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Market Overview: Data Center Networking Solutions, Q1 2012

by Andre Kindness
for Infrastructure & Operations Professionals

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The Data Center Networking Solutions Mimic I&O's Virtualization Maturity

by Andre Kindness
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EXECUTIVE SUMMARY

Over the past year, infrastructure and operations (I&O) professionals have focused their enterprise networking efforts on readying network infrastructure to support virtualization, consolidation, and enabling a private cloud. The networking industry initially missed the virtualization train and has been playing catch-up ever since. Vendors have raced to release products and solutions geared toward helping the networking teams catch up to the virtualization revolution. This report focuses on critical selection criteria for evaluating the data center networking vendors and the ways in which your maturity with server virtualization should influence vendor choice.

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NOTES & RESOURCES

Forrester interviewed vendor and user companies, including Alcatel-Lucent, Arista Networks, Avaya, Brocade Communications Systems, Cisco Systems, Dell, Enterasys Networks, Extreme Networks, Hewlett Packard, IBM, and Juniper Networks.

Related Research Documents

"Virtual Network Infrastructure"
December 12, 2011

"The Data Center Network Evolution: Three Core Network Management Tools"
August 10, 2011

"Assess Your Infrastructure Virtualization Maturity"
July 10, 2009

YOUR NETWORK MISSED THE VIRTUAL REVOLUTION

Love it or hate it, virtualization ignited today's networking renaissance after smoldering for nearly half a decade. During that time, network teams discussed if enterprises needed gigabit to the desktop, ogled over the possibilities of 40 GbE, and weighed the merits of controller versus controllerless wireless LAN infrastructure. Meanwhile, server and storage teams sneaked up to the network infrastructure and implemented their own VLANs, virtualized their infrastructure, and stole that fluffy cloud icon that used to represent your network diagram. Forevermore, the tried and true ways of architecting, deploying, managing, and updating networks are no longer enough for the highly efficient, dynamic, and scalable infrastructure demands. It's gone so far that other groups are challenging networking's domain and architecting solutions that marginalize the network's value and even remove responsibilities owned by networking personnel. For example, take the rise of three technologies that move the network control away from network administrators:

- **Software-defined networks.** By defining flows and determining which paths those flows will take through a network, regardless of the underlying hardware, administrators or individual applications can take control out of the infrastructure — the switches, routers, and even network team — and put it into the application arena.

- **Flattening the network.** By creating a large flat environment, VMware with vShield v5 allows virtual administrators the ability to set policies, services levels, and security areas for applications and traffic to and from virtual machines (VMs).

- **Virtual instances and multitenancy of services.** Business units are pushing I&O to purchase multitenancy networking appliances (physical and virtual) — such as application delivery controllers (ADC), WAN optimization controllers (WOC), and routers — so that they can manage their own services. In addition, app developers are starting to purchase their virtual appliances like ADCs and firewalls.

I&O Leaders Lack Insight Into The Network

At first glance it would seem that I&O teams are transforming themselves into network manager-free entities. But nothing could be further from the truth. I&O leaders want to reduce costs but don't believe that eliminating the value of the network is the answer. I&O managers want to create a more tightly integrated infrastructure and data center team that can react quickly to business needs. That means integrating the network team with other functions, not doing away with it. This concept is echoed in the hundreds of networking inquiries from large enterprises that Forrester has fielded in the past two years. There's a clear trend of the network rising in importance for both IT and business objectives. I&O leaders have asked the following questions about the network:

> "How can my network help me improve communications?" (VP of operations, construction equipment manufacturer)

"What should I do about providing visibility into the network?" (Data center manager, insurance company)

"How can I create more dynamic infrastructure if it takes two days to make a network change?" (CIO of large financial institution)

"We have large swings in usage. What solution has the network elasticity that I need?" (Director of data center operations, retail company)

"I'm worried about the data. It seems like someone turned out the lights when we started virtualizing the data center. What network monitoring solution can give me visibility to meet my SLAs?" (Data center manager, manufacturing company)

Networks Are A Key Ingredient In Your Data Center Strategy

Why is there so much pressure on data center teams? CIOs have already invested in virtualization and private cloud computing. But networking infrastructures are the latest hurdle keeping I&O managers from completing the data center and virtualization initiatives they started back in 2009 and 2010. After years of investment in consolidation and virtualization of servers, I&O teams, in general, haven't realized the expected capital and operational savings. As a result, they can't hit their efficiency objective of running a lights-out data center. In surveys, server personnel, VoIP administrators, virtualization managers, and storage teams consistently assert that it's the network that's holding them back. Networks are components that connect everything, yet they fail to help orchestrate the right services. Thus, CIOs have realized that networks are:

- **A key factor for business competitiveness.** Networking is the fabric that connects customers, employees, partners, and suppliers. CIOs understand that networks are important in entering new markets, merging with or acquiring other companies, and integrating disparate business systems. Moreover, CEOs are pushing I&O teams to architect networks that embed the business into their customers' lives.

