VMware Customer Solutions
Virtual Infrastructure Success Stories
Aerospace and Defense
Lockheed Martin Space Operations .......... 4
            Marine Corps Enterprise Network .......... 6

Education
Broward Community College ................. 10
Community College of Baltimore .......... 13
Texas State Technical College .......... 16

Finance
AIG Technologies ................................ 19
Guardian Life Insurance ..................... 21
Merrill Lynch .................................. 23
Prudential ..................................... 25
UMB Financial Corporation ................. 27

Healthcare
Baptist Healthcare System ................. 31
Clark Memorial Hospital ..................... 34

Law
Addleshaw Goddard ............................ 38
Best Best & Krieger LLP ..................... 40

Manufacturing
Alstom ........................................... 44
Moen ............................................. 47
Subaru of Indiana ............................... 49

Media
E.W. Scripps ..................................... 53

Pharmaceutical
GEHE Informatik Services GmbH .......... 57
Purdue Pharma ................................. 59

Recreation
Delaware North Companies .................. 62
TQ3 Navigant .................................. 65

Retail
7-Eleven .......................................... 69
CDW ............................................. 72

Services
Administaff ...................................... 76
Professional Services Firm ................. 78
Surebridge Inc .................................. 81
Willis Group ................................... 84

Technology
Google ........................................... 87
Monster.com .................................... 88
PTC .............................................. 91

Telecommunications
Cellcom .......................................... 95
QUALCOMM .................................... 97
Vidéotron Telecom LTD ...................... 100
Aerospace and Defense
Lockheed Martin Commits to Contain Costs for NASA Contract

When Lockheed Martin Space Operations was awarded NASA’s $3 billion+ Consolidated Space Operations Contract (CSOC), the contractor took on the responsibility of providing end-to-end space operations support for NASA missions, including the Space Shuttle and International Space Station mission operations and planning systems design, development, and integration. CSOC-sponsored “storefronts” are a key component in meeting these obligations in a cost-effective manner. The storefront program involves setting up a facility on or near selected university campuses, where students are hired to perform software engineering and other related work under the supervision of CSOC.

The first of these storefronts, located at Prairie View A&M University (PVAMU) in Prairie View, Texas, opened on September 6, 2001. The Prairie View storefront provides support to the maintenance of approximately 6.5 million lines of code currently being sustained for Johnson Space Center by the CSOC Software Engineering organization in Houston.

Security Requirements Complicate the Picture

“When Lockheed Martin was awarded this contract, our primary goal was to minimize costs while providing premier space operations support,” said Bill Smith, Project Engineer at CSOC. “In doing so, we of course had to maintain NASA’s high security standards, which required a setup to handle unclassified sensitive and unclassified activities. VMware products allowed us to do this and assisted us in getting the storefront up and running rapidly and in a cost-effective manner.” Using VMware Workstation, CSOC is able to run three configuration types on each workstation in the storefront facility, resulting in:

- **Significant cost savings.** Smith estimates that, without VMware, the cost of the user workstation equipment for the storefront would probably have been double what it was, simply because the architecture would have required twice the number of workstations and network infrastructure components.

- **Worry-free management of security requirements.** The storefront’s security requirements are easily handled with the isolation provided by virtual machines. Each workstation runs three virtual machines simultaneously, and each virtual machine is configured with a different operating system and security setup.

- **Rapid start-up.** With VMware products, the storefront team was able to get the facility up and running rapidly and efficiently – within a couple of months.

“VMware offered an effective solution to minimize hardware and infrastructure costs: not only could we buy fewer machines, we could also minimize physical network connections while managing our complicated security requirements.”

Nancy Patterson
Engineering Director, CSOC Johnson Space Center

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**KEY SUCCESSES**

- Cut storefront start-up hardware costs in half
- Maximized hardware utilization
- Enabled set-up of complex three-tier security system on a single desktop
- Established three different configurations per machine
- Enabled developers to work remotely and securely

VMware Helps Lockheed Martin Space Operations Provide Low-Cost, Efficient Support to NASA

VMware® Workstation and VMware GSX Server Assist Lockheed in Lowering Costs, Maintaining Security
VMware Software Minimizes Equipment Costs, Maximize Security

“We needed to run some applications on Windows NT 4.0, and some on Linux; some communications would use a T-1 line; some would require a VPN layered on top of that,” said Smith. “VMware offered the technology necessary for us to run these applications while maintaining the highest security level.”

