January 15, 2009

Storage Choices For Virtual Server Environments

by Andrew Reichman
for IT Infrastructure & Operations Professionals

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Storage Choices For Virtual Server Environments

Most Firms Go Conservative But Still Struggle With Performance And Efficiency

by Andrew Reichman
with Stephanie Balaouras and Christian Kane

EXECUTIVE SUMMARY

Server virtualization is the most substantial shift in IT so far this decade. Adoption is high, and firms are virtualizing mission-critical and business-critical applications. But while server virtualization has become mainstream, firms still struggle with storage availability and performance. Storage configuration options abound, and successful deployment can be tricky. In an attempt to add clarity to this tricky decision process, Forrester surveyed 124 of its global clients on the topic of storage for virtual server environments. Overall, Forrester found a high number of virtual server deployments in production, mainly using preexisting Fibre Channel storage area networks. For IT professionals who will either upgrade or deploy a new storage environment to support server virtualization, this report gives an overview of what firms have done in the past, as well as key Forrester recommendations.

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NOTES & RESOURCES

Forrester's September 2008 Global Virtual Server Environments Online Survey was fielded to 124 infrastructure and operations professionals from our ongoing IT research panel. The panel consists of volunteers who join on the basis of interest and familiarity with specific IT topics. For quality assurance, panelists are required to provide contact information and answer basic questions about their firms' revenue and budgets.

Related Research Documents

"Q&A: Top Questions About VMware Backup"
July 14, 2008

"Cost Comparison Of iSCSI Versus Fibre Channel SAN Components"
February 7, 2008

"Trim The Fat In Storage With Thin Provisioning"
July 23, 2007

YOU CAN'T IGNORE THE IMPORTANCE OF STORAGE IN YOUR VIRTUAL ENVIRONMENT

To achieve many of the benefits of server virtualization, such as the flexibility to move virtual machines between physical hosts for workload balancing and high availability, physical hosts must be networked to shared storage. IT professionals can network storage in multiple ways, including traditional Fibre Channel (FC) storage area networks (SANs), iSCSI SANs, and network attached storage (NAS). IT professionals must take the time to carefully select the appropriate storage networking approach and storage system, because server virtualization is now in production and supporting mission- and business-critical workloads. In addition, it's likely that in the near future your storage environment will need to support and integrate with more than one hypervisor. From September to October 2008, Forrester surveyed 124 IT decision-makers about their virtual environments and found that:

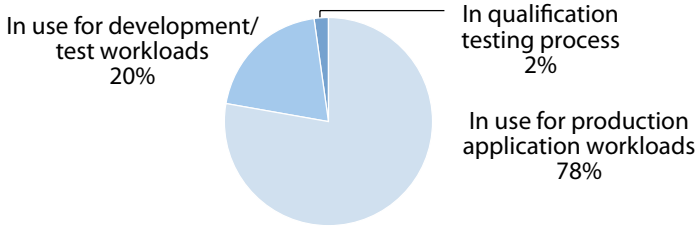
- **Most organizations already use server virtualization in production.** Seventy-eight percent of respondents report that they are using virtual server technology for production workloads, 20% state that they are using it for development/test workloads, and 2% indicate that they are in some form of qualification testing (see Figure 1-1).

- **Businesses most often virtualize Web, off-the-shelf, and infrastructure applications.** Consistent with previous Forrester surveys, Web, commercial off-the-shelf, and infrastructure applications ranked high on the list of workloads IT virtualizes (see Figure 1-2).[1] Interestingly though, a reasonable number of respondents do report running Oracle Database, Oracle applications, and email applications in their virtual server environments, long considered to be holdouts from the world of x86 server virtualization.

- **VMware is still the primary choice, but other hypervisors are gaining traction.** VMware is the clear leader in virtual server software selection among our survey respondents, with 98% of respondents indicating that they have ESX in their environment (see Figure 1-3). However, a not insignificant number of respondents state that they have an alternative vendor's product as well: 17% of respondents state that they use either Microsoft Virtual Server 2005 or Hyper-V, closely followed by Citrix's XenServer at 10%.