- **The place to support revenue growth.** The data center is only one aspect that organizations have invested in over the past few years. The other is the user's edge where desktops, laptops, printers, etc. connect. These ports are the key to supporting business decision-makers' top two priorities — growing revenue and acquiring/retaining customers.[1] To do this will require supporting a mobile, dispersed, and empowered workforce. That workforce demands a dynamic and flexible system to orchestrate the right service to the right person at the right time. And you can't meet that demand if the transport isn't built to accomplish the task.

- **A pathway toward cloud computing.** Cloud is yet another forcing function that has stressed I&O teams and wreaked havoc on the networking team. Many in the networking world remember the schematic cloud icon fondly, but now many detest the cloud because the business

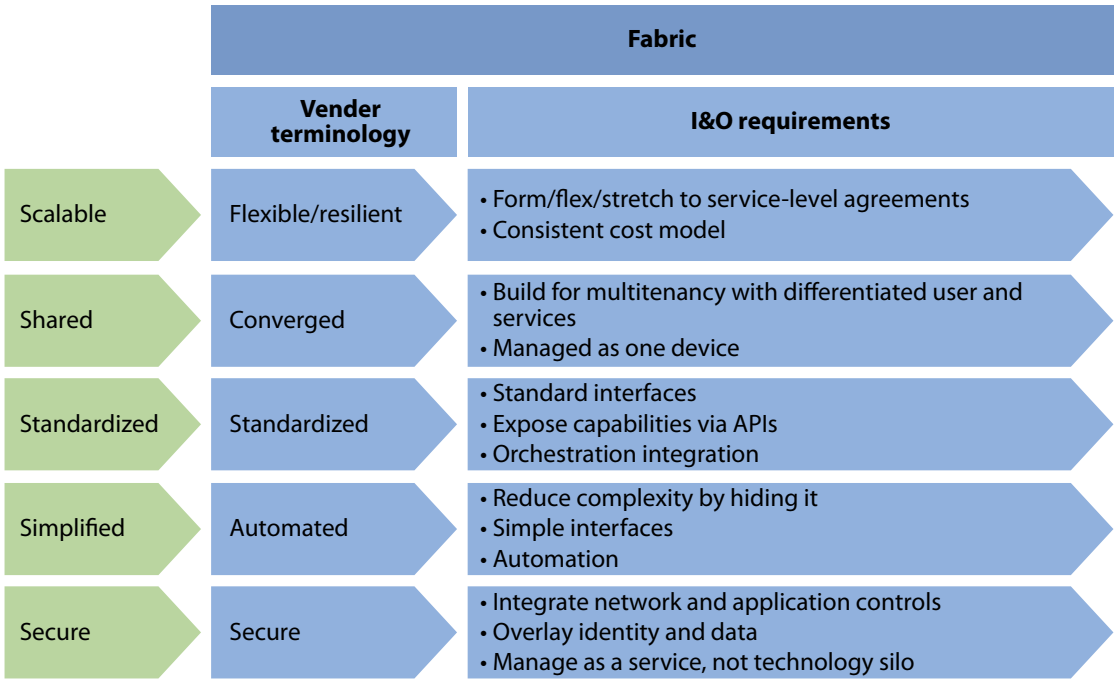
side is asking why other companies have it and they don't. The reality is that few clouds exist today. Forrester surveyed enterprise hardware decision-makers in Q3 2010, and 6% stated that they had a private environment as of the survey date, and another 25% stated that it was a high or critical priority for 2011. The goal is to achieve cloud efficiencies. Make sure your network strategy is plugged into the attributes of a cloud: self-serviceable, elastic, and metered usage.[2]

USE THE "FIVE S'S" TO SELECT YOUR DATA CENTER NETWORKING SOLUTION

Whether the business is striving to create infrastructure that mimics cloud compute capabilities or just wanting to increase its services and become more efficient, I&O professionals need to deploy an infrastructure that can accomplish five goals: 1) leverage and balance workloads between 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 interconnected components; 4) automate and orchestrate the infrastructure to deliver the right services for each user; and 5) allow management by business units.

The key to meeting these challenges is to invest in a data center "fabric." Fabrics are the key to modernizing your data center network and meeting the new IT and business demands. But what is a fabric, and why isn't it the same as what's been deployed over the past two decades? To date, fabrics have run the gamut from marketing fluff that does little to differentiate from traditional Ethernet architecture to a laundry list of technical attributes. Forrester believes that fabrics aren't specific technical attributes. Instead, we define a fabric as a network with five architectural characteristics, the five S's: 1) scalable; 2) shared; 3) standardized; 4) simplified; and 5) secure (see Figure 1). I&O managers should use these architectural characteristics as vendor selection criteria.

Figure 1 Evaluate Networking Fabrics Using Five Simple Architectural Characteristics



57738 Source: Forrester Research, Inc.

Fabric Characteristic No. 1: Scalable

Scalable infrastructure can expand easily. The infrastructure has the capability to flex and push traffic in new directions if it encounters resistance in other areas. And scalability isn't just about expansion on demand — it's also about the ability to contract without penalty. When considering the economics and capabilities in a scalable solution, I&O managers should approach it from:

- **An infrastructure vector.** As virtualization management tools move VMs around and split multitier applications across the data center to maximize server efficiency, the network must adjust while maintaining the highest services levels — even if links go down or more services are spun up. Interwoven links will flex and stretch — or reorient — traffic from one destination to another to minimize latency and packet drop. Vendors have responded to I&O demands for increased scalability and efficiency with proprietary or standards-based protocols — shortest path bridging (SPB), Transparent Interconnect of Lots of Links (TRILL) — protocols.[3] They offer multipathing capabilities for Ethernet. Avaya is one of the only options to keep your network open. I&O pros will have to weigh the importance of that, because they will be locked into a vendor contract for five to seven years.

