Bridging the Virtual Server Chasm

Virtualized server adoption among enterprises of all sizes has reached a critical juncture. The applications that were the easiest to migrate and consolidate onto virtualized x86 servers—typically using VMware—have generally been moved. These include servers devoted to test and development, print and file serving, and other applications lower down the priority ranking. Now comes the hard part: migrating the tier-one business-critical applications.

Defining the Chasm

Typically, the first phase of deploying server virtualization is deceptively easy. IT administrators can take a handful of less-than-critical applications and migrate them over to one or a few idle, spare, or underutilized servers. Installing a number of virtual machines without the management and other add-ons is a relatively simple and inexpensive proposition. Hence, many virtualized server deployments start-off with no real “skin in the game” beyond some modest staff time devoted to the effort.

These initial low risk/high impact virtualization projects pay big dividends relative to their initial investment and can therefore suggest that virtualization more broadly is likewise inexpensive and easy.

But, after the low-hanging fruit has been harvested, IT administrators begin to see that a potentially much larger investment of both time and IT resources must be made in order to progress through their application inventory toward finally virtualizing their critical business applications. IT administrators then realize that established operational procedures will likely be impacted, users groups will have to be brought into the migration plan, and a return-on-investment (ROI) justification will be required to implement a comprehensive virtual infrastructure. At that point, as IT administrators realize the magnitude of the job ahead, a gap—call it a chasm—opens between the virtualized server environment and the rest of the application workload that is still residing on physical servers. This is the point at which one has to construct the comprehensive ROI justification, secure the required support, and move the migration project forward. Required hardware/software resources can include:
• More powerful servers
• Networked storage
• Additional network resources and bandwidth
• New software tools to monitor, visualize, and manage the virtualized IT environment

In addition, IT administrators will have to examine and rationalize the potential impact to ongoing operations and user group support. Areas of focus can include:

• Server management and acquisition processes
• Capacity planning
• Backup processes
• User group problem resolution
• Internal politics

Without clear justification, further virtualization of the application inventory will likely slow to a crawl. There has to be a reason to make the additional investment—one can call it the permanent investment—in virtualization. Finding the reasons and bridging that chasm—moving even the critical applications to the virtual server world—is the subject of this Illuminata Insight.

To get a realistic sense of what both the chasm and the bridge look like, we spoke to a small group of users representing different vertical industry segments who went beyond harvesting the low-hanging fruit. They migrated business critical applications to virtual server environments successfully. We review what motivated them to make the often considerable effort required and we present their experiences as best practices to emulate.

**What Motivated People to Cross the Chasm?**

Virtualizing critical systems is a serious project with long-range implications. Due diligence must be applied to planning, internal selling, and execution. Generally speaking, IT administrators need a compelling reason to embark on such projects. Power, server hardware, and other such savings from server consolidation may be sufficient motivations to virtualize lower-tier applications. However, we have found that a more compelling reason or set of reasons is required to marshal the forces required to virtualize critical applications. During our interviews, we encountered the following motivators:

**Poor performance on critical systems is threatening service delivery**—We spoke to an IT administrator in the healthcare industry. Degrading performance on clinical systems was beginning to threaten care delivery and patient outcomes. Administrative staff were spending increasing amounts of time on menial tasks and errors were becoming more frequent. Adding more servers was not the solution because the healthcare provider’s data center was both space and energy constrained. The answer was to find “virtual space” on fewer but more powerful virtualized servers. Application performance improved and the healthcare provider’s IT department gained some room to grow in spite of the physical constraints.

**System and application availability is suffering because growth can’t be managed non-disruptively**—The CIO of a small but quickly growing financial services firm said that the need to constantly bring servers down to install application modifications threatened getting both front-end customer-facing applications and trading applications on the back-end to market quickly. It also hurt the availability of customer-facing applications. Implementing virtualized servers allowed him and his staff to run test and development platforms alongside the production environment, and place new applications into production without disruption.

**The recessionary economy has forced IT administrators to maintain IT service delivery levels in spite of budgetary constraints**—The economic climate has forced a Web-based graphic design services provider to reduce the prices it charges for its services in order to maintain growth and keep ahead of its competitors. The Director of IT Operations had planned to construct a new data center to keep pace with growth. Those plans were put on indefinite hold. He now had to work with a
reduced budget and his current infrastructure. Server virtualization let him reduce the number of physical servers dedicated to service delivery applications. This cut energy, maintenance, licensing and support costs, and gave him room to grow within current constraints.

Changes in the external market threaten the business model– In our conversations with IT administrators, we also encountered situations where changing business conditions were challenging the company’s IT department to respond quickly or risk losing business. Another financial services firm we spoke to that deals in options trading wanted to prepare for an anticipated move from trading in five cent increments to penny increments. They expected this to greatly increase the processing power needed by their critical applications. And, like others we spoke to, the recession was causing budget cuts. In spite of the constraints, they were able to do a number of things to prepare:

- Swapped-out some older generation servers for new, more powerful models
- Virtualized the server environment
- Contracted with a leasing company to lease the new servers coming in, and run a sale-leaseback on the retained servers

They not only virtualized the server environment that supports critical applications; they also moved it to a different financial foundation that is independent of the firm’s capital expenditure budget.