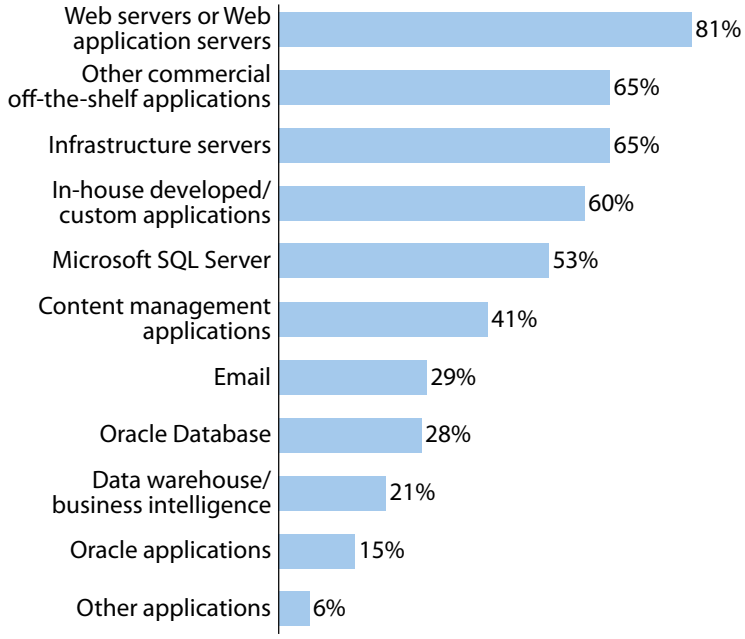
Figure 1 VMware Dominates In A Matured Virtual Server Market

1-1 "At what phase of implementation is your deployment of virtual server technology?"



Base: 124 global IT decision-makers currently using x86 server virtualization technology

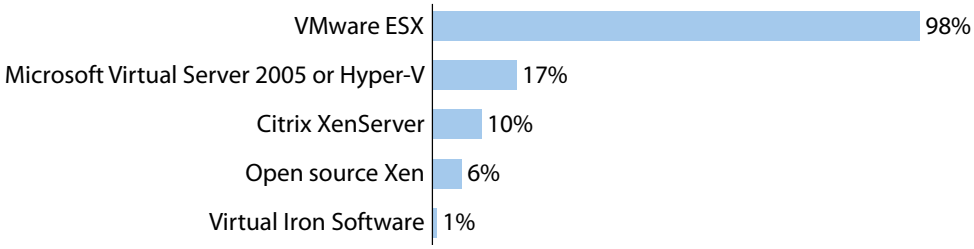
1-2 "Which applications do you run in your virtual server environment?"



(multiple responses accepted)

Base: 124 global IT decision-makers currently using x86 server virtualization technology

1-3 "Which virtual server technology do you have in your environment?"



(multiple responses accepted)

Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

Performance, Backup, And Capacity Management Are The Top Storage Challenges

When asked to rank their top three storage challenges in a virtual server environment, 23% of respondents ranked performance, 19% named backup success, and 14% named capacity efficiency as their No. 1 challenge (see Figure 2). Based on client inquiries, customer engagements, and vendor briefings, Forrester has found that:

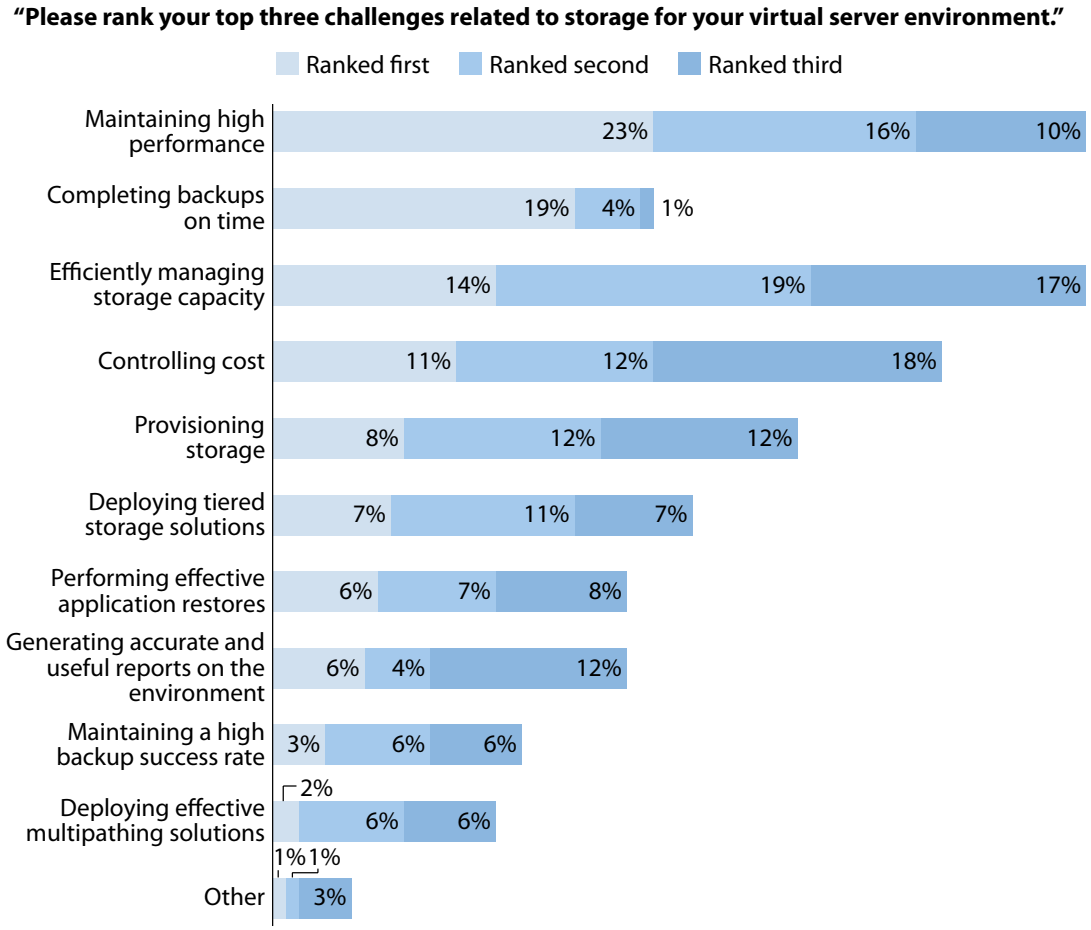
- **Building high performance is a key goal but hard to get right.** Given the range of possible storage networking and storage configuration options in virtual server environments and the general lack of performance analysis and tuning in most storage organizations, it's not a big surprise that this is seen as challenging. There are many moving parts in a virtual server implementation, and using trial and error to work toward acceptable performance balanced with cost control can be daunting. To select the optimal storage configuration for their server virtualization environment, businesses that are planning to implement or improve server virtualization should work with vendors to fully test possible configurations in a lab environment that closely resembles production workloads.

- **Server virtualization compounds backup complexity.** While server virtualization solves many problems of server utilization and flexibility, it can also create new headaches, with backups being a primary concern. Server virtualization can create virtual server sprawl, and backing up all these new images in a timely manner can be difficult. Plus, as IT increases the ratio of virtual machines to physical hosts, completing backups within defined maintenance windows is difficult.[2] Having good visibility into the policies and jobs configured can also be problematic, and while backup software vendors have started to provide tailored options to help with virtualization-specific challenges, the data here indicates that businesses are still seeking the solution.

- **Server virtualization can decrease capacity utilization.** While server utilization reduces server hardware acquisition cost, it can put an extra layer into the process of allocating and managing storage, both technically and organizationally. Many organizations describe struggling to create (and keep lean) a consistent and efficient process for allocating storage to virtual servers. Organizations frequently use a "gold image" approach, deploying a common server image and standard storage allocation for many different virtual servers.