- **A business vector.** Today, if an organization adds an edge switch and the distribution or core switches don't have any more capacity left, then it will need to add two distribution and two core switches to support the new edge switch and provide redundancy — the cost becomes a step function. When done correctly, additional increases in edge capability shouldn't cause a domino effect. I&O organizations have a variety of options to make costs scale linearly instead, but the options are size-dependent. For example, Brocade offers a solution that can scale from two to 24 switches under one logical control plane, then a new cluster needs to be formed. While Juniper scales to more hosts under one logical unit, its solution entry cost is higher: I&O will need to purchase a node, fabric, and controller to obtain all the QFabric benefits.

Fabric Characteristic No. 2: Shared

Sharing isn't new, but it's one of the hardest traits for organizations to achieve. Organizations hold on to information for the fear that losing it would result in diminished capacity and marginalize the group. This selfish attitude only hampers organizations from creating effective teams. This holds true for infrastructures. Highly efficient, flexible, dynamic infrastructure requires an open flow of information to efficiently use the resources that are available. To take virtualization to the next level in your data centers, you require:

- **Logical switch management, not just physical management.** Most networking vendors offer varying levels of management, ranging from simple single IP address control of a couple of switches to full orchestration of hundreds of devices. A shared control plane enables better coordination and orchestration of services. It can drive big efficiencies by configuring and managing multiple switches, eliminating spanning tree, and leveraging all links. For example, HP's IRF technology aggregates two upstream physical switches to allow a single switch downstream to send packets to both since the downstream switch sees them as a single switch.

- **The ability to support and merge traffic types.** I&O teams use FCoE, iSCSI, object storage, and NFS to move storage protocols off their own networks and onto a converged Ethernet fabric. This allows the use of a single cabling infrastructure to simplify network topology, reduce cost and complexity, eliminate half of the I/O adapter cards in a rack, and reduce power and cooling overhead — all while eliminating redundant operations. Most of them leverage Layer 2/3 networks, but FCoE requires a Layer 2 environment.

Fabric Characteristic No. 3: Standardized

As I&O pros ramped up virtualization, they realized that without solid processes in their organization, they'd end up with VM sprawl.[4] Thus, I&O leaders set out to industrialize their processes in order to enable the consolidation and avoid drowning in a sea of a thousand errant VMs. This effort produces simplified workflow, deployment, configuration, and maintenance of a data center in which automation can then take over parts that are repetitious. Standardization is the key — but standardization doesn't just mean standards-based; it also means consolidating options to a simple menu. Standardization pushes teams to leverage the same set of resources and therefore

reduces waste and ultimately creates a common language to facilitate communications between infrastructure components and inter-personnel. And, as always, buyer beware: Vendors play fast and loose with the phrase "standards-based" precisely to confuse I&O pros. This means I&O managers must do their homework and figure their business strategy around best-of-breed or partnering with only a few vendors who supply the end-to-end solution. With strategy in hand, I&O managers can find standards-based solutions ranging from:

- **Components . . .** Features like quality of service (802.1Q), link redundancy (MSTP), or routing (protocol) within solutions allow any component to be removed and replaced with another from another company and the solution will work just fine. Standards-based network features and components provide access to compelling volume economics, flexibility to adapt a much wider array of solutions, and relief from hiring specialized talent to run a science project. On the flip side, I&O organizations typically spend too much time trying to make the components work together since no vendor is providing best practices for all the options.

- **. . . to modules.** By grouping multiple components together, vendors offer a solution for a tier within the data center or the entire network. Proprietary elements can exist within a solution, but the ability to connect, have visibility, and leverage the resources must be available so that I&O can connect to other parts of the infrastructure and the flexibility to make changes later. This is fundamental in developing an ecosystem to serve the users. The key is to not standardize on technical features or individual components, but for example, on APIs that govern how the systems are orchestrated.

Standardization pushes teams to leverage the same set of resources, thereby reducing waste and ultimately creating a common language to facilitate communications between infrastructure components and even between functions. Thus, I&O should make sure that the solution supports the function to:

- **Drive out repetitious activity.** A set of standards have emerged that dictate flow control, bandwidth management, congestion management, and data center bridging communications. The new protocols — 802.1Qbb (PFC), 802.1az (ETS), 802.1au (CN), and DCBX — standardize them to ensure consistent deployment policies across the infrastructure: application to network to storage. Converging new services like storage onto Ethernet was the catalyst for these standards, and FCoE was the poster child for data center bridging protocols. The real value behind 802.1Qbb(PFC), 802.1az (ETS), 802.1au (CN), and DCBX is the protocols can lead to automation since there is a common way to carry policy information through the infrastructure.

