

A Forrester Consulting Thought Leadership Paper Commissioned By Brocade

Myth Buster: Deploying Virtualization Technology Does Not Automatically Create A Private Cloud

Next-Generation Data Center Can Only Be Achieved With Maturity In Virtualization, Infrastructure, And Process Standardization: Where Are You In Your Evolution To A Private Cloud?

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Executive Summary

Deploying server virtualization does not mean you have a private cloud. Surprisingly, 75% of respondents to this survey believe it does, and while server virtualization is vital, it's only one piece of the overall puzzle. To deliver on the benefits of cloud computing, IT must first achieve a minimum maturity level with virtualization, infrastructure, and process standardization. To achieve this level of maturity, Forrester has written that: "Cloud computing contains the seeds of the next generation of IT infrastructure, which allow the infrastructure to achieve greater utilization, flexibility, and operational efficiency. Automation is key to achieving this goal of dynamic infrastructure. But it's not an all-or-nothing proposition."

In most cases, server and storage have been virtualized and can be considered relatively mature, but components like process, people, and standards — to enable private clouds — are just emerging. In addition, enterprises have realized the infrastructure that connects everything together isn't ready either. Achieving the necessary levels of infrastructure maturity requires transforming today's complex, inefficient, and rigid multitiered data center networks into a dynamic, efficient, automated, and scalable system that has all the components tightly woven together and acts as a single unit.

In January 2011, Brocade commissioned Forrester Consulting to evaluate what was required to support the next-generation data center. Forrester Consulting surveyed 163 IT decision-makers from enterprises around the world and found organizations needed to address people, processes, and automation to transform their data center into a cloud. In addition, infrastructure and operations managers needed to balance their virtualization investments with investments into a network that works in harmony with the changes to servers, storage, and applications.

To help organizations navigate this transformation, organizations can self-assess their maturity based on their peers' experiences. This will enable IT organizations to understand where they are and how they can get to their goal based on those who have transformed.

Key Findings

Forrester's study yielded three key findings:

- Organizations will fail to achieve the value of private cloud if they underinvest in the network.
What it means: Companies need to invest in and deploy Ethernet fabrics to support flexibility and automation required by today's virtualized and cloud architectures.
- IT managers underestimate the importance of people, process, and automation in realizing their next-generation data center architectures.
What it means: To achieve the value of a private cloud, companies need to create processes, standardize them, and use them to automate the components of a data center.
- Most organizations do not understand the interdependencies of virtualization, servers, networking, storage, personnel, and applications.
What it means: Today's IT managers must assess their virtualization maturity, identify gaps, and find ways to evolve their data centers from static virtualization to cloud computing.

IT Is Aligning Efforts With Broader Business Initiatives But Suffers From Complexities And Meager Improvements

Industrialization through standardization and mechanization has been the staple for manufacturing, processing, and retail for decades, but IT organizations have traditionally been impervious to Lean Thinking concepts: measuring by objectives and optimizing workflow, Six Sigma, and kaizen; however, this exemption status has changed over the past few years with new pressures from the business. Thus, IT's uncontrolled build-out and euphoria of deploying the latest technology, in the name of supporting business initiatives, has come into question by CEOs. IT budgets have been growing exponentially over the past two decades while company revenues have seen marginal increases, and other departmental budgets are shrinking. During the economic downturn, infrastructure and operations professionals were questioned about:

- **The large amounts of distributed software and hardware.** Many firms questioned the redundant and fragmented IT capabilities of having duplicate assets, support functions, relationships, and processes. In fact, Forrester found that two-thirds of companies are restructuring their IT organization to be better aligned with the business and to reduce costs associated with duplication, inefficiency, and management ambiguity — poorly designed processes and organization structures, overloaded staff, and IT's traditional workaround culture.¹
- **Underutilized compute and storage power.** Traditional data centers had a single application or database associated with a particular piece of hardware to ensure that one application didn't interfere with the operations of another one. An x86 server deployment achieved only meager utilization and single-digit efficiencies.

Tearing a page from multitasking mainframes, 82% of technology departments embarked on the virtualization road to help them align with strategies like Dieter Zetsche, CEO of Daimler, espoused: "We systematically streamlined our business processes, increased efficiency, reduced costs, and otherwise left no stone unturned." The goals were to: 1) create a more shared and efficient infrastructure; 2) improve manageability and flexibility of the infrastructure; and 3) lower the total cost of ownership to support their organization in driving costs down.

