

A Virtual Success

DePaul University turns to server virtualization to meet its data-center demands.



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Server virtualization was the perfect cure for DePaul University's data-center blues.

About three years ago, the Chicago university's information services department realized that its strategy of simply adding more servers to meet the seemingly insatiable computing demands of 23,000 students, 6,000 faculty and staff, and a large alumni organization was no longer working.

DePaul's main data center, with about 250 servers, was beginning to run out of power and cooling capacity, while the backup data center, with about 30 servers, was running out of space. Essentially, the data centers were reaching their limits, threatening the IS department's ability to support the university's future plans for new applications.

"We felt the old way of doing things of acquiring individual servers for each project and application was not a sustainable model," recalls Jason Yao, who manages the data center as operations manager at DePaul. "But we're on a limited budget like everybody else. We had no funding to fully redesign our data centers. We needed something new to meet the challenges we were facing."

DePaul turned to server virtualization, software that helps IT departments make better use of existing server resources by making each server operate as if it was many servers. Specifically, it carves a server into multiple "virtual machines" (VMs). Each VM, which houses its own operating system and application, shares the same server resources, such as processing power and memory, but operates independently of each other. The technology allows IT departments to consolidate servers and reduce their power and cooling needs, which results in cost savings from reduced hardware and energy consumption.

DePaul's IS department is reaping the benefits of virtualization. So far, Yao and his colleagues have deployed about 90 virtual machines on eight servers and plan to virtualize the majority of the university's applications over the next two to three years. The work they've completed has already helped alleviate the space, power and cooling problems in their data centers.

The university has implemented a pilot project and an initial virtualization deployment that includes VMware virtualization software licenses; IBM System x servers to house the virtual servers; and Hitachi Data Systems Thunder 9585V storage devices to store data. Yao estimates that the university has saved about \$400,000 on hardware costs alone by virtualizing those 90 servers.

"The amount we save is dynamically changing and will grow as we deploy more VMs," Yao says.

Virtualization Goes Mainstream

The x86 server virtualization phenomenon, which first burst on the scene about six years ago, has gone mainstream with half of enterprise IT departments using x86 server virtualization today, growing to two-thirds by 2009, according to a November 2007 study by Forrester Research.

Virtualization adoption is just as high at colleges and universities, says CDW•G account executive Tony D'Anca.

"Higher education has really embraced virtualization, and it's because of several factors coming together, including the tremendous cost savings that universities can gain from server consolidation and lower energy usage," D'Anca says. "Virtualization also aligns nicely with many of my customers' moves toward 'green data centers,' and the importance of reducing waste and becoming more energy efficient."

The concept of server virtualization is simple. Traditionally, IT departments have run one application for each server. But VMware's software allows users to run between eight to 12 applications on a two-processor server, says Bogomil Balkansky, VMware's senior director of product marketing. Each application that is virtualized can save 7,000 kilowatts of power, or \$560 per year, he says.

Being more energy efficient and becoming greener has been an added bonus, Yao says. "We have a green initiative at DePaul, and it's absolutely important for us to help save the environment," he says.

Besides cost savings and becoming greener, server virtualization also simplifies the deployment, maintenance and management of servers. It improves server uptime and aids in continuity of operations and disaster recovery, Yao says. For example, if a server goes down, VMware's management software will automatically move the VMs to another server to keep applications up and running.

Getting Started

Joe Salwach, DePaul's associate vice president of information systems, directed his staff to pursue a server virtualization pilot project three years ago after reading about the virtues of the technology.

"I encouraged our people to break away from the norm, give virtualization a shot and see if it was ready for prime time," recalls Salwach, who suggested that his staff start small and try virtualizing some noncritical systems.

Yao and his team evaluated several virtualization products, including Microsoft's free Virtual Server; the open-source Xen product; and several versions of VMware's product family, including a free version and the high-end ESX version. The team tested each product and rated them based on performance, manageability, scalability and support services.

VMware's ESX Server won out.

Other solutions run on top of an operating system, such as Windows, which makes the VMs vulnerable, Yao says. VMware's software is more secure because it features its own customized Linux operating system kernel with a built-in firewall.

IS staffers can use VMware's VirtualCenter software to centrally manage VMs and create rules that prioritize hardware utilization and handle load balancing. For example, if one VM has an increased workload, the IS staff can automatically give the VM the extra server resources it needs by rearranging VMs across the servers. And, as previously mentioned, if a server goes down, the software immediately migrates the VMs to a healthy server to prevent downtime.