  While this is simple, it creates large amounts of unused storage, which leads to low utilization. Thin provisioning technology is meant to address such a problem. With thin provisioning, a storage administrator allocates storage capacity as usual, but capacity is only reserved as data is written to it, rather than upon initial provisioning.[3] However, based on Forrester client inquiries and other interactions, and given that most clients in this study leveraged an existing SAN, it appears that thin provisioning is not adopted widely enough to really solve the problem. Forrester believes it's time for buyers to put more weight on storage solutions that offer thin provisioning and get past their reservations about the technology, given the struggles with capacity efficiency.

Figure 2 Top Storage Challenges In Virtual Server Environments



(multiple responses accepted)

Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

IN VIRTUAL SERVER ENVIRONMENTS, FIRMS PLAY IT SAFE WITH STORAGE

While server virtualization adoption is high and there is a consensus of best practices, the same is not true for the storage required to support server virtualization. There is a wide range of possible networking and configuration options. In addition, every storage vendor in the market is working hard to create differentiation and competitive advantages in the area of storage for virtual servers, with varying levels of success. The following data points were gathered in an attempt to better shed light on how firms select and deploy storage for their virtual server environments:

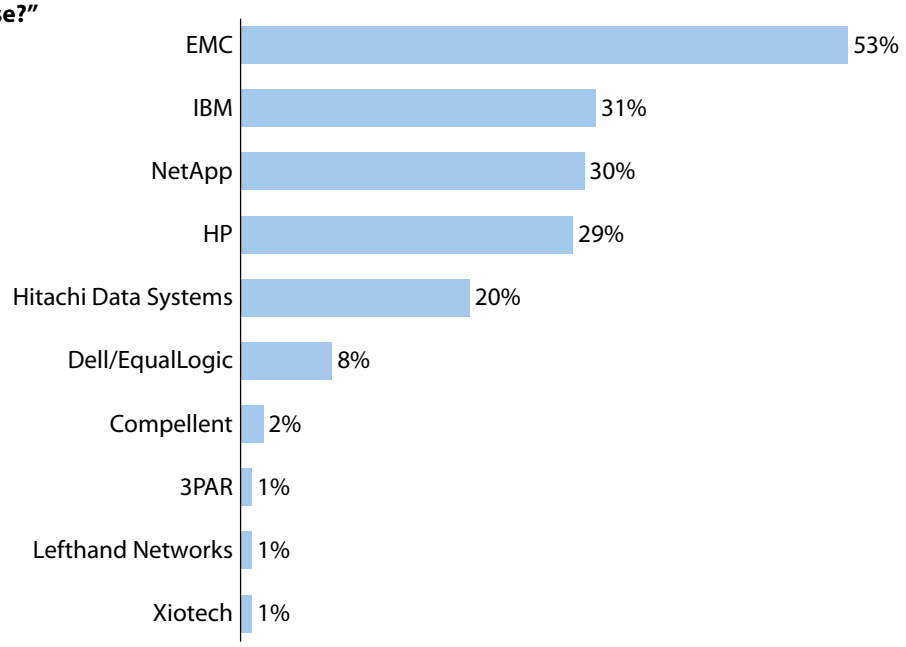
- **Buyers prefer to stick with major storage vendors.** According to the respondents of this survey, EMC is the most prevalent storage vendor in their overall environments, followed by IBM, NetApp, HP, and Hitachi Data Systems. The adoption of vendors used specifically for virtual server environments shows the same rankings, with very similar adoption percentages (see Figure 3). This indicates that most users are sticking with the storage vendor they use generally, rather than making a separate purchase decision for the virtual server environment. Forrester client inquiries and consulting engagements indicate that a few firms are planning to buy storage from alternative vendors specifically for their unique benefits in virtual server environments, but the majority are not doing so.

- **Buyers show a preference for a single storage vendor.** While heterogeneity is a complicated reality for many storage environments, 63% of respondents indicate that they have purchased storage for virtual server environments from only one vendor (see Figure 4). This points to a fairly high level of storage vendor consistency within virtual server environments. At least for now, firms seem to prefer the benefits of having a single vendor across their virtual and physical environments over the benefits that some storage vendors might provide in the virtual environment.