The sixteen PCs and two servers at the PVAMU storefront are connected to CSOC’s Houston Operations via a T-1 line. Each PC is configured with Red Hat Linux 7.1 as the host operating system, and runs three guest operating system environments simultaneously in virtual machines, with the help of VMware Workstation:

1. The Microsoft Windows NT 4.0 guest operating system gives storefront workers access to CSOC Online at the “business and restricted technology security level,” which is used for e-mail, office applications, and Internet access.

2. One Red Hat Linux 7.2 guest operating system provides a secure connection, via a Virtual Private Network (VPN), to the Houston R&D facility. Workers use this virtual machine to do evaluations of commercial off-the-shelf products and train on the operational software.

3. A second Red Hat Linux 7.2 guest operating system runs at the highest security level so employees can access the mission control and planning software to do maintenance, updates, and fixes. In this configuration, cut and paste between sessions is disabled, preventing migration of data or information without the use of secure procedures.

In addition, one of the servers in the storefront uses VMware GSX Server to maintain user rights configuration and tools configurations. The server provides read-write capabilities for each virtual session separately on the server. In the unlikely event that the T-1 communications link fails, the users still have access at the local PVAMU StoreFront network to save work and files. The server has a backup and restoration capability to ensure no work is lost.

Lockheed Martin’s use of VMware Workstation and VMware GSX Server software is another example of VMware’s ability to help companies optimize resources and complete projects quickly.
VMware Enlisted to Serve Marine Corps Enterprise Networking Requirements

Smartronix Utilizes VMware to Arm Marines with 250 Percent Better Memory and Processor Utilization, Drill Hardware Needs Down 25 Percent, and Provide Advanced Disaster Recovery Capabilities

Marine Corps Network Needed "Always Faithful" Recovery Site

Comprised of smart, highly adaptable men and women, the Marine Corps is a smaller, more dynamic force than any other in the American arsenal; and the only forward-deployed force designed for expeditionary operations by air, land, or sea. Its size and expertise allow the Marines to move quickly, with agility.

The Marine Corps Network Operations and Security Command (MCNOSC) provides global network operations and computer network protection for the Marine Corps Enterprise Network (MCEN), facilitating seamless information exchange to support Marine and Joint Forces around the world. One of the requirements to meet this mission of seamless information exchange is providing enterprise application services. The MCNOSC also provides technical leadership for service-wide initiatives that utilize the enterprise capabilities delivered by the MCEN.

Smartronix, Inc., a global professional solutions provider, was tasked by the MCNOSC to establish an alternate site to recover enterprise services in the case of catastrophic failure at the Marine Base at Quantico, Virginia. Preserving the communication integrity of the MCEN is a top priority for the MCNOSC. "Because the MCNOSC supports the exchange of mission-critical, sensitive information, it needed a reliable, efficient system in place," says Dan Carroll, Senior Application Development Engineer for Smartronix, Inc.

VMware Honored to Serve

The MCNOSC had 30 two- and four-CPU servers providing enterprise level services that needed to be available 24 hours a day. Each of these servers ran just one application and utilized only a fraction of its processing and memory power—typically less than 30 percent. These critical enterprise-level services included Exchange Directory Synchronization servers, Active Directory Forest Root Domain servers, child domain controller servers, and Public Key Infrastructure servers.

To achieve complete recovery and enablement capabilities for enterprise services at the MCNOSC alternate site, Carroll’s team considered several factors, all directly or indirectly related to real-time data transfer. The MCNOSC needed to design an alternate site network and figure out how to move the data to the alternate site. “We needed instantaneous service availability to the entire enterprise when the alternate site was being put into production,” says Carroll. “And oh by the way, we also had to have a solution that was affordable and easily-managed.”