- **Create a bridge between storage and Ethernet.** LAN and SAN convergence requires a unified management system to help with transition of duties from a SAN team to a LAN team. Team members can look at the same information, which will help them maintain the same communication vehicle for effective communication. Ultimately storage will become like VoIP — another service for the networking team to manage.

Fabric Characteristic No. 4: Simplified

The Airbus A380 has tens of thousands of monitored systems and surfaces, all detecting numerous changes and variations during the course of a long flight. Yet in the cockpit, all of the information is displayed on only eight monitors. The visibility system in the plane understands what is normal and what is expected during the course of a flight, and by using that understanding it can intelligently decide what information is significant and what is insignificant. Modern aircraft are much too complex for a pilot to fly one unassisted; the aircraft need to have onboard systems to stabilize and control the plane under the direction of the pilot.

Simplifying infrastructure and processes has a direct correlation to increasing the efficiency and flexibility of the organization while allowing a company to tap into a larger pool of human resources. As with aircraft, simplification isn't about having fewer moving parts, but about hiding the complexity. I&O teams can drive toward simplicity by standardizing and building infrastructure that can support infrastructure and process automation. This architecture consists of three components — the automation and orchestration controller, a monitoring and data collection system, and a configuration and management system — so that the network can intelligently orchestrate a set of services. I&O pros must look at their level of automation maturity and then review a solution's level of:

- **Management sophistication.** Management systems should allow for the deployment, management, and upgrade of the infrastructure through a GUI instead of the de facto standard, the command line interface (CLI). A good example is the transformation that occurred in the PC industry. Customers moved off DOS to GUIs with plug-and-play functionality.

- **Orchestration integration.** Solutions should allow for integration into larger tool sets. The vendors should offer application programming interfaces (APIs) to allow third-party access, unlocking value in data and services that would otherwise be hidden behind monolithic legacy systems. I&O should look for vendors who choose to expose APIs in this fashion. Those vendors will treat external developers as a customer constituency — they'll design the APIs to be intuitive and make the integration process simple.

- **Process support.** Data center automation solutions allow IT organizations to automate a variety of workflows that support configuration and change management processes across IT infrastructure.

Fabric Characteristic No. 5: Secure

Trust is the fundamental problem in information security today. With a higher trust model, I&O managers can deploy networks that are easier to build and maintain; I&O can even make them more efficient, more compliant, and more cost-effective. Visibility gives security professionals insight into what is actually going on in their network and the ability to verify access and inspect behavior on the network. There is an assumption that we need to monitor all applications individually in order to know who is accessing each application and what those people are doing. However, implementing

various controls and agents on each application in a large organization is not scalable. Luckily, in order for an application to work, traffic must traverse the network. It is much easier and more efficient to reconstruct and review what is happening on the application level by analyzing network traffic than it is to try and monitor hundreds or even thousands of individual applications.

The network is more than just a collection of physical links, switches, routers, or application delivery controllers (ADC); network also contains virtual instances of those physical devices. There is a lot of network traffic that stays within the virtual domain. But lack of visibility remains a top issue in the data center. It's not that I&O teams don't have tons of monitoring tools on-premises, but I&O might not have the right tools that give them traffic visibility into both the virtual and physical worlds. If I&O does have the tools, then there is an issue of teams having to look at different tools and correlate information or spend the time trying to integrate those tools. I&O teams can benefit from extending networking teams' control and management into the virtual world. Here's how to achieve unified visibility and control:

- **Monitor and manage virtual networks as one.** In a virtual server environment the most common way to provide virtual machine (VM) switching connectivity is a Virtual Ethernet Bridge (VEB), like VMware vSwitch, Microsoft virtual switch, and XenServer Open vSwitch. 802.1Qbg, 802.1Br (VN-Tag) protocols give networking teams a consistent management and control plane into the virtual world without being dependent on a particular virtualization vendor's management interface like VMware vCenter.

- **Integrate virtual and physical networks.** A virtual switch embedded in a typical hypervisor OS serves two purposes: It does the (usually abysmal) job of Layer-2 forwarding and (more importantly) hides the details of the physical hardware from the VM. In both cases, the details of the physical hardware are hidden from the VM, allowing you to deploy the same VM image on any hypervisor host in your data center (or to cloudburst it if you believe in that particular mythical beast), regardless of the host's physical Ethernet NIC. The hardware abstraction also makes the VM movement process run smoothly — the VM does not need to re-initialize the physical hardware once it's moved to another physical host.

THE DATA CENTER NETWORK LANDSCAPE CONSISTS OF FOUR STAGES OF FABRIC MATURITY

We're just in the infancy of data center fabrics. Many of the products now on the market are less than two years old, which means they have a ways to go on completeness, level of integration, and polish, which can affect your time-to-market and the degree of integration and customization work you will face. The data center networking arena is not short on the amount or types of solutions, but the differentiating aspects aren't very clear since the terms are bandied around so liberally. The industry has yet to create a de facto standard for fabric, and so we recommend using Forrester's five S's as the framework.