- **Server virtualization doesn't usually motivate a first-time SAN purchase.** Storage vendors and channel partners are very excited about growth opportunities for networked storage as a result of server virtualization, but at least among the respondents to this survey, who are predominantly in enterprises, SAN or some other form of networked storage was already in place (see Figure 5).

Figure 3 Storage Vendor Adoption — Overall And Within Virtual Server Environments

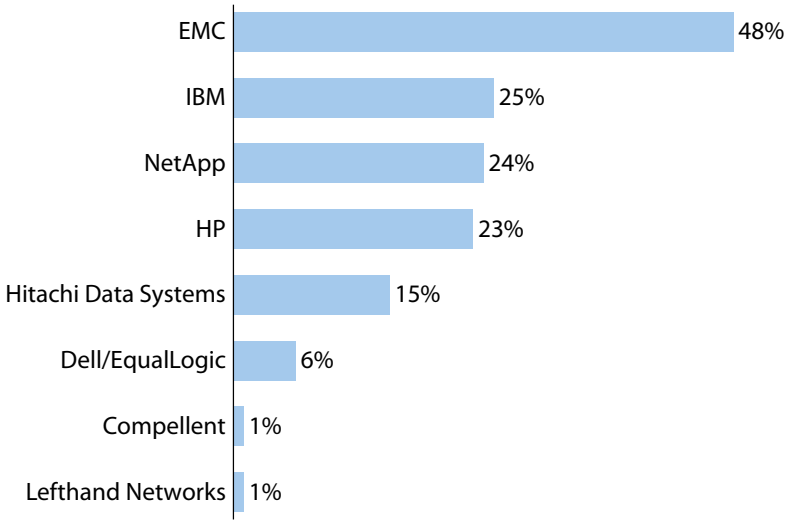
3-1 "From which storage vendors have you bought SAN or NAS connected storage that is currently in use?"



(multiple responses accepted)

Base: 124 global IT decision-makers currently using x86 server virtualization technology

3-2 "Which vendor(s) supplied the networked (SAN or NAS) storage used for your virtual server environment?"



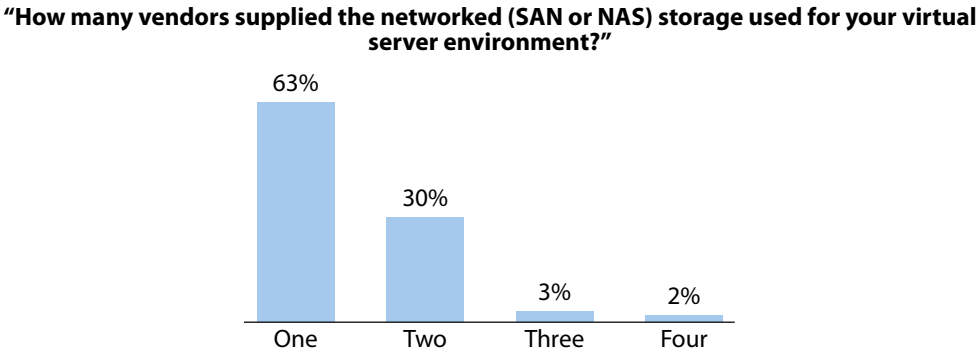
(multiple responses accepted)

Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

Figure 4 The Incumbent Storage Vendor Has The Upper Hand In The Virtual Server Environment