Ultimately through virtualization, organizations believe they can create a cloud compute infrastructure: standardized IT capability delivered in a self-service manner and can be billed on a per-use manner.² However, after 10 years of having the capability of server virtualization, very few have created an environment where pools of resources can be ignited on demand. Most organizations that have embarked on the path to private cloud were not very far along the transformation and stuck on either putting their arms around virtualization, reacting to the new stresses on the infrastructure with consolidation, or trying to understand why a 5-minute VM move took two days to complete. These potholes are a shocker to most who wanted to ratchet up utilization and turn on policy-based automation overnight. Through hundreds of interviews, Forrester has determined that the creation of cloud is not a light switch that can just be turned on but follows a pattern that breaks down into four stages of maturity (see Figure 1):³

- **Stage 1: acclimation.** Twelve percent of companies surveyed have started testing the value behind virtualization. Companies typically virtualize noncritical applications and wrestle with trying to understand

how to leverage virtualization when it comes to security, application acceleration, and networking in this stage, so any kind of efficiency gains are difficult to ascertain.

- **Stage 2: consolidation.** Almost half the respondents are in stage 2, where application and server teams grow more comfortable with the concept, maturity, and stability of virtualization (see Figure 2). They have been able to align support services to VM instances. Typical benefits from consolidation and standardization are still low because large amounts of time and energy are spent retracting hardware and software from remote locations, deploying them in the new virtualized environment, testing the new architecture, and adjusting resources for unaccountable issues.
- **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 (data flow): 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. This stage is where companies drive the largest efficiency gains as wasteful, laborious processes have been eliminated, and resources are directed toward creating new value and reducing friction.

Figure 1

The Four Stages Of Infrastructure Virtualization Maturity

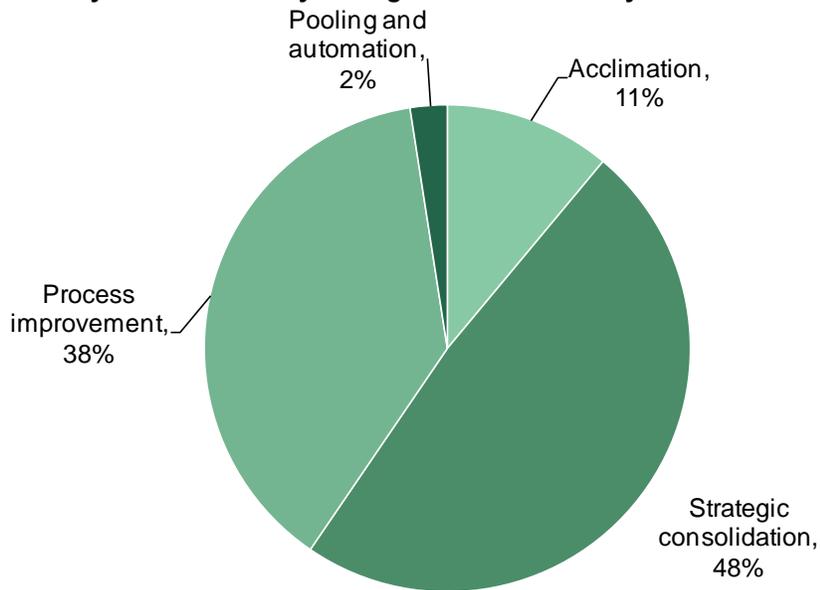
<p>Stage 1: acclimation</p> <ul style="list-style-type: none"> • Get comfortable with it as a concept and tool. • Deploy for test/dev. • Deploy for non-business-critical DR. • Some production deployments — but tactical • No change to operations processes • Limited virtualization tool deployments 	<p>Stage 2: strategic consolidation</p> <ul style="list-style-type: none"> • Comfortable with concept, use, maturity, stability • Shift mindset from server to virtual server. • Spread production deployments widely. • Begin deployment for some business-critical DR. • Painfully transition from server sprawl to virtual server life-cycle management. • Experimenting with live migration of VMs and balancing resources pools with utilization
<p>Stage 3: process improvement</p> <ul style="list-style-type: none"> • Using live VM migration and starting to trust system feedback on utilization and resource availability • Deploy for business-critical DR. • Begin bifurcating applications between priority and nonpriority. • Developing new operational efficiencies • Process improvement spreading/butting up against network, storage, security, development 	<p>Stage 4: pooling and automation</p> <ul style="list-style-type: none"> • Trust automatic optimization of resources and consumption. • Implementing production policies for automation • Some mission-critical DR deploys • Pooling and internal cloud development • Chargeback/utility tracking • SLAs and QoS focus

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

Figure 2

Few Organizations Have Reached Cloud-Like Capabilities

“How would you characterize your organization’s maturity level with virtualization ?”