“THE MCNOSC needed an affordable and easy-to-manage alternate site with real-time data transfer that would be reliable in the event of a catastrophe. The VMware virtual infrastructure so effectively met these requirements that it is being leveraged for regional server farm and deployed operations implementation.”

Dan Carroll
Senior Application Development Engineer, Smartronix
The Right Tactics for Disaster Recovery

Smartronix, in partnership with MCNOSC Marines and civilians, initiated the design and implementation of a virtual machine applications network. Several catastrophe and disaster scenarios were developed to set the parameters for the alternate site’s responsiveness and functionality. The final design leveraged VMware® VirtualCenter 2.0 and three VMware GSX Server 3.1 licenses for a VMware virtual infrastructure with Network Appliance storage solutions enabling the seamless movement of large amounts of data from the MCNOSC Command Center to the alternate site.

Now with SnapShot and SnapMirror running on all VMware host servers, all data is within three hours of real time as well as recoverable from up to a two-week period of time. All network application data exists in its entirety at three locations, with a variety of backup and recovery capabilities in place. Should all systems at the main site in Quantico fail, the MCNOSC alternate site would come online immediately to provide uninterrupted enterprise-level services.

Successful Strategy Brings Benefits

The VMware virtual infrastructure deployment provided a number of benefits, including:

• **Increased utilization.** Server utilization was typically less than 30 percent. Now, memory and processor utilization is approximately 75 percent.

• **Increased return on investment.** MCNOSC repurposed the 22 retired physical servers for its alternate site virtual network and other service areas in the enterprise network.

• **Improved server management.** The MCNOSC can now move virtual machines between hosts, create new machines from pre-built templates, and control existing virtual machine configurations. They also can gather event log information from a central location for all VMware hosts; have an increased ability to identify asset utilization and troubleshooting warnings prior to problems occurring; have easier management of physical system bios updates and firmware upgrades; and have centralized management of all virtual machines within the network.

• **Lower costs.** By eliminating 22 servers, the MCNOSC has achieved lower power and cooling costs.

• **Decreased deployment cycle times.** The ease of deploying additional VMware virtual machines, based on the ability to clone virtual machines from templates, has greatly reduced deployment cycles.

The VMware virtual infrastructure is ideal for accelerating software development and testing operations with easily-provisioned and managed server-based virtual machines.

"VMware does for Intel servers what Henry Ford did for the automobile," Ramseyer says. "In the same way that more people were able to afford a Model-T because of the innovation of the assembly line, VMware enables us to allocate more server resources to developers. It has been a pleasant change now that getting a server up and running for a new project is not the delay it once was."

To Adapt and Overcome Future Challenges

The MCNOSC faced quite a challenge and had no clear path to completing a transfer of all application network systems, including enterprise and local assets. With the help of VMware virtual infrastructure, Smartronix met that challenge head on and successfully completed the mission. The implementation has been so successful that the MCNOSC is now planning the expansion of this concept to develop regional server farms leveraging a VMware virtual infrastructure.

"The MCNOSC needed an affordable and easy-to-manage alternate site with real-time data transfer that would be reliable in the event of a catastrophe," says Carroll. "The VMware virtual infrastructure so effectively met MCNOSC requirements that we are leveraging it to expand into other efforts."
About Smartronix

Smartronix is a global professional solutions provider specializing in Networking and Systems Management, Information Systems Security, Application Integration and Development, Software and Hardware Engineering, and Business Management Services. Smartronix is headquartered in California, MD with operating offices in VA, NC, FL, AL, and CA and employees throughout the US and the Pacific Rim. The company has been recognized as one of the Fastest 50 growing companies in the Greater Washington area and one of the top 500 nationally as ranked by Washington Post and Inc 500 media, respectively.
The Need to Cut Costs With Server Consolidation

With 80,000 people needing to access applications on school servers, systems engineers at Broward Community College wanted to create the most efficient, cost effective, reliable IT infrastructure possible. With about 70,000 students, Broward is the sixth largest community college in the United States. To meet the needs of its students, faculty and staff, the college had accumulated 70 servers. Systems engineers wanted to consolidate the servers to cut costs and maximize efficiency. “We had 70 boxes from various vendors, at various stages on their warranties,” says Systems Engineer Ken Libutti. “We were going to need to replace a lot at one time. It would have been tens of thousands of dollars, not to mention the hassle. We wanted to get out of the cycle of ongoing costs of replacing hardware when it went off warranty every few years, and we didn’t want to deal with the problems of maintaining so many individual machines.”