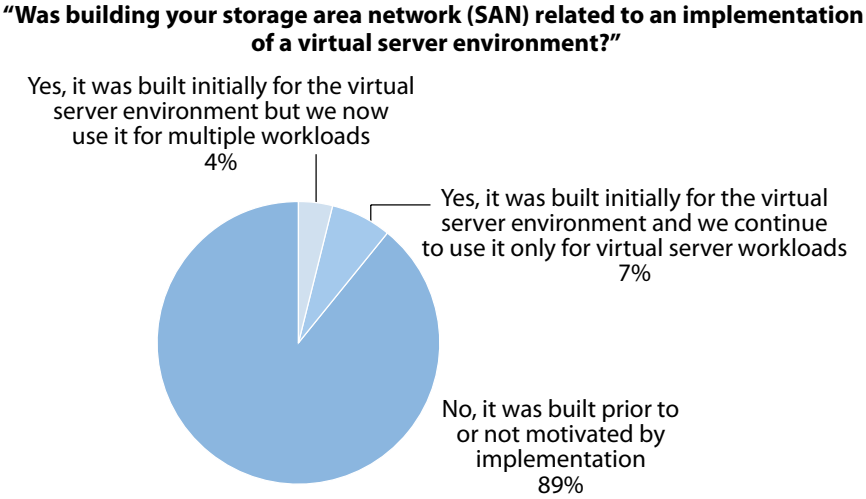


Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

Figure 5 SAN Acquisition Is Not Motivated By Virtual Server Environments



Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

FC Leads The Storage Protocol Selection, But A Significant Number Use iSCSI Or NFS

Most individuals surveyed said that their organizations are using FC as the network storage protocol for virtual server environments (see Figure 6-1). This is not surprising given the dominance of FC, especially within enterprise environments. Among smaller organizations, iSCSI and FC are closer to parity, reflecting the simplicity and cost benefits that organizations ascribe to the Ethernet-based storage protocol.[4] Interestingly, few small and medium-size businesses (SMBs) say they are

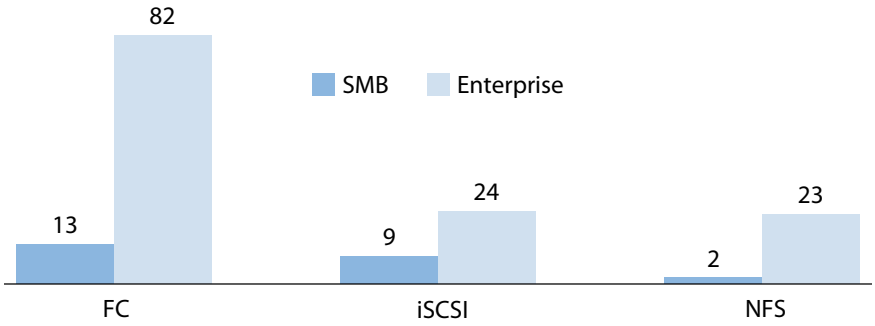
using NAS via the NFS file system protocol for connectivity, but a decent number of enterprise respondents state that they are doing so. While the samples are small in this survey, iSCSI seems to be the leading alternative to FC for small shops, while iSCSI and NFS are about equal in prevalence as an alternative for enterprises. One thing is clear: The overwhelming preference for storage is networked storage. Only a handful of survey respondents indicate that they use some type of direct attached storage. Forrester found that:

- **There is little correlation between vendor and protocol selection.** Surprisingly, there is not a strong pattern linking the choice of vendor to the preferred protocol. Even NetApp, with its strong heritage in file storage and ability to offer in-depth best practices for NFS in virtual server environments, still shows a prevalence of FC — NFS is the least common option. This is due to the following: 1) VMware did not add support for iSCSI and NFS until ESX Server 3.0; 2) storage vendors are generally protocol-agnostic — they support and recommend all available protocols; and 3) customers are often unwilling to diverge from what they know and use already (see Figure 6-2).

- **FC users show some willingness to try other networking protocols.** In general, most respondents show a low level of interest in switching storage protocols used for virtual server workloads, especially among FC users. Clearly, users have an "if it ain't broke don't fix it" mentality when it comes to production workloads, but the messaging around flexibility, simplicity, and cost benefits of iSCSI and NFS have at least caused users to consider this approach, if not to go down the path so far (see Figure 6-3).