"VMware ESX let's us be proactive, rather than be reactive," says DePaul System Administrator Mike Medin.

Installation and Implementation

DePaul kicked off its virtualization pilot two-and-a-half years ago. Based on a recommendation by IBM, the university standardized on four new IBM xSeries 366 servers, a four-way server with dual-core Intel Xeon processors and 32GB of RAM.

Yao and his team targeted a handful of small, low-priority applications and migrated them to VMs. They also deployed newly developed applications from new projects, including one that handled the university's telecommunications billing.

"Instead of buying new servers for new projects that came along, we decided to try it in a virtual environment and use that to convince the rest of the university that virtualization was reliable and that this platform would support their needs," he says.

The pilot took three months and was a complete success. About five months later, Yao and his team got the go-ahead to pursue virtualization in earnest.

To do so, the university purchased more equipment, including VMware licenses, additional Hitachi storage devices and three IBM System x3850 servers. The servers, which were an update to the xSeries 366 servers, also featured dual-core Intel Xeon processors and 32GB of RAM.

To ease the power and cooling constraints in the main data center, the IT staff has placed all new applications in VMs. While the new applications consume power, the fact that they are in virtual servers has helped reduce energy consumption by 40 percent.

And to ease the space constraints in the backup data center, the staff consolidated servers by virtualizing the university's entire disaster recovery operation as well as some mission-critical applications, including the university's PeopleSoft application, which handles student records, financials and human resources.

The disaster recovery process is now easier and more cost-effective, Yao says. In the past, servers in DePaul's backup data center housed and operated duplicate copies of critical applications. The IS staff had to configure and regularly update them, so if the main servers went down, the backups would spring into action and keep applications running. "They sat idle, not doing anything, waiting for a disaster to happen," he says.

Thanks to virtualization, the IS department simply clones copies of production servers and stores them as image files in the backup data center. That way, the servers in the backup data center can perform other jobs, and if a disaster occurs, the IS staff can shut down those jobs and bring the critical applications back up, he says.

Implementing virtualization is not simple, Yao warns. Doing it right requires not only good hardware skills, but also software management, engineering and capacity planning skills, he says.

"We didn't want to overtax each server because the load for each application can change over time. We designed each server to handle a medium load initially, so that each server doesn't get overloaded with work," he says.

Virtualization also altered the way the IS department performed change management. But it was for the better. With virtualization, the IS staff no longer has to schedule server downtime with users to upgrade or troubleshoot servers, Medin says.

If IS staffers need to troubleshoot a server, they can use VMware's VirtualCenter tools to move the VMs to a second server, fix the original server, then move the VMs back to the original server without any downtime. In the past, the staff would have to come in at midnight, turn off the server and take the application offline to make the hardware fix, he says.

In fact, when DePaul's School for New Learning requested that the IS department take over the management of its departmental data center, the work to migrate the servers to the university's main data center took just 18 hours. "Before virtualization, something like this would have taken weeks or months," Yao says.

In all, the IS department has virtualized about 30 percent of the university's applications and plans to virtualize an additional 50 percent of all applications in two to three years. As the staff migrates existing applications to a virtualized environment, it will retire older servers, which will reduce the server count, Yao says.

DePaul won't virtualize every application because the technology isn't perfect for all situations. Virtualization is memory intensive, and high-transactional software, such as databases and Microsoft Exchange e-mail, already make good use of each server's computing resources.

"Virtualization is most beneficial for Windows applications that only utilize 20 to 30 percent of system resources," Yao says.

Future Plans

To continue its virtualization efforts, DePaul invested in more virtualization licenses, servers and storage this year. The university is purchasing the newest version of the IBM server that they have standardized on. The IBM x3850 M2s, which feature four-way Intel quad-core Xeon processors with 32GB of RAM, are expandable and can increase to 32-ways if and when the university's server needs grow.

"A box that can scale to 32-ways gives us a better ROI," Yao says.

In addition, the university plans to overhaul its storage with new technology that offers new features, including virtualized storage, IP-based replication and a concept called "thin provisioning," which improves storage utilization rates.

Chang Ding, DePaul's managing director of information services, has overseen the server virtualization process and says the technology has worked as advertised. Virtualization has resolved the problems DePaul was facing with its data centers, and now they are running more efficiently than ever.

"Our requirement was to do something different and give virtualization a shot," Ding says. "We did it, and the benefits have been amazing."



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