Since the products were so new, Forrester found that the vendors were at different stages of fabric maturity. By extrapolating Forrester's Virtualization Maturity Model, Forrester placed each vendor in one of the four stages of fabric maturity:

- **Stage 1: Acclimation.** Although servers have been virtualized, organizations wrestle with trying to understand how to leverage virtualization when it comes to security, application acceleration, and networking in this stage. Typically, vendors will offer logical groupings of switches and basic levels of fabric scalability. The solutions have been designed specifically for the data center, but a lot of capabilities have not been turned on. I&O should expect to see these vendors quickly move to stage 2.

- **Stage 2: Strategic consolidation and virtualization.** Networking, storage, and server teams feel more comfortable with the concept and have deployed in one form or another. They have been able to align support services to VM instances. More sophisticated automation and integration tools have been created but are usually limited to one hypervisor vendor. Most of the vendors were in stage 2, which makes sense because most of the respondents in Forrester's survey found themselves in that spot.

- **Stage 3: Process improvement.** Few organizations get past leveraging the unique benefits of the virtualization infrastructure features. Why? Implementation of processes requires development of workflow (dataflow): connection of compute, storage, applications, services, and users. This set of links highlights that everything is connected and analysis must be performed to determine where wasteful one-offs can be eliminated and standardization implemented. Vendors offer I&O teams consistent control from the physical world to a virtual one.

- **Stage 4: Automation and pooling.** Organizations discover that the key is automation, which reduces and potentially eliminates the repetitious and error-prone manual labor by creating virtualized pools of networking, storage, and server resources that can be instantiated by client self-service. There aren't commercially available infrastructures that enable customers to organize their network resources into a flexible cloud infrastructure that integrates the network with I&O's existing IT operational tools and processes. There needs to be more development and innovation by the vendors to create this network abstraction layer that allows customers to provision and deploy numerous individual network components based on policies that automatically respond to predetermined business scenarios and provides maximum performance across networking products and service delivery platforms.

Align Your Virtual Maturity With Vendor Stage, And Use The Five S's To Find The Right One

For those trying to keep all of this straight, the good news is that most of the solutions on the market will help to bring networking in line with the other teams in the data center. Each vendor has commercially available products and addresses unique data center challenges in at least one way. All the vendors offer a way to increase utilization of links and automated policies with VM movement, but then the field changes dramatically when examining other areas. To help I&O teams make sense of it all, Forrester categorized the vendors according to their fabric maturity. Look for a vendor that is at the same stage of fabric maturity or better as your I&O team. For example, if your I&O team is at stage 2 of your virtual maturity level, look at vendors in stage 2 or 3 — and use the five S's to narrow them to down to the best fit for your infrastructure:

- **Vendors at stage 1(acclimation).** I&O managers looking for one vendor to provide an end-to-end converged DC solution should look at stage 1 vendors. The vendors are juggling a lot of components and are at the beginning of building out their data center network solutions, but they all have scalable networking capabilities and some shared resource functionality with their logical switch management features. For I&O pros just starting down the long road of virtualization and wanting a converged infrastructure should look at HP, Dell, and IBM for partnering (see Figure 2). All three companies have bought networking solutions and thus can offer customers compute, storage, and networking in one pod. HP is the farthest ahead, with Intelligent Management Center, Virtual Connect, and Intelligent Resilient Framework. However, IBM and Dell can quickly catch up thanks to IBM's acquisition of BNT and Dell's recent acquisition of Force10.

- **Vendors at stage 2 (strategic consolidation and virtualization).** I&O teams further along in their virtualization, aligned with one hypervisor vendor, and wanting creative, practical, and consistent features will find vendors with solutions that scale, allow for standardization, and have shared functionality and secure features. For I&O teams managing high-speed data centers and wanting to leverage their existing tool sets, Arista Networks and Extreme Networks continue to build on their core strengths. Arista's modular switch software (EOS) and VM Tracer help I&O teams build their current orchestration tools and automate policies with VM movement. Extreme offers I&O support for standard extensible markup languages (XMLs), application programming interfaces (APIs), and software development kits (SDKs) for integration with other management platforms. If the organization hasn't committed to one hypervisor vendor and feels comfortable with multi-vendor platforms, Avaya has taken a leadership role in providing an open data center solution with its 802.1aq capability and support of VEPA (802.1Qbg). As an alternative, I&O leaders who don't want to get locked into one data center vendor should investigate Alcatel-Lucent's OmniSwitches and VitalSuite software. I&O professionals who have large data centers, need to reduce the operational cost associated with multiple management points, and want to move to converged infrastructures should consider Brocade or Juniper (see Figure 3).[5]

- **Vendors at stage 3 (process improvement).** Cisco offers I&O teams consistency across virtual and physical networks (see Figure 4). To Cisco's credit, it recognized that networking needed to change to accommodate the new demands of the data center. Cisco brings I&O managers the largest toolbox of all the vendors, chiefly because it has been developing data center solutions the longest. With 1000V and DCNM, I&O teams can start to standardize processes across storage and virtualization, support live migration across to other data centers, and implement patch tools that find noncompliant VMs. Next, I&O teams can use resource management tools to automate more and more of those pesky manual tasks such as bandwidth allocation or priority queuing.

