



Server Virtualization

Does server virtualization work for small-to-medium-sized companies?
You bet.



Virtualization software allows you to run multiple virtual machines on the same physical host. Each virtual guest runs in a separate environment, so errors with the operating system or application will not take down other guests running on the same physical host.

Often small- and medium-sized businesses require application functionality similar to enterprise businesses; they just do it on a smaller scale. These applications might include file and print servers, e-mail servers, databases and Web servers. Smaller companies may have a single server running all of these applications. Even in this scenario, companies can benefit from virtualization for security reasons alone.

Additionally, server virtualization can help heighten security, make restores quicker, improve fault tolerance and reduce server maintenance costs.

Security

Let's assume that the server is running Exchange 2003 and Outlook Web Access (OWA). With a single server, the OWA server is the same server that also stores the company's e-mail, database, files and other valuable information. If a hacker is able to compromise the OWA server, they will have access to the entire server, not just OWA, because all of the data resides on the same server.

Larger companies typically install a dedicated front-end server that only handles OWA traffic and does not contain any mail databases or other information. If a hacker manages to hack this machine, they still have to compromise the back-end Exchange Server in order to access any data.

In this single-server scenario, you could set up an Exchange server as a virtual server that is accessed from the Internet. A smaller company would benefit from having a dedicated front-end server without the overhead of purchasing a separate server. If the company is hosting its own Web site, this OWA front-end server also could double as a Web server. The Web page

information would reside on this virtual server, but not any of the company's critical data files.

Simplified Bare-Metal Restores

In this single-server scenario, if the server is running Windows Server with Active Directory, it is the only domain controller (DC). If you've ever had to perform a bare-metal restore of a single server that was acting as a single DC and had other applications running on it such as Exchange and SQL Server, you know this is a complicated and challenging process. Virtualization can help in this area as well.

There is one file for each virtual guest's hard drive and a configuration file that is stored on the host server. When a server is virtualized, a consistent generic hardware platform is created for the virtual server guest, regardless of the physical hardware. This means that any virtual guest can run on any server host because the hardware platform is always the same.

A common backup strategy is to get an image backup of all of the virtual server guests running on the host during a weekend. A script can be created to shut down the virtual server guests on the host, and then these files can be backed up to tape or copied to a different location on the host server. During the week, differential backups are performed on each virtual server guest.

In order to restore any virtual server, you must restore the latest image backup of the virtual server and then run the latest differential restore. Because the weekend backups are essentially an image backup of the server, you don't have to worry about going into Active Directory Server Restore mode or remember not to make the server a domain controller during the recovery process of the DC.

If the host server entirely crashes, you would have to obtain a new server, install the host operating system, install the tape backup software, catalog the tape, and then restore your virtual server images and virtual server software. Assuming that you have each server virtualized

by application, you could restore the most critical servers first. This would allow users to gain access to these critical services without having to wait for the entire server to restore.

Reduced Maintenance Overhead

Virtualization also can save you significant time when you have to bring up a new server. Try staging server images with the different operating systems you may need. This can save you at least an hour or more of setup time when you have to bring up a new server.

For example, you can build an image of Windows Server 2003 with the latest service pack and hot fixes, but not join the domain. When you need to build a new server, you can copy this virtual server disk file on the host to a different location and rename it. Then you can create a new virtual server on the host and add in the virtual disk you just copied. When you start the virtual server, all you have to do is rename the server, join the domain and install the latest hot fixes. This entire process can be completed within 15 minutes, compared to an hour or more to build the server from scratch.

In a small company, you may need to run computers with different operating systems that usually require separate servers. With virtualization, you can run virtual servers with different operating systems on the same physical host.

In the small and medium market space, VMware's VMServer has the best support for guest OSes. You can run almost any Microsoft OS as well as a wide variety of Linux and Unix OSes on the host server, potentially eliminating the need to purchase additional separate servers.

Multiple Hosts Will Improve Fault Tolerance

Most of the previous scenarios assume that the company has a single server; thus, the single point of failure is not an issue because virtualization will not decrease the fault

tolerance of the server. If a single server fails, virtualized or not, the company will suffer.

But what if your company has more than one server? For example, if a company has nine servers that run various applications, it may be possible to consolidate these servers onto three physical hosts and still provide fault tolerance if one of the hosts is lost.

If the servers are due for upgrades, instead of purchasing nine new servers, you may be able to consolidate three virtual server guests onto one physical host. These servers will have more processor, memory and disk capacity than single-purpose servers. In this multiple-server scenario, you can even configure the virtual guests as "warm" guests on a different host server.

By combining the power of Windows Server 2003 R2 Distributed File System Replication (DFSR) and virtualization, you can easily move virtual guests to a different host in the event of a server crash.

Assuming you perform an image backup of all the virtual server guests during a weekend and run differential backups throughout the week, you can move the virtual server guests to a different host and recover the servers faster than if they were running on dedicated machines.

Over the weekend, you can copy all of the server guest files running on a host to a folder that is replicated with DFSR. DFSR then will replicate these guest files to a different host server.