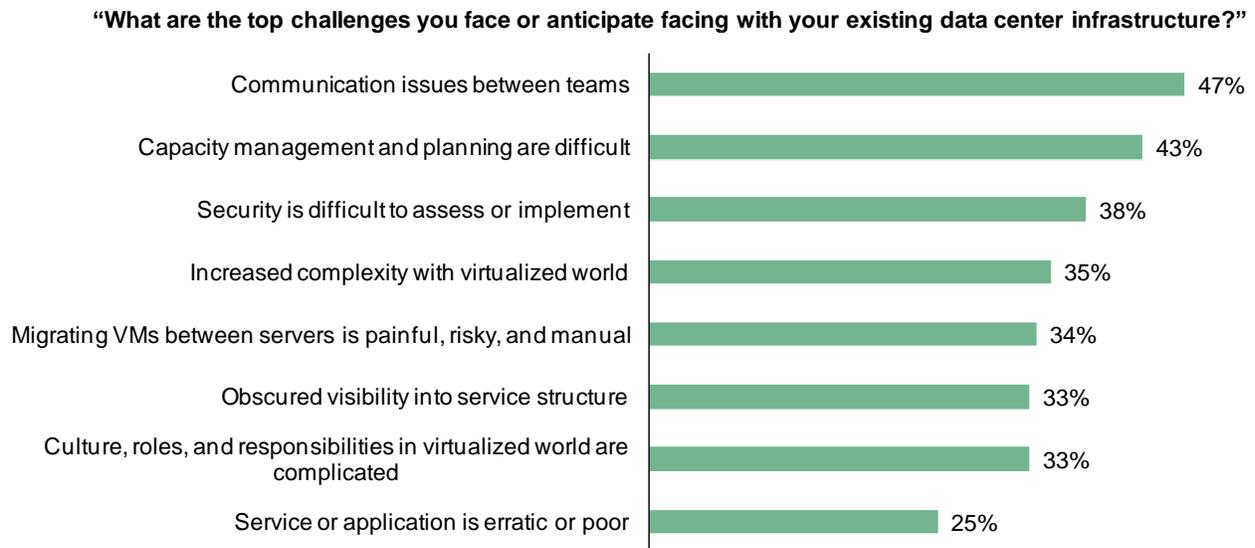
Base: 163 IT decision-makers in North America, Europe, and APAC
(percentages may not total 100 due to rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

With most respondents in stage 2 and stage 3, even though they have embraced and deployed virtualization capabilities, it’s not surprising that the results have been meager; 80% of respondents say efficiency improved only slightly or none at all. The respondents felt they weren’t getting the return on investment (ROI) because the infrastructure and operations managers were plagued by miscommunication, complexity, and one-off processes, which sabotaged business goals (see Figure 3). The lack of standardization and the creation of process within IT have hampered organizations from obtaining cloud value.

Figure 3

Process Improvement Continues To Weigh Down Data Center Improvements



Base: 163 IT decision-makers in North America, Europe, and APAC
(multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

The Network, Processes, And Automation Are Central To Achieving Today’s IT Objectives, Yet Companies Get Transfixed By One Variable: Virtualization

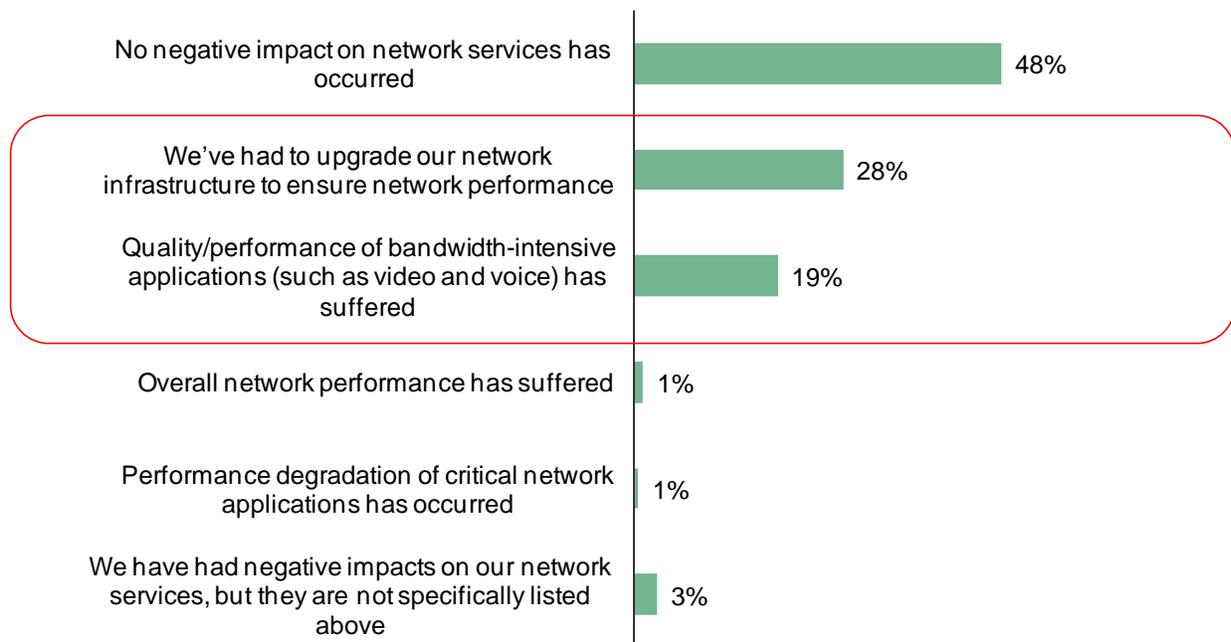
The issue isn’t that virtualization technology isn’t a good value or cloud economics can’t be achieved, but rather value can’t be achieved without the following ingredients: virtualization, networks, and automation. Automation can’t occur without the creation of processes (the input and output of interlocking pieces: virtualized hardware, networks, and applications). Organizations, in stage 2 and stage 3, were focused on virtualization of servers. For example, 75% of IT departments feel that server virtualization will enable infrastructure to become a private cloud. And yet the largest issue plaguing departments was communication between teams because these organizations had overlooked the interdependency between the server infrastructure and the network. Instead of having a pool of resources responding to demands automatically, these organization silos communicate through service tickets. For example, a VM move would require a service ticket being issued to the networking team that would adjust the port settings on both the existing port as well as the destination port for the virtual machine. Upon completion, the ticket would be passed to the server team to perform the move. Lastly, the ticket would be sent back to the requester for verification and closure. This process is antiquated, time-consuming, and error-prone.