Results

• Consolidated 70 servers onto three physical machines
• Saved over $100,000 in hardware costs
• CPU utilization increased from 1-2 percent to about 40 percent
• Improved memory utilization
• Able to serve about 80,000 people using applications on virtual machines
• Deployment time dramatically reduced; Instead of taking months for ordering, procurement and setup, it takes 15 minutes
• Increased hardware reliability
• Achieved higher performance with load balancing
• Increased management functionality with remote console
• Faster reboot times
• Load balancing increases efficiency

Better Than Expected Results

Soon after the IT team obtained an evaluation copy of VMware ESX Server, it realized the software’s effectiveness. The team began to migrate applications in staged steps. “We rolled one production box at a time, and evaluated and adjusted it as necessary,” Libutti says.

“We’ve been very impressed with the control that VMware ESX Server gives us; It’s administrator friendly. The speed of deployment and ability to set and control different variables, including CPU and memory allocation, means we can best use our resources while optimizing our responsiveness to the needs of students, faculty and staff.”

Ken Libutti
Systems Engineer
Broward Community College
The benefits were better than expected, including being able to consolidate 20 servers in virtual machines onto each physical server, instead of the 12-15 expected. "With 20 virtual machines, we haven’t even reached 40 percent utilization, so we could do even more," Bartholomew says.

Now, about 80,000 people – including students, faculty and staff – use applications running on virtual machines. These include faculty and student email applications, the online library database repository and accounting applications. For the college’s many Web systems, IT staff set up a duplicate of the production environment for testing on virtual machines. Then they run through development, approval, and are deployed to production.

The benefits to Broward of creating a virtual infrastructure to meet the demands of its large group of users include:

• **Hardware Savings.** Systems engineers estimate cost savings of more than $100,000 with the purchase of three IBM servers instead of about 50 smaller servers.

• **Faster Development/Deployment Times for New Servers and Applications.** "It’s amazing," says Broward Systems Engineer Matt Hodgson. "For Windows servers, we can utilize the sys prep utility to create a blank machine, so we can just copy it. It literally takes us 15 minutes to get a machine up, so we can better react to the needs of students, faculty and staff. Before, it would take a day or two to set up. With the ordering and procurement process, it could take months."

• **Server Consolidation.** Being able to consolidate 70 servers onto three powerful servers means a better use of space and resources, and eliminates the issue of maintenance for a large number of separate machines.

• **Higher Performance with Load Balancing.** Running applications on higher-powered servers, and being able to load-share, has yielded better performance. "For our staff and faculty email server, we got much better performance running the SMTP (simple mail transfer protocol), the GWIA (GroupWise internet agent) and MTA (message transfer agent) on virtual machines. We were having issues with it on one physical server, but when we put it on two virtual machine servers to split the load, it worked well," Libutti says. Hodgson adds, "In the past, if we’d had to split out services like that, we would have encountered problems because we wouldn’t have the hardware to do it. With VMware ESX Server, all we have to do is bring up another virtual machine."

• **Higher Performance Windows Servers.** Libutti says that Windows operating systems running in virtual machines perform better. "We’ve migrated mostly Windows machines, and we’ve noticed the reliability improves. Traditionally we’ve always thought you had to reboot a Windows machine at least once a month in order to keep it running smoothly. We’re not seeing that with VMware ESX Server. The boxes just run."