Figure 6 FC Dominates In Enterprise Virtual Server Environments

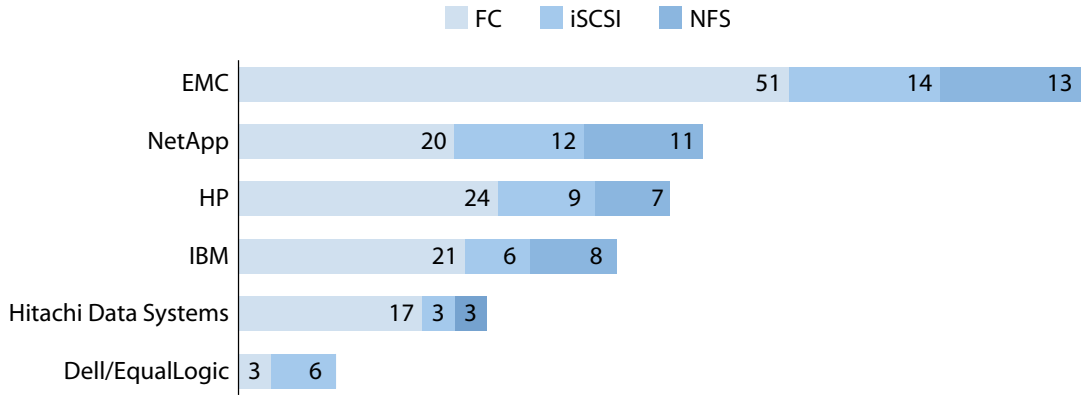
6-1 "Which protocol(s) do you use for networking virtual server hosts to the SAN?"



(multiple responses accepted)

Base: 124 server and storage decision-makers currently using x86 server virtualization technology

6-2 "Which vendor(s) supplied the networked (SAN or NAS) storage used for your virtual server environment?"



(multiple responses accepted)

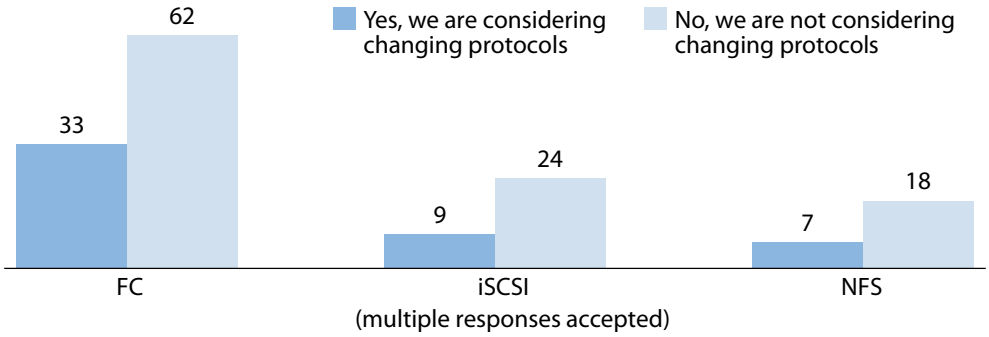
Base: 124 global IT makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

Figure 6 FC Dominates In Enterprise Virtual Server Environments (Cont.)

6-3 "Which protocol(s) do you use for networking virtual server hosts to the SAN, and are you considering changing protocols?"



Base: 124 global IT decision-makers currently using x86 server virtualization technology

Source: September 2008 Global Virtual Server Environments Online Survey

48079 Source: Forrester Research, Inc.

RECOMMENDATIONS

STORAGE BUYERS: THINK OUTSIDE THE BOX IN VIRTUAL SERVER ENVIRONMENTS

Storage networking and configuration options abound for the storage infrastructure that supports the virtual server environment. Given that storage vendors are just now creating their differentiation in these environments and developing recommended best practices, it's incumbent on the buyer to explore all the options and make the choice that works best for their needs. Some key considerations here include the following:

- **Demand more from your storage vendor in a virtual server environment.** Pick a vendor that offers thin provisioning, has deduplication on the road map, and has documented best practices in virtual environments. Server virtualization is likely to be a large and critical part of your overall computing environment, and storage success will help it grow and flourish. If you're a large organization, with 50 terabytes (TB) or more of data in the virtual environment, then you will likely need dedicated arrays for that workload. If so, make sure you pick storage from a vendor that offers the best set of capabilities to enable virtualization success, even if it means diverging from the vendors you use currently. The benefits of specialization are likely to outweigh those of consistency, especially as the virtualization environment grows. If you're a smaller shop, with 20 TB to 100 TB of total storage capacity, then consistency and functional convergence make more sense.
- **Consider Ethernet first, then FC.** There are pros and cons for each of the storage network protocols that can support virtual server environments. Ethernet-based protocols such as

iSCSI and NFS can reduce costs while simplifying management, but they have their own best practice requirements that need to be followed. Forrester recommends looking at iSCSI or NFS first given the significant cost savings and the maturity and wide range of vendor choices. Even if server virtualization is the primary motivation for going down the Ethernet path, it's likely to be worth it because virtualization is important and growing, as well as because storage over Ethernet is likely to be more important generally over time.

- **Don't forget about backup and restore considerations.** Backing up virtual machines is difficult because of the ratio of virtual machines to physical hosts and because of virtual machine sprawl. Backup solutions for virtual environments must be designed specifically for the environment and integrate with application programming interfaces (APIs) from the hypervisor such as VMware's Consolidated Backup (VCB). In addition, you want a storage system that can provide snapshot and replication capabilities for both backup as well as disaster recovery. Once again, you want to make sure that the storage vendor integrates with the hypervisor to create *consistent* snapshots and remote site replicas.

SUPPLEMENTAL MATERIAL

Methodology

Forrester's September 2008 Global Virtual Server Environments Online Survey was fielded to 124 infrastructure and operations professionals from our ongoing IT research panel. The panel consists of volunteers who join on the basis of interest and familiarity with specific IT topics. For quality assurance, panelists are required to provide contact information and answer basic questions about their firms' revenue and budgets.

Forrester fielded the survey from September to October 2008. Respondent incentives included a summary of the survey results. The main selection criterion was the existence of virtual server technology in the environment, so this data is not indicative of overall adoption of that technology; it only looks at the way current users deploy and configure the infrastructure for virtualization. Eighty-four percent of respondents work at firms with 1,000 or more employees, considered by Forrester to be enterprise respondents. Seventy-three percent of respondents are located in the US, with Canada and Germany following as the most represented geographies. In terms of role, 62% of respondents identify themselves as director of IT or CTO, with storage director and server director as the next most prevalent roles. In terms of industry, financial services and insurance is the most prevalent, with 41% of respondents, but the survey is fairly well distributed across industry verticals. The average reported size of overall storage environment is 833 TB, with a wide range of responses from very small to extremely large.

Exact sample sizes are provided in this report on a question-by-question basis. Panels are not guaranteed to be representative of the population. Unless otherwise noted, statistical data is intended to be used for descriptive and not inferential purposes.

If you're interested in joining one of Forrester's Research Panels, you may visit us at http://Forrester.com/Panel.

ENDNOTES

[1] In 2006, 40% of firms reported adoption of server virtualization, with the most common application workloads being file and print servers, Web servers, and infrastructure servers. For more info, see the June 19, 2006, "Pragmatic Approaches To Server Virtualization" report.

[2] How can you efficiently back up hundreds of virtual machines that contain critical corporate data? Today, VMware is the most widely deployed x86 server virtualization technology and leads the market with third-party backup tools as well. Forrester regularly receives calls about how best to back up large VMware environments. What have we found? IT managers should default to VMware's Consolidated Backup (VCB) as the best option today, but don't hesitate to explore specialized tools and storage-specific functionality — both of which have come a long way to support VM-specific intelligence. See the July 14, 2008, "Q&A: Top Questions About VMware Backup" report.

[3] Thin provisioning uses over-subscription of storage resources to draw capacity from a common pool, reducing total overhead requirements. Most major storage vendors today are offering the capability in some form. For more info, see the July 23, 2007, "Trim The Fat In Storage With Thin Provisioning" report.

[4] Adoption of iSCSI is shown to reduce storage costs significantly in terms of switching, server-side connectivity components, and cabling. For more information, see the February 7, 2008, "Cost Comparison Of iSCSI Versus Fibre Channel SAN Components" report.

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