Stage 4 IT departments, as they moved from stage 1 to stage 4, understood that ROI could only be attained if they invested in more than just server virtualization. This result can be shown by 50% of the companies that didn't invest in the network before or during the data center transformation. These companies suffered from degradation of services or had noticeable increases in operational costs (see Figure 4). When they did invest in network upgrades, not just a refresh, the businesses felt they had achieved a 100% increase in efficiency and productivity from where they were before the upgrade. The key was balance of investment in server virtualization and an infrastructure that supported the flow of information and the network.

Figure 4

The Network Was Underinvested And Not Considered In The Evolution Of The Data Center

“Since implementing solutions for your top-ranked IT initiatives, which of the following most closely describes what your organization has experienced as a result?”



Base: 163 IT decision-makers in North America, Europe, and APAC

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

Investing in the network is only the first part to keep organizations from achieving a private cloud. The other is creation of processes after realizing the components — servers, applications, and networks — are interconnected. Once processes are defined and standardization is created, then automation can start to occur. Humans and organizations don't have the capacity, nor is it practical, to manually monitor and adjust all the variables within the cloud. Cloud requires a fly-by-wire (FBW) solution. Automation helps orchestrate virtual

infrastructure components: provision new components, manage the configuration, alter the data center, update hardware firmware, and issue new versions on the fly. Process automation has two main benefits:

- **It effectively reduces the time and resources.** On average, CIOs say it takes two days to get a new set of IP addresses from the IP team even though it's 30 minutes of manual work. The process requires a ticket to be created and assigned, someone to acknowledge and process the request, and then for it to be verified and closed.
- **It guarantees greater accuracy.** Greater accuracy in turn leads to a reduction in resources required to repair the errors introduced while performing these tasks. This improves the reliability of the system and lowers the operation cost of the organization, eliminating the need to hire extra personnel to monitor problem locations.

Many organizations will remain in stage 2 and stage 3 of cloud maturity if they continue to rank network management and automation second to last on their list of priorities (see Figure 5). By not incorporating tools that enable automation, 32% of respondents indicate that the amount of personnel has remained the same while 47% say they have a larger staff in the data center (see Figure 6).

So what can you do to transform your data center? Forrester recommends a two-step process:

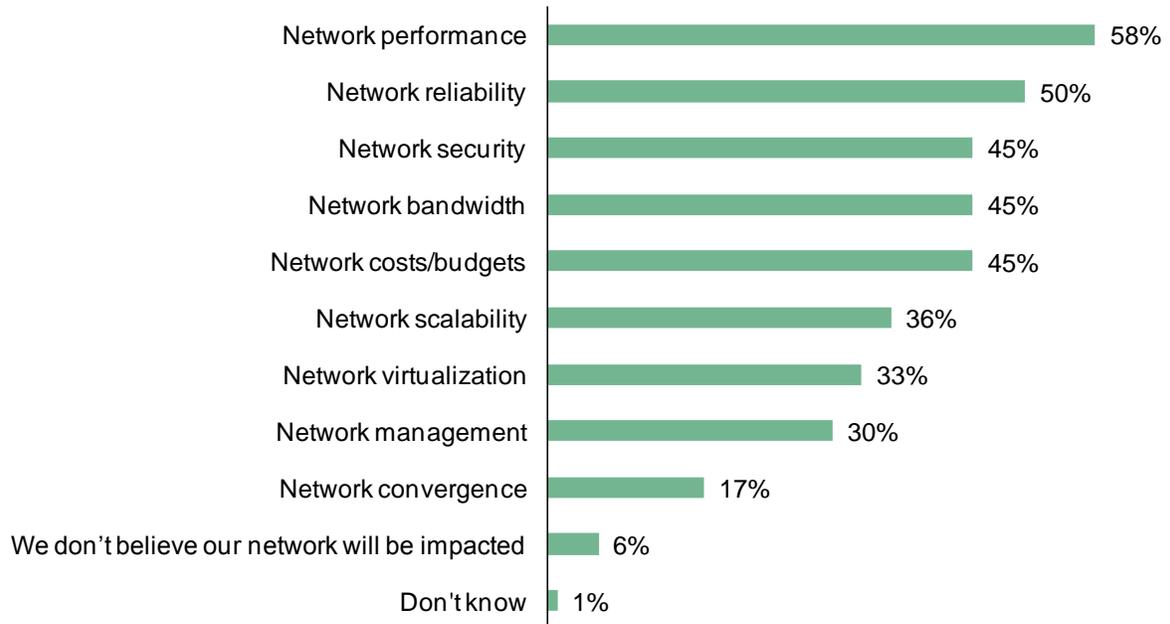
- **Step 1:** Include the network in your data center transformation to realize the true value of a private cloud.
- **Step 2:** Assess your virtualization maturity and close any gaps necessary to move from basic virtualization to a cloud-optimized data center.