• **Less Worry.** "It lets us sleep at night," Libutti says. "We don’t have to worry about hardware breaking down, and servers on virtual machines reboot quickly; faster than a regular hardware server."
Remote Management Capabilities. Because they are on call at all hours, being able to manage servers from remote locations means increased responsiveness. “It’s convenient, especially in the evenings, when we’re at home, but on call,” Hodgson says. “Once we get through our VPN (virtual private network) and use the VM console, it’s just as if we’re sitting in front of a server on campus, so we can turn off the server and turn it back on.”

Better Server Management. VMware ESX Server gives the Broward IT team optimal control of servers and resources. The systems engineers can quickly deploy servers and set key variables, including memory size or CPU utilization.

Increased Flexibility for Programmers and Developers. The virtual KVM (keyboard, video, mouse) concept also helps programmers for the college because they can work on servers from the personal computers at their desks instead of needing to go to a computer lab.

Disaster Recovery. Broward Community College uses Backup Express on virtual machines, and have applications in append mode so they can roll them back. Because each of the IBM servers is connected to the SAN storage, and all virtual disks reside on the SAN, if one server goes down, the virtual machines can easily be moved onto another server.

Increased Responsiveness Helps With Viruses. Libutti adds that in the case of a virus attack, VMware ESX Server enables them to bring up another machine in just a few minutes, so they can quickly move any systems and repair them.

Providing a Seamless IT Infrastructure

It is important for the Broward systems engineers to provide the school with high performing computer applications, enabling faculty and staff to best serve its large student population, and helping students receive the best education possible.

Libutti says VMware ESX Server provides an affective server management solution that enables them to save money and manage their resources.

“We’ve been very impressed with the control that VMware ESX Server gives us; It’s administrator friendly,” he says. “The speed of deployment and ability to set and control different variables, including CPU and memory allocation, means we can best use our resources while optimizing our responsiveness to the needs of students, faculty and staff.”

“It’s like giving us a virtual KVM anywhere we need it, and we can assign different rights based on users, allowing them access to only certain virtual machines,” he adds. “This way, each application user gets exactly what they need, and can work from their personal computers instead of computer labs.”

While saving money and resources was the goal of the project, the team says they are most pleased about the performance of applications running in virtual machines.

“It’s better performance all around compared to any of the servers we’ve had before,” Hodgson says.
Community College of Baltimore County Budget Goes Further With VMware Software on Blades Servers

VMware ESX Server Software Streamlines College’s Computing Infrastructure With Faster Deployments and Improved Hardware Manageability

CCBC Looks to Eliminate Inefficiencies

The Community College of Baltimore County (CCBC) spans five campuses, offering a broad range of courses to a culturally diverse student body. As a public educational institution, CCBC is also well versed in transforming a limited budget into unlimited potential. The secret to success is simple: be efficient.

This need for efficiency was the driving factor behind CCBC’s recent implementation of VMware® ESX Server™ software. According to Senior Network Engineer/Manager Benjamin Thompson, the college’s IT organization was interested in getting more value out of its server infrastructure, and the use of virtual machines (VMs) had obvious appeal. Acting as fully isolated partitions, VMs would allow multiple applications and operating systems to run independently of each other on the same physical server, while sharing distributed resources.

Virtualization was particularly intriguing, says Thompson, because CCBC was in the midst of migrating to an IBM® BladeCenter™ system featuring IBM HS20 servers. By themselves, the blades would ultimately allow CCBC to run 14 blade servers in the space previously required by just two full-size servers. Combined with a virtualization strategy, however, the BladeCenter could accommodate the power of 70 virtual servers in a single rack. For an organization intent on building efficiency, this was a dream scenario.

After several engineers saw a demonstration of ESX Server, the IT department purchased a license for the virtual infrastructure platform and began exploring its capabilities. “We built a VM on one of our HS20s and tried running DNS inside,” Thompson recalls. When the application ran without a hitch, engineers simply turned the staging environment into a production platform. “And we just kept going,” says Thompson.

Before long, the department had tested and gone live with an assortment of critical production applications, including print services and a global password changer (GloPass). “We knew immediately that ESX Server software would help us get more out of the equipment we already had, as well as the equipment we were planning to deploy,” Thompson says. “VMware was that good.”