OpenFlow And Other Software-Defined Networking Solutions Will Create New Entrants

In this market overview, we only included vendors that had production-ready solutions that provided core capabilities of a data center network. However, new entrants will offer alternatives to the established architectures of the networking giants. For example, Big Switch Networks, Nicira Networks, and NEC are either planning an OpenFlow type of solution or have one in limited production now. OpenFlow solutions propose to create a more dynamic and flexible infrastructure at a much lower cost. Here's how: Using the principles of server virtualization, OpenFlow solutions model network services within a logical control so that I&O can pre-provision and dynamically control the logical network without touching the physical foundation. Other solutions are offering an application or a BU the ability to program the network by seeing the network as a logical unit and manipulating by sending commands to the physical layer. However, Forrester recommends that mainstream I&O teams wait to adopt OpenFlow or virtualization solutions until they have been tested in open production environments.

Figure 2 Data Center Networking Vendors At Stage 1 Of Fabric Maturity

	Acclimation (converged infrastructure)		
	HP (3Com)	**IBM Network Systems**	**Dell (Force10 Networks)**
Scalable			
Intra-DC meshing technology	IRF	vLAG	Distributed Core Fabric
Inter-DC meshing technology	Extending IRF	None	None
Does your solution support RFC 5556, Transparent Interconnection of Lots of Links (TRILL) or 802.1aq?	No	No	No
Shared			
No. of physical devices managed as one logical unit	2	8	None
FCoE-enabled	No	Yes	No
FCoE multihop-capable	No	Yes	No
Standardized			
One LAN/SAN management system	No	Tivoli and IBM System Networking Element Manager	No
Data Center Bridging (DCB) protocols	No	802.1Qbb, 802.Qaz, 802.1au	No
Which system (VMware, vCenter, Citrix Cluster Manager, and Microsoft System Center) does your solution connect with?	None	Tivoli	None
Do you offer network APIs?	No	No	Yes
Simplified			
What is your data center management (DCM) software?	Intelligent Management Center	IBM Networking Element Manager	Dell OpenManage Network Manager (OMNM)
Orchestration software integration	None	Tivoli	Dell AIM
Can you create workflow process interfaces with your solution?	No	Yes	No
Secure			
Policy control on a virtual switch	None	None	None
How do you identify VM movement?	MAC	VMready+MAC	Dell Force10 Virtual Server Networking and vCenter
802.1Qbg edge virtual bridging (VEB AKA VEPA) and/or 802.1BR (VN-TAG technology) capable	No	No	No
Can you monitor, configure, or secure Virtual Ethernet Bridges (VEBs)?	No	No	No
Traffic visibility in management solution (physical port or virtual port on virtual switch)	Physical	Physical	Physical

57738 Source: Forrester Research, Inc.

Figure 3 Data Center Networking Vendors At Stage 2 Of Fabric Maturity

	Strategic consolidation and virtualization		
	Alcatel-Lucent	**Arista Networks**	**Avaya**
Scalable			
Intra-DC meshing technology	MLAG	MLAG	802.1aq (Shortest Path Bridging)
Inter-DC meshing technology	None	None	VPLS/MPLS
Does your solution support RFC 5556, Transparent Interconnection of Lots of Links (TRILL) or 802.1aq?	No	No	Yes, 802.1aq
Shared			
No. of physical devices managed as one logical unit	8	No	No
FCoE-enabled	No	No	No
FCoE multihop-capable	No	No	No
Standardized			
One LAN/SAN management system	No	No	No
Data Center Bridging (DCB) protocols	No	802.1Qbb	802.1Qbb
Which system (VMware, vCenter, Citrix Cluster Manager, and Microsoft System Center) does your solution connect with?	None	None	vCenter
Do you offer network APIs?	No	Yes	No
Simplified			
What is your data center management (DCM) software?	OmniVista Network Management Manager (NMM) & Virtual Machine Manager (VMM)	None	Configuration & Orchestration Manager (COM) and Virtualization Provisioning Service (VPS)
Orchestration software integration	None	None	None
Can you create workflow process interfaces with your solution?	No	No	Yes
Secure			
Policy control on a virtual switch	None	None	None
How do you identify VM movement?	virtual network port (vNP)+MAC	CDP packets+ VMware events	VSP+vCenter
802.1Qbg edge virtual bridging (VEB AKA VEPA) and/or 802.1BR (VN-TAG technology) capable	No	No	802.1Qbb
Can you monitor, configure, or secure Virtual Ethernet Bridges(VEBs)?	No	No	No
Traffic visibility in management solution (physical port or virtual port on virtual switch)	Physical	Physical	Physical

57738 Source: Forrester Research, Inc.

Figure 3 Data Center Networking Vendors At Stage 2 Of Fabric Maturity (Cont.)