The combination of steps provides organizations a blueprint to move past the hurdles that have slowed others from realizing the full benefits of the cloud.

Figure 5

I&O Managers Fall Back To Performance Even Though Process Improvements Hinder Their Evolution

“When thinking specifically about the network, which, if any, of the following aspects do you believe will impact your current applications or IT initiatives?”



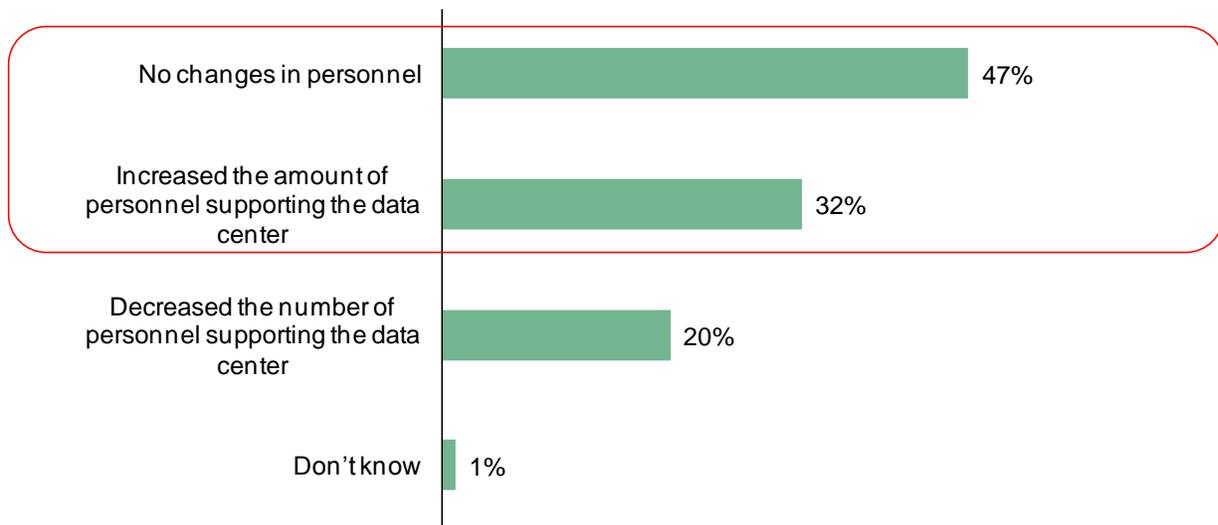
Base: 163 IT decision-makers in North America, Europe, and APAC
(multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

Figure 6

Automation Hasn't Taken Hold In The Data Center

“With respect to data center transformation (consolidation and virtualization), how has the amount of people supporting the data center changed?”



Base: 163 IT decision-makers in North America, Europe, and APAC

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

Step 1: Include The Network In Your Data Center Transformation To Realize The True Value Of A Private Cloud

Virtualization of servers has increased the efficiency of hardware but has done little for process, except increased the complexity. With multiple VMs on a machine, there are multiple IP addresses, policies, and services associated with that port now. The key is to take the human out of the equation, similar to what was done in the aerospace industry with FBW.

FBW broke into the big time with the Apollo program, which landed on the moon 40 years ago. Testing teams demonstrated that humans couldn't fly the rocket or big airplanes because human reflexes are simply not fast enough to keep an aircraft on course with so many variables, which is true with data centers today.

Virtualization is the vehicle or craft to negate the cohesion of an application to a server, but virtualization alone does not create a private cloud. The cloud (craft) needs to have:

- **A closed-loop control system.** Standardizing process and hardware allow for this system to be monitored, a management system to automatically adjust the system based on specified criteria. This takes out human interaction, which will cut down time for response and errors.
- **A high-speed, resilient, flexible, and intelligent infrastructure.** VMs will theoretically move on the fly, based on usage, around the data center. Old networks that were static and often fixed by throwing more bandwidth at them will go away. The next-generation ones will have to be intimately tied in the virtual world and virtual switches; it will have to utilize wasted redundant links and flat and resilient architectures, have high throughput and high-speed storage onto IP, and is intelligent to accept commands from an automated, closed-loop control system, automated.

