock-in • Features velocity achieved through new hardware platforms • Drive value through their own SDN controller	• Single approach for intra- and inter-data center connectivity • Simple, common building blocks for different customer architectures • Open for flexibility with ecosystem and investment protection

Conclusion

The revolution of data center design, management and operation is in full force. Traditional approaches are fast giving way to new frameworks that support heterogeneous, multisite philosophies that support a mix of physical and virtual resources.

Customers need to think about more than just switching when considering how to optimize their data center networks. One key element to this approach is taking extra time to ensure that all network architecture elements—from switches and controllers to APIs and security platforms—are easily managed as a synchronized asset. With this guideline, IT organizations need to think about working with a supplier that has a clear vision for where the data center is headed, in order to avoid confusion down the road and steer clear of potential problems that could affect data center investment protection.

Without new solutions that make data centers easier to manage, less complex and more cost efficient, IT and business leaders would continue to struggle under the weight of rapidly changing business requirements and the need to keep data center networks in alignment with those needs. Fortunately, new solutions are emerging that deliver comprehensive and flexible network architectures that are built upon three key pillars: simple, open and smart.

While there are several ways IT organizations can go in order to try to achieve that cohesive, end-to-end architecture, Juniper Networks' MetaFabric architecture is rapidly gaining acceptance over competing approaches. As data centers increasingly embrace new network infrastructure from different suppliers, the need for a modernized network architecture becomes more important than ever—one that supports a wide range of data center products and functionality, including switches, security protocols, orchestration platforms and software-defined networking.

Data center managers and network infrastructure decision-makers would be well served to consider Juniper's MetaFabric architecture as a way to support a wide variety of business objectives including increasing agility, simplifying management, protecting legacy investments and future-proofing the data center.