	Strategic consolidation and virtualization			
	Enterasys	**Extreme Networks**	**Brocade**	**Juniper**
Scalable				
Intra-DC meshing technology	Virtual Switching+LACP	MLAG	VCS	QFabric
Inter-DC meshing technology	None	None	VPLS/MPLS	VPLS/MPLS
Does your solution support RFC 5556, Transparent Interconnection of Lots of Links (TRILL) or 802.1aq?	No	No	No	No
Shared				
No. of physical devices managed as one logical unit	2	None	24	128
FCoE-enabled	No	Yes	Yes	No
FCoE multihop-capable	No	No	Yes	No
Standardized				
One LAN/SAN management system	No	Yes	Yes	No
Data Center Bridging (DCB) protocols	No	802.1Qbb, 802.1Qaz	802.1Qbb, 802.1Qaz, 802.1Qau	802.1Qbb, 802.Qaz, 802.1Qau
Which system (VMware, vCenter, Citrix Cluster Manager, and Microsoft System Center) does your solution connect with?	Plugin vCenter and XENCenter, powershell MS SCVMM	All	None	vCenter
Do you offer network APIs?	Yes	Yes	No	No
Simplified				
What is your data center management (DCM) software?	Enterasys Data Center Manager	Ridgeline	Brocade Network Advisor	Junos Space
Orchestration software integration	Yes	None	None	None
Can you create workflow process interfaces with your solution?	No	Yes	No	No
Secure				
Policy control on a virtual switch	None	None	None	None
How do you identify VM movement?	DCM+vCenter	Ridgeline+MAC +VMWare/Citrix/ Microsoft	Brocade One+ vCenter+MAC	Junos Space+ VMware
802.1Qbg edge virtual bridging (VEB AKA VEPA) and/or 802.1BR (VN-TAG technology) capable	No	No	No	No
Can you monitor, configure, or secure Virtual Ethernet Bridges(VEBs)?	No	Yes	No	No
Traffic visibility in management solution (physical port or virtual port on virtual switch)	Physical	Virtual/Physical Port	Physical	Physical

57738 Source: Forrester Research, Inc.

Figure 4 Data Center Networking Vendors At Stage 3 Of Fabric Maturity

	Process improvement Cisco
Scalable	
Intra-DC meshing technology	FabricPath, Virtual Port Channel (vPC), and vPC+
Inter-DC meshing technology	OTV/LISP/VXLAN
Does your solution support RFC 5556, Transparent Interconnection of Lots of Links (TRILL) or 802.1aq?	No
Shared	
No. of physical devices managed as one logical unit	2
FCoE-enabled	Yes
FCoE multihop-capable	Yes
Standardized	
One LAN/SAN management system	Yes
Data Center Bridging (DCB) protocols	802.1Qbb, 802.Qaz, 802.1Qau
Which system (VMware, vCenter, Citrix Cluster Manager, and Microsoft System Center) does your solution connect with?	All
Do you offer network APIs?	Yes
Simplified	
What is your data center management (DCM) software?	Data Center Network Manager
Orchestration software integration	HP, CA, BMC, IBM
Can you create workflow process interfaces with your solution?	Yes
Secure	
Policy control on a virtual switch	1000v
How do you identify VM movement?	1000v or VMware/Microsoft/XenServer
802.1Qbg edge virtual bridging (VEB AKA VEPA) and/or 802.1BR (VN-TAG technology) capable	802.1BR
Can you monitor, configure, or secure Virtual Ethernet Bridges (VEBs)?	Yes
Traffic visibility in management solution (physical port or virtual port on virtual switch)	Virtual/Physical port

57738 Source: Forrester Research, Inc.

RECOMMENDATIONS

MATCH BUSINESS STRATEGY WITH THE RIGHT SOLUTION

Whether your organization runs multiple large data centers that are completely virtualized or a few medium-size data centers that are in the middle of consolidation and virtualization, there is a solution out there to make your data center more efficient. This doesn't mean you can go out and pick a solution off the shelf. Most of them are relatively new and contain vaporware, but the reality is that most organizations aren't ready for them anyway. To help zero in on the right set of vendors, Forrester recommends asking the following questions:

- **Where is your I&O team is in its virtual environment maturity?** Is your organization barreling down the path of standardization and automation, or are you still struggling to do something the same way twice? Don't buy a solution that has radically more functionality or capability than your I&O team can handle. Conversely, if you're fairly advanced already, make sure you don't sacrifice the other four S's for scalability.
- **Is FCoE part of your plans?** Convergence of FC and LAN significantly reduces the number of vendors who can support a converged environment. Some of the vendors claim to support FCoE, but only from a limited standpoint. For example, they may be able to offer one hope for an FCoE solution. Only a couple of vendors offer the same level of management and services that are found in separate SAN and LAN data centers.
- **Will you keep building out your data center, or will you buy public cloud services?** I&O teams that are considering leveraging outside infrastructures might not need the solutions that scale to tens of thousands of physical ports. Some of the solutions have higher entry costs because they scale so large. Economically they are suited for large data centers.
- **Will you support just one hypervisor or multiple hypervisors?** Although the majority of your virtual environment today probably relies on VMware, a growing number of I&O execs are demanding solutions that support Microsoft Hyper-V, Xen (and its variants such as Oracle VM), or KVM Resources. Quite a few of the vendors have not ported all of their capabilities over to other hypervisor vendors so that their solution integrates with multiple hypervisors.
- **What's your organization's comfort level with picking a single vendor?** Most of the technology in the data center is early in the adoption cycle, and thus most solutions require an end-to-end commitment if you want all the benefits. Keep in mind that data center infrastructure typically has a refresh cycle of seven to eight years — and that may be too long for you to commit to one supplier.