Perceived Barriers to Migrating the Critical Applications

After determining what motivated these IT administrators to virtualize at least some of their critical systems, we then wanted to understand what barriers they encountered and overcame when planning and executing the migration. Even when the decision to cross the chasm was warranted, they still needed to address and overcome barriers.

Disruptive Migration– Once the applications to be virtualized have been identified, they must be moved with minimal to no disruption. Detailed planning of the migration of these applications is critical so that downtime is minimized (and, ideally, eliminated) during the move. Therefore, it’s important to map out the migration process beforehand and secure any required hardware, software, and personnel resources needed to maintain the availability and service levels of critical applications.

Questions that must be answered include:

How much server capacity is necessary to support the virtual servers? Because CPU utilization may well be higher in the post-migration environment —indeed, that’s typically a major objective—more memory may be needed to maintain balanced system resources. There’s also some overhead associated with virtualization—albeit less than there used to be both because of software and processor technology improvements—that should be taken into account as well.

In a similar vein, can the networking gear—whether server-to-server or server-to-storage—handle the anticipated load? More efficiently utilized servers running multiple virtual machines often need more I/O capacity than a server running a single application.

Has the migration process been planned out in advance and do all involved feel comfortable with the plan? Does the plan include regression back to the previous application state if the move encounters problems or does not deliver the required application service level?

Backup and Recovery Processes– Because the backup of critical application data is absolutely essential, enterprises will already have in place established backup and recovery processes for these applications. Virtualization will often force changes to these processes and force IT administrators to do things in new ways. They will also be challenged to keep backup windows from becoming elongated and maintaining established recovery time
objectives (RTO) and recovery point objectives (RPO) for these applications.

Administrators will have to come up with a process to back-up both virtualized servers in their entirety and virtual machines. Restoring an entire virtual server to recover one virtual machine is too inefficient and time consuming for critical applications environments. Generally, IT administrators responded to this challenge by working more closely with their preferred backup application vendors. In some cases, outside consulting help was used.

An inability to establish the right balance that delivers the most efficient process could artificially limit the number of virtual machines per virtualized server or elongate recovery times and invalidate recovery point expectations.

**Performance**—Visibility into the virtual server environment is an absolute requirement for supporting critical applications that generate high transaction levels. Database applications were the ones most often identified as needing visibility into I/O processes. Administrators reported needing to be able to identify I/O bottlenecks quickly and come up with either permanent fixes or at least temporary work-arounds. These activities were not always successful. In one case, performance was periodically degrading to the point that a politically powerful user group within the organization forced the server administration group to move that application back to the physical world.

**Capacity planning**—Putting up virtual machines (VM) is relatively easy. But once one has everything working satisfactorily, being able to predict the future demand for IT resources becomes more difficult than in the purely physical server world. IT administrators need to understand if the physical servers hosting virtual machines have enough headroom to grow and at what rate the demand for resources is growing. Just knowing the impact of adding VMs can be difficult without some way to measure past capacity utilization trends. Again, visibility is required.

**Management**—The administrators we interviewed spoke rather pointedly about the need to understand that managing virtual machines is a new discipline. The fact that virtual machines are connected only logically to physical machines forces management processes to change. Owing to the ease in which new virtual machines can be deployed, virtual environments tend to grow more quickly than those still bound to the physical world. This can lead to quickly escalating complexity and an increased frequency in outages—in other words, many of the management problems that server virtualization is supposed to solve. New management processes were typically established for the following:

- Dealing with outages
- Maintaining user support and help desk operations
- Responsibility for, and centralized control of, new virtual machines
- Deploying upgrades and new software releases
- Disaster recovery and business continuance planning, implementation and testing
- LUN creation and removal
- Configuration change management applied to servers, networks, and storage
- Tracking of virtual machines

**What People are Doing to Survive and Thrive (Best Practices)**

Virtual environments can deliver more efficient management, better performance, and cost savings even when critical applications are added to the mix. However, administrators learned by doing, responding, fixing, selling, and cajoling. Documenting best IT administration practices for managing virtual environments could fill a book. However, we can at least summarize the most important sentiments of IT administrators who have “been there” as follows:

**Acquire the required visibility**—Visibility into the virtual world is critical. Visibility can be defined as
monitoring, discovering, mapping, and reporting capabilities. The good news from our perspective is that the large systems, storage, and application vendors that sell virtualization-capable products now understand this need and are delivering appropriate management instrumentation. In addition, a growing number of independent tools vendors are addressing the problem in specific ways, bringing solutions to market for capacity planning, performance monitoring, virtual machine tracking, and security. We mention visibility into the virtualized system environment first because we feel it is the most critical requirement and the one that enables other best practices to function.

**Build a solid physical infrastructure**—Cobbling together server virtualization from a collection of available servers will work for a while and for the lower-tier applications. But we know that critical applications in the physical world require solid servers. Virtual machines supporting critical applications will likewise require solid systems—servers, networks, and storage. And, indeed, the physical infrastructure may matter even more—both because it’s more heavily loaded and because it’s supporting more users. The due diligence typically applied to major IT projects is required to build an infrastructure that is scalable and reliable.