Implement An Ethernet Fabric As Your Primary Data Center Network Investment

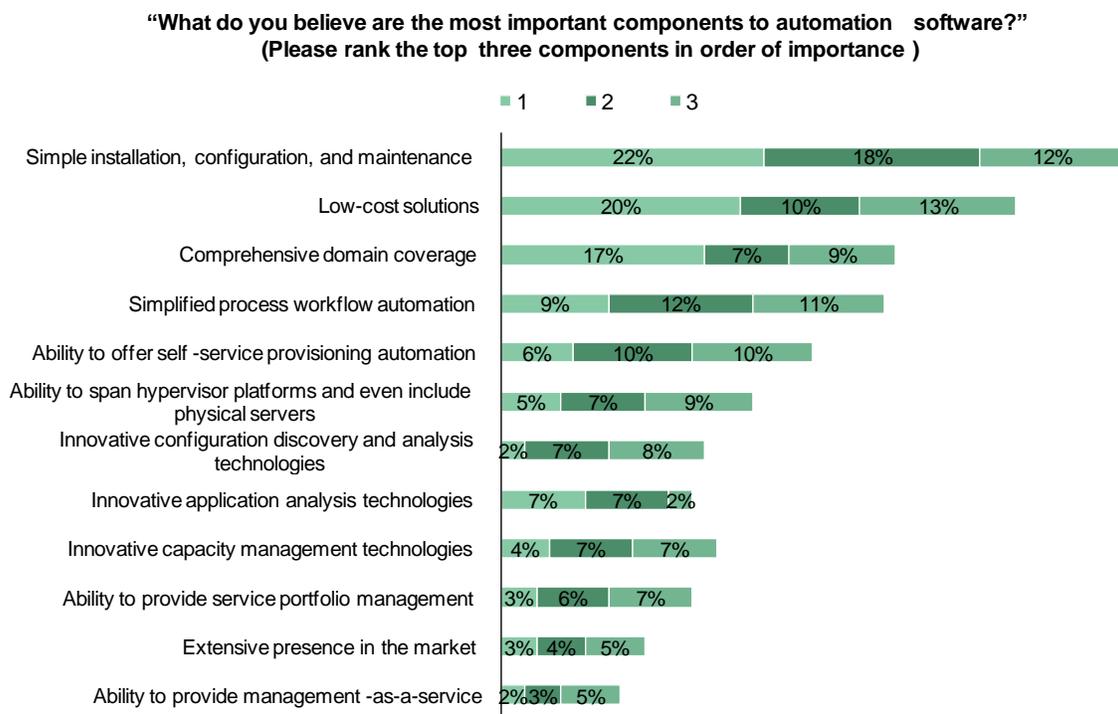
Implementing an Ethernet fabric is the key to achieving an FBW network architecture. Why? Because an Ethernet fabric is a highly scalable, interwoven, intelligent, and efficient set of connections to enable the flow of data. Like threads in a cloth that are interwoven, networking hardware and software are interwoven together and act as a single unit providing capabilities more powerful than the individual components. In short, an Ethernet fabric provides the necessary flexibility and automation needed for next-generation data center architectures.

To get started with your Ethernet fabrics, you should do four things:

- **Tie virtual switches into the network and its management.** Today, most server teams have control over a virtual switch (vswitch), which is an extension of the network edge into a hypervisor. As a vswitch exhibits the same characteristics as its physical counterpart, vswitch management should be part of the networking solution. This will ensure that there is standardization across the network fabric.
- **Control interactions between the server vswitch hypervisor and the physical switching infrastructure.** To maximize efficiency and security, there needs to be control and balance between what packet processing is done in the server versus what can be accomplished by a physical switch. Virtual Ethernet Port Aggregator (VEPA) moves this switching to the physical switch and removes the burden of switching from the physical server's CPU.
- **Flatten the network layers, and converge it with storage.** Elimination of standby links and separate networks (LAN/SAN) reduces the amount of components within the infrastructure that requires purchase, management, maintenance, and troubleshooting. Process implementation and standardization can occur more rapidly when design, deployments, and management are simplified and no longer redundant or done by disparate teams.
- **Integrate management systems as part of the networking solution.** Orchestration and automation can only occur if the supporting component feeds fault, configuration, traffic, security, and performance information into a data center system that allows for automatic corrective action and realignment of all the components (server, network, applications, security services, etc.).