DFSR has two features that make it ideal to replicate virtual server guest files: remote differential compression (RDC) and cross-file replication (CFR). RDC will examine a file and only replicate the changes made to the file to a remote server.

CFR examines a file and searches for files that are available locally to create the desired file. This lends itself very well to replicating virtual server guest files because most of the information in the file remains static, and they have a significant

amount of the same information stored in them. Although the files themselves can be quite large, the differences in the files on a weekly basis may only be between 100 megabytes (MB) to 3 gigabytes (GB).

After the initial replication, the actual time to replicate the virtual guest files should be short. You can create the virtual server guests on the other hosts, but leave them down and only bring them up if you have a problem with one of the host servers.

In this three-host-server scenario, let's assume you lose host server A, which has three virtual servers running on it. Assuming that you already have the virtual guest files replicated to the other two host servers, you could bring up two guests on server B and one guest on server C. Then you would need to restore the latest differential backup to get the servers as current as possible.

If you design your server host farm with this in mind, make sure to have enough processor, memory and disk capacity to handle the failure of one host server. If you do lose a host server and use this strategy, you should be able to bring up all three guests within a few hours or possibly even faster, depending on how long it takes to restore the last differential backup.

The major drawback of this strategy is the additional storage required to keep "warm"

virtual server guest files on the other host servers. This virtual-server configuration also lends itself very well to having a remote disaster-recovery warm site or other remote location. Instead of copying the files to a local server, you could use DFSR to replicate the virtual server guest files to a remote server.

Virtualization Drawbacks

Of course, there are some drawbacks to virtualization. One of the biggest is a potential decrease in fault tolerance. But if you have multiple hosts and copy the virtual server guest files to other server hosts, you can bring up the virtual server guests on different hosts if one of the servers crashes.

With Virtual Server 2005 and VMware Server, a guest server can have a maximum of 3.6GB of memory. If your server requires more than that, it shouldn't be virtualized.

You probably will need more memory on the host server and an OS that is capable of addressing this memory if you plan to host more than a few virtual server guests. Assuming that you plan to run four virtual server guests on a server host, roughly 6GB to 10GB of memory on the host is necessary. This depends on the memory requirements of each virtual server guest. ■



Case Study: Server Virtualization

Virtualization helps Phillips Architecture launch its software development effort.

By Ryan Suydam

Phillips Architecture of Raleigh, N.C., which was founded in 1989, specializes in providing commercial interior design and architecture services to regional and national clients. Their strong focus on building value for clients helped lead Phillips Architecture to be named one of PSMJ's 25 Circle of Excellence 2006 A/E firms in the nation.

Phillips Architecture, a 30-person company in Raleigh, N.C., relies on savvy investments in technology to create best-of-breed delivery of services. Because of our strong market position, Phillips launched a software development effort in 2003 tasked with harnessing the best practices of the design firm and converting these practices into a Web-based software solution that other design firms could leverage in their own practice.

The software, DesignFacilitator, had a market-ready first version scheduled for launch by the end of 2006. Delivering a Web-based product, we needed a substantial and reliable back-end solution. Phillips already had a highly available IT infrastructure nearing end-of-lease, but as each server was hosting a corresponding operating system, all resources were taken. Even though the HP ProLiant DL380 and DL580 servers were nearly three years old, none was more than 10 percent utilized (with regards to processor and memory resources). A recent digital archiving initiative also quickly filled up a clustered SCSI disk array of 500 gigabytes (GB), necessitating a storage upgrade.

Aside from a standard array of domain controllers, Exchange server, SQL server and a high-availability file server cluster, we needed to build entire development, test and live networks to present the Web application to users. A network plan was architected requiring more than 25 servers — a substantial increase from the eight we already had.

We have a very small data center (about 100 square feet) with limited power (80 amp limit) and minimal cooling capacity. Tripling the physical footprint of our hardware was not possible on site, and moving to a remote data center was very cost prohibitive. Another very real limitation was our budget, because we had to keep the cost for our project under \$100,000.

We began to investigate the possibility of utilizing a virtualized infrastructure to overcome our physical limitations, while providing the logical advantages in the areas of redundancy, availability and flexibility. Virtualization allowed us to host 24 servers on as few as four physical

server boxes, better utilizing our resources while staying within our data-center footprint and physical limitations. While a few products exist on the market, EMC's VMware ESX Infrastructure 3 was the only solution that seemed to meet all our concerns. Microsoft Virtual Server 2005, VMware GSX Server and Xen were also considered as options because of their low cost. However, none of these solutions provided the combination of management, availability and redundancy that ESX provides (with Virtual Center Manager, VMotion and High Availability, respectively).

We simultaneously considered several SAN solutions to connect our server infrastructure. We looked at iSCSI options by LeftHand Networks (SAN/iQ), NetApp and EMC. We also investigated traditional Fibre Channel (FC) SANs by HP (EVA 4000) and EMC (CX3-20). In the third quarter of 2006, VMware had not yet qualified iSCSI for VMotion, clustering and a few other options we planned to use. In the end, we settled on the EMC CX3-20, configured with 6 terabytes (TB) of FC disk.