**Be prepared to do some internal selling**—Some IT administrators may have to deal with an established pattern whereby departmental user groups take a more active role in managing servers and database application, sometimes without support and guidance from centralized IT. In these cases, selling the virtualized server concept to departmental user groups will be required. This could represent an opportunity to change the nature of the relationship between centralized IT and particular user groups. Virtualization could be an avenue for establishing a services delivery model backed up by Service Level Agreements (SLAs) where these do not yet exist.

**Be open**—Reports generated by performance monitoring and capacity planning tools should be made available to administrators outside the server management team—including those groups involved with application, database, and storage administration. Server virtualization is often a process that is managed by server administrators, but it is also a process that impacts entire systems.

**Explore the financial alternatives**—It’s a given that, during 2009 at least, IT administrators will be pressured to put off major projects, even those with solid ROI justifications. This is a time to get creative and think of financial alternatives to purchasing IT resources using the capital acquisition budget. Leasing infrastructure (hardware, software, and even services) can move financing for a new major project to the operational side of the balance sheet. One administrator we spoke to was also able raise some needed cash to move the project forward with the CFO’s approval by engineering a sale-leaseback of existing hardware with an equipment financier.

**Find “hidden” storage capacity**—Deduplication and thin provisioning technologies can be used to increase already-available storage capacity and greatly reduce backup overhead. Implementing either or both could remove the need to acquire additional primary and/or backup storage to support the expanded virtual server environment. But deduplication of primary volume data—a capability that storage vendors are now introducing to reduce the amount of primary storage consumed by critical applications—can also reduce the need for additional storage. It is often the case that cost savings from virtualizing the server environment can at least partially evaporate when IT administrators realize the resulting need for additional tier-one array-based storage. Adding both deduplication and thin provisioning capabilities into the mix of infrastructure support tools can allow administrators to more effectively control the growth of primary array-based storage in service to virtualized server environments, thereby reducing the overall cost of a migration project.

**Be prepared to reorganize**—Once the critical applications have been migrated, a common, centralized management group for all virtualized applications should be established. This group
should certainly represent server administration, but it could also include representatives from network, storage, database, and application administration. Virtualized system maintenance policies and procedures should be formulated and assigned. At least one of the administrators we spoke to warned against letting software within the virtual environment get too far behind on updates for example; this creates a situation where some parts of the virtual environment are managed differently from others, re-introducing the old physical server world of management complexity and inefficiency. Another mentioned that virtual machine “sprawl”—the unauthorized establishment on new virtual machines—would also effectively “turn back the clock” on the management progress made by virtualizing the production IT environment. Still another spoke of the ease with which one could lose track of virtual machines given their mobility using facilities like VMware’s vMotion.

**Beyond Virtualization to the Cloud**

The reward for virtualizing can extend beyond the benefits of consolidating the infrastructure and management tasks required for the critical applications. IT groups are now looking seriously at the feasibility of in-house cloud-based computing architectures, often referred to as “private” compute clouds for at least two reasons:

- Cloud computing infrastructures as built by many of the current external cloud-based services providers are cheaper to provision and maintain than traditional compute infrastructures. Enterprise IT administrators can, we believe, correctly conclude that if external services providers can build compute clouds, they can, too.

- The cloud services delivery model is all encompassing and the closest thing to true utility computing we have yet seen. Providing IT services on the “pay as you go, pay only for what you use” utility model simplifies charge-back and other interactions between user groups and IT administrators. Internal or private clouds also keep user groups from wandering away from centralized IT, lured by the external cloud services providers who generally have no regard for an individual company’s data governance and compliance policies.

Virtualization is a key enabler of cloud based computing. Virtualization “encapsulates” applications, allowing them to be easily introduced into cloud architectures, and allowing them behave fluidly within a physical infrastructure. It is easier to provision and scale hardware resources non-disruptively in a virtualized environment—a fundamental attribute of cloud computing. Finally, virtualization delivers the sometimes dramatic reduction in infrastructure costs demonstrated by cloud services providers as compared to those required to support traditional IT architectures.

**Conclusion**

Moving critical applications across the physical-to-virtual chasm forces some permanent changes in the way IT functions within an organization. That’s at least one of the reasons IT administrators stop short as they virtualize their way through the application inventory. Without a powerful motivator, change here is not likely to happen. However, the current decline in the world’s economic state may now be enough to force change that allows IT administrators to keep pace with growth in the demand for IT resources while holding the line on expenditures.

IT administrators must be ready to modify established management processes and adopt new ones. The flexibility and fluidity of these environments is a double-edged sword: change is easier to implement but complexity can grow more quickly, too. Creating a centralized virtual systems management group within IT administration is highly recommended.

Server virtualization can deliver management efficiency and cost savings to the administrators of the critical enterprise applications. The tools required to non-disruptively migrate and manage them within the virtual systems world are available today. The chasm now can be crossed by those who are ready.