SUPPLEMENTAL MATERIAL

Companies Interviewed For This Document

Alcatel-Lucent
Arista Networks
Avaya
Brocade Communications Systems
Cisco Systems
Dell (Force10 Networks)
Enterasys Networks
Extreme Networks
IBM
Juniper Networks

ENDNOTES

[1] In the age of the customer, only the customer-obsessed will survive. That's why your business is prioritizing revenue and customer growth over cost-cutting in 2011. But is your IT infrastructure and operations (I&O) organization ready to participate? On one hand, business decision-makers already value technology's ability to support and serve customers much more highly than its ability to reduce costs. On the other hand, I&O leaders have a lot of work to do in reshaping the mindset and priorities of an organization that values availability and cost efficiency above all else. For more information, see the July 26, 2011, "Focus Your IT Infrastructure And Operations On Customer Obsession, Not Just Cost Savings" report.

[2] Another forcing function that has stressed I&O teams and wreaked havoc on the networking team is "cloud." Many in the networking world remember the schematic icon fondly but now many detest the term because business side is asking why other companies have it and they don't. Of course, no one is talking the same language; this leads to confusion and, ultimately, miscommunication and frustration. Communication is the No. 1 issue ranked by CIOs in the data center. To help alleviate the pain and create a common starting line of communication, both NIST and Forrester, similarly, define the cloud as:

A standardized IT capability (services, software, or infrastructure) delivered in a pay-per-use, self-service way.

The creation of a cloud computing infrastructure is not a light switch that just can be turned on but follows a pattern that breaks down into four stages of maturity:

Stage 1: Acclimation: Although servers have been virtualized, organizations wrestle with trying to understand how to leverage virtualization when it comes to security, application acceleration, and networking in this stage.

Stage 2: Strategic virtualization and consolidation: Networking, storage, and server teams feel more comfortable with the concept and have deployed in one form or another. They have been able to align support services to VM instances.

Stage 3: Process improvement: Few organizations get past leveraging the unique benefits of the virtualization infrastructure features. Why? Implementation of processes requires development of workflow (dataflow): connection of compute, storage, applications, services, and users. This set of links highlights that everything is connected and analysis must be done to figure out where waste — one offs — can be eliminated and standardization implemented.

Stage 4: Automation and pooling: Organizations discover that the key is automation, which reduces and potentially eliminates the repetitious and potentially error-prone manual labor by creating virtualized pools of networking, storage, and server resources that can be instantiated by client self-service.

Oh, wait. I don't want a cloud!

The reality is few clouds exist today. Forrester surveyed enterprise hardware decision-makers in Q3 2010 and found that 6% stated that they have a private environment today, while another 25% stated that it was a high or critical priority for 2011. The reality is most organizations don't want to become a cloud and are focused on other business matters. However, they do want to achieve higher levels of efficiency and be more flexible while being able to react quickly to business climate and demands.

So where are most organizations on this quest? Forrester found most organizations are still in stage 2 and the larger priority for 2011 was still consolidation and virtualization (reported as a high or critical priority by 80% of respondents. According to our Q3 2010 Hardware Survey, less than half (45%) of the x86 servers within enterprises are virtualized today and very few have reduced the amount overhead or increased their overall efficiencies.

[3] Proprietary protocols include IRF, VCS, and FabricPath. Standards-based protocols include shortest path bridging (SPB) and Transparent Interconnect of Lots of Links (TRILL).

To build a meshed Ethernet fabric, there are two categories of protocols you'll need: Standards-based options: TRILL (IETF) and 802.1aq (IEEE). These competing standards both use IS-IS for multihop environments and enable multipathing for Layer 2 networks. They remove the restrictions placed on networks by STP single-path networks, but don't require that STP be removed from your datacenter Ethernet infrastructure. Vendor-specific options: HP IRF, Cisco vPC, Brocade VCS, and Juniper Virtual Chassis These proprietary versions of TRILL can be considered a subset the standards bodies' proposals. Although it's tempting to deploy these options today, we've found there are many restrictions, poor interoperability, and enabling the functionality can often hamper other features within the product. See the December 15, 2010, "The Data Center Network Evolution: Five Reasons This Isn't Your Dad's Network" report.

[4] Why are most organizations not achieving more with infrastructure virtualization? They just aren't ready to. Through more than 200 enterprise interviews, correlated with survey data, Forrester has identified four clear stages of infrastructure virtualization maturity that dictate readiness for various management and automation technologies, process improvements that must be made, and standardizations that have to be realized to achieve greater gains. Organizations progress from gaining acclimation with the technology, to strategically standardizing on it, through a period of chaotic VM sprawl that leads to process improvements, on to the point of pooling and policy-based automation. See the July 10, 2009, "Assess Your Infrastructure Virtualization Maturity" report.

[5] Brocade's VCS fabric technology and its pedigree in the storage arena give networking teams the tools to simplify storage and Ethernet management. Data centers with large pools of servers or Hadoop cluster could leverage Juniper's QFabric technology to control up to 128 switches or more than 6,000 ports under one logical switch and provide a high-speed platform.

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