Only through a combination of servers, virtualization, automation, and closed-loop fabric networks will IT be enabled to follow the lessons of other business movements that have industrialized their processes to achieve more efficient business outcomes and sustainable competitive advantage. The industrialization efforts enable the consolidation process to effectively eliminate a death by a thousand cuts. Essentially, this would provide a simplified workflow, deployment, configuration, and maintenance of data center that organizations are striving to achieve (see Figure 7). Forrester defines this type of architecture as: “A standardized IT capability (services, software, or infrastructure) delivered in a pay-per-use, self-service way.”⁴

Figure 7
Simplification And Reduction In Resources Is At The Top Of Mind And A Critical Attribute To Cloud Computing



Base: 163 IT decision-makers in North America, Europe, and APAC

Source: A commissioned study conducted by Forrester Consulting on behalf of Brocade, February 2011

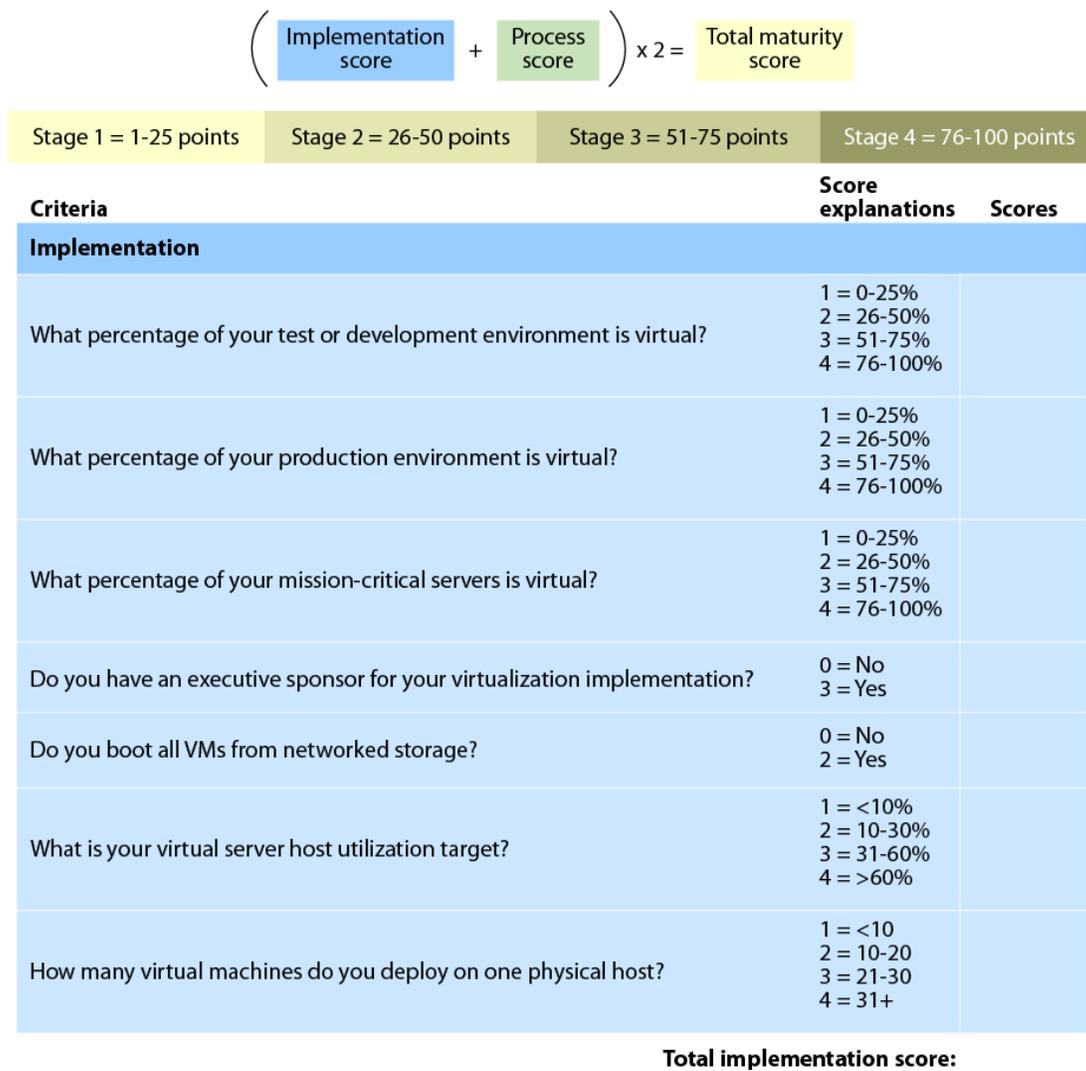
Step 2: Assess Your Virtualization Maturity And Close Any Gaps Necessary To Move From Basic Virtualization To A Cloud-Optimized Data Center

Investing in your network resets your data center foundation. It provides an orchestration layer to embrace automation and address the process and standardization issues that plague legacy data center approaches;

however, your work is not done. Upon this foundation, you must now tackle the remaining virtualization best practices to evolve your overall data center and private cloud maturity. In short, you must achieve stage 4 maturity in Forrester’s Virtualization Maturity Model.

So where is your organization in achieving a cloud-like infrastructure? Assess your current maturity, and this will help you to identify your stage of maturity and uncover unseen anchors (see Figure 8). With this visibility, you have a clear starting location and line of sight to move on to the next stage.