VMware offers an Infrastructure 3 Enterprise Starter Kit that includes four dual-processor licenses and many options. This proved to be the most cost-effective license to meet our needs. All together, we were able to acquire the SAN, storage network, VMware and implementation services for just under our \$100,000 budget.

To complement the back end, we needed servers to run VMware. Since virtualization with automatic failover of live running servers minimized any reliance on hardware, we decided to repurpose our existing servers. We had six HP ProLiant DL380s, each with a single processor. We combined CPU and memory from these boxes into three dual-processor servers with 6GB of RAM each. The DL580, already a dual CPU machine, was upgraded from 2GB to 8GB of RAM. Fibre Channel HBAs (Host Bus Adapters) were installed, ESX was loaded, and we were up and running within a few days of delivery. We did acquire one new DL380 server to act as a backup server, utilizing Veritas Backup Exec and

VMware Consolidated Backup to perform host and agent backups to both disk and tape.

Four existing servers were migrated from physical to virtual, and two dozen new servers were created fresh within VMware. Both processes were fairly painless. P2V (Physical to Virtual) software worked as advertised. We booted to a P2V assistant CD, which then “sucked” our OS onto the SAN, and then booted the OS on a VM.

Each server took about two hours to process — the only downtime we experienced during the migration. Building new VMs was a quick process, as we were able to install Windows Server once, apply updates and applications as needed, and then clone the install to new machines.

The Features

We immediately fell in love with VMotion. As we were repurposing existing servers, we started with one VM server, moved a handful of P2Vs onto that server and claimed another hardware box for VMware. We repeated this process until all servers had been virtualized; however, we didn’t have the virtual servers running on the boxes we wanted.

VMotion allows a simple drag-and-drop to move virtual servers to different hardware while the server is still running. We held our breath the first time — “VMotion-ing” our production Exchange server during business hours. No one phoned in, and after a quick poll, no one even noticed anything happened. Exchange kept all client connections alive and continued to service requests and send e-mail.

High availability is another feature that quickly earned our respect. We had upgraded our DL580 with generic memory rather than HP parts. Unfortunately, we experienced a compatibility problem, bringing the server down. Within a minute, five servers that had been running on that box were back up and servicing clients on the other three boxes. This time, while the IT staff noticed a few blips, there still were no users who

called to report anything unusual. Once fixed, those five servers were back without a hitch, thanks to VMotion.

We did experience a few items that caught us a bit off guard. Networking was a bit challenging — the basics went smoothly enough, but we wanted to team multiple NICs to increase performance and provide redundancy by sending all data through two network switches externally. A compatibility issue with our Extreme switches limited us to redundancy only, via failover, rather than the performance-enhancing NIC teaming we desired.

Windows 2003 Clustering works on ESX, but only pre-service pack 1. We had planned to install SQL 2005 to take advantage of the low-cost active/passive clustering available in SQL 2005 Standard. Attempting to install SQL 2005 revealed a Microsoft prerequisite of having Windows 2003 Server with SP1 installed. Until Microsoft and VMware resolve this issue, we are without our SQL cluster, relying instead on VMware’s availability options, which do not protect against application level failures, whereas SQL clustering would.

VMware Consolidated Backup is also challenging because of the “Version 1” nature of the product. We’ve almost got it working and expect resolution on that shortly. Meanwhile, we have relied on traditional agent-based backups.

Exceeding Expectations

In the end, we were able to achieve nearly all our goals, exceeding many of our own expectations. Virtualization is definitely market-ready, mature and well supported. VMware support has been top-notch; and in only a few months, we have managed a virtual infrastructure, saved a lot of time and become highly addicted to the flexible on-demand nature of our new back end.

We can deploy a server in hours and perform maintenance any time — even during the day. Our small IT staff has appreciated the early evenings and free Saturdays. We experienced

very few budget surprises and only a couple of technical surprises.

Phillips Architecture and DesignFacilitator now share a highly available backbone, while having separate security domains and virtual application servers. This consolidation has not only allowed us to share costs, but also to reduce them and maintain operations despite limited server-room capacity. Performance has been adequate, even with five servers on each box.

Virtualization allowed us to roll out a cost-effective Web farm while simultaneously improving IT services for our parent company. While we may see rapid growth, virtualization will allow us to respond with hardware as needed, without having to redeploy operating systems and the many hours of configuration needed. Our leasing cycles on hardware also can be lengthened,

as each individual component becomes less critical in a virtualized environment. Now we can replace hardware only when we need performance, not just because we're concerned that it's too old and might die. We can also save on service contracts for hardware maintenance. Since each component is individually dispensable, the low-cost next-day warranties make more sense than expensive four-hour same-day contracts.

Overall, we consider the move to virtualization to be a huge success for us. Now that we've made the jump and have invested in the technology, we are eager to grow in a dynamic, flexible, on-demand manner. ■

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