Figure 8
Forrester’s Infrastructure Virtualization Maturity Assessment



Processes		
Do you utilize live migration?	0 = No 1 = Yes	
Do you utilize automated resource scheduling?	0 = No 2 = Yes	
Do you utilize VM templates to propagate changes into production?	0 = No 1 = Yes	
Have virtual servers reduced the number of people or tools required to deploy new systems?	0 = No 2 = Yes	
Have you used virtual servers to simplify day-to-day tasks like patching or system changes??	0 = No 2 = Yes	
Are you virtualizing applications even if they require a dedicated VM host?	0 = No 1 = Yes	
Have you financially accounted for the benefits of virtualization to your organization?	0 = No 1 = Yes	
Have you set up improved SLAs for your virtual environment (e.g., better availability)?	0 = No 2 = Yes	
Do you charge back or allocate costs based on virtual resource consumption?	0 = No 2 = Yes	
Are you using virtualization-optimized management tools for VM backups?	0 = No 1 = Yes	
Are you using virtualization-optimized management tools for VM monitoring?	0 = No 1 = Yes	
Are you using virtualization-optimized management tools for VM migrations?	0 = No 1 = Yes	
Are you using virtualization-optimized management tools for capacity planning?	0 = No 1 = Yes	
Are you using virtualization-optimized management tools for high availability?	0 = No 1 = Yes	
Does every VM that you deploy start with an approved template from a formal library that is maintained and updated centrally?	0 = No 1 = Yes	
Have you implemented a self-service portal for provisioning VMs?	0 = No 1 = Yes	
Do your testing and development VMs all have expiration dates?	0 = No 1 = Yes	
Have you implemented a "virtual first" policy?	0 = No 2 = Yes	
Do you have a virtual infrastructure architect on staff?	0 = No 1 = Yes	

Total process score:

Source: "Assess Your Infrastructure Virtualization Maturity," Forrester Research, Inc., July 10, 2009

KEY RECOMMENDATIONS: THE WHOLE IS GREATER THAN THE SUM OF THE PARTS

Companies are striving to lower their operating costs and increase services through enabling private cloud computing services. A cloud solution isn't just a virtualized server but also a finely tuned machine with interlocking components that are synchronized and controlled by a sophisticated management system. Enterprise I&O shops will fail to realize the benefits of cloud if they maintain a "silo" approach or fail to consider the impact of the network infrastructure. To be ready, organizations must scale operational standardization, automation, interconnecting technology, and virtualization mountains. Those physical barriers can be overcome by:

- **Breaking down the technology silos.** The IT industry has been focused on the interdependencies of servers and applications but has forgotten about the importance of a network that must be highly resilient, intelligent, and converged. The network is a key asset to enable the value of virtualization and enable a cloud compute infrastructure.
- **Forcing process standardization.** Organizations that take on the task of standardization with hardware (server, storage, and networking), software, and procedures also create methods of workflow and optimize communication. Organizations that have not standardized all the pieces will not be able to realize the full value of a cloud computing infrastructure.
- **Incorporating the deployment of automation tools.** Every transaction or movement of data has hundreds of underlining activities within an infrastructure. Management tools and infrastructure that can seamlessly and automatically monitor, analyze, alert, and correct the situation will enable an abstract set of resources to be used in a self-service and billable manner.

Appendix A: Methodology

In this study, Forrester conducted an online survey of 163 enterprises in North America, Europe (the UK), and APAC (Australia and India) to evaluate what was required to support the next-generation infrastructure. Survey participants included decision-makers in roles such as:

- Senior network administrators and engineers (individual contributor).
- Directors, VPs, and other senior decision-makers of network operations (managers).
- Infrastructure architects (to understand where the network fits into technical architecture).
- Enterprise or application architects (to understand project and personnel issues related to the network).

The study began in January 2011 and was completed in April 2011.

Appendix B: Endnotes

¹ CIOs who wish to position IT for more sustainable contributions to business productivity and innovation must first address two problems that have consumed IT since the early days of client server: 1) duplication within IT assets and organizations, and 2) IT's traditional workaround culture. These conditions sap IT budgets and management's attention — making focus on business outcomes elusive and fleeting. CIOs must regularly look for symptoms signaling a rise in duplication and organizational ambiguity on the strategies and values that should guide IT efforts. Source: "Position IT For Innovation By Fixing Duplication And Ambiguity," Forrester Research, Inc., July 13, 2007

² A standardized IT capability (services, software, or infrastructure) delivered in a pay-per-use, self-service way. Source: "You're Not Ready For Internal Cloud," Forrester Research, Inc., July 26, 2010

³ Source: "Assess Your Infrastructure Virtualization Maturity," Forrester Research, Inc., July 10, 2009

⁴ Source: "You're Not Ready For Internal Cloud," Forrester Research, Inc., July 26, 2010