“Certainly we are purchasing less hardware, but more importantly, we are cutting expenses on maintenance, energy and real estate. We are getting more out of the money we spend, so our infrastructure will last longer and perform better. These are the cost savings that, over time, help make an organization truly efficient.”

Benjamin Thompson
Senior Network Engineer/Manager, Community College of Baltimore County
VMware ESX Server Brings a New Class of Value

CCBC is currently running ESX Server on three IBM HS20 blade servers at one campus, and on one HP ProLiant ML530 at a second campus. The HS20s are connected to a storage area network (SAN) based on an IBM TotalStorage “Shark” Enterprise Storage Server system, while the ML530 is attached to a Fast-T 500. Thus far, the ESX Server implementation has provided benefits beyond the IT group’s initial expectations. Advantages include:

- **Long-term cost savings.** As CCBC consolidates its servers onto a blade system, the IT department has been averaging five VMs per blade and anticipating deploying seventy VMs in seven CPUs of rack space. Not only does this strategy dramatically increase the utilization potential of each server, but it also amounts to a vastly enlarged pool of resources in a much smaller space. “The up-front expense of this configuration is not where we are looking to cut costs,” says Thompson. “Certainly we are purchasing less hardware, but more importantly, we are cutting expenses on maintenance, energy and real estate. We are getting more out of the money we spend, so our infrastructure will last longer and perform better. These are the cost savings that, over time, help make an organization truly efficient.”

- **Reduced time frames for server provisioning and application deployment.** Before the VMware implementation, fulfilling requests for new servers could be a painfully long process. Now that Thompson’s team can create a VM at will without reconfiguring physical hardware, CCBC enjoys almost instant server provisioning. “On-the-fly deployment is almost too simple,” laughs Thompson. “Don’t tell our users, or they will want a new server every minute.” Test and development time frames have also been reduced because VMs configured for test scenarios can be simply and quickly turned into production machines. This is especially beneficial for CCBC, as its IT group frequently uses VMs to test new software or write new application code.

- **A more efficient education.** The combination of cost savings with shorter deployment and development cycles ultimately translates into a better education for the students at CCBC; it provides over 2,500 faculty/staff, 75,000 students and 5,000 workstations with a reliable computer system for accessing email, completing critical assignments and more. With a more cost-effective foundation, the IT group has more available resources—including budget, time, and expertise—with which to assist users and to continue implementing new innovations that facilitate learning.

Blade System Leverages VMs to Make Less Space More Manageable

When asked where ESX Server has presented the biggest benefits to CCBC, Thompson immediately points to the IBM BladeCenter. “If possible, deploy VMware on blade servers,” he advises. “A lot of people are afraid of blades because there is a slight learning curve. But the configuration becomes so much more manageable and redundant, and that boosts efficiency even more.” Why? Because blades not only take up half the space of traditional 1U servers, but they also share vital resources such as switches and interface cards, allowing for more simplified, centralized management.

“1U servers might offer the same performance, but they each require their own Fibre Channel interface cards to attach to the SAN, their own switches, and so on,” Thompson explains. “The IBM BladeCenter, on the other hand, has a main chassis through which a single redundant Fibre Channel switch attaches to all 14 servers. That means only one management interface for the SAN, and one management interface for the servers,” says Thompson.

**VMware ESX Server at Work**

- VMware ESX Server deployed on IBM Blade Center and HP/Compaq ProLiant servers
- Three dual-processor IBM HS20 blade servers, 2GB RAM, one dual-processor HP ProLiant ML530 server
- Each server connected to IBM Enterprise Storage Server (ESS Shark) in a SAN with 2.4 TB capacity
- Host operating system: VMware ESX Server
- Guest operating systems: SUSE® LINUX™, Red Hat® Linux, Microsoft® Windows®, MandrakeLinux, Novell® Netware™
- Applications: Domain name service, WebCT, Common UNIX Printing System (CUPS), GloPass, Web servers, Nagios®, Nortel Networks Optivity™, SquirrelMail for students
The Future Looks Bright With VMware Solutions

In addition to consolidating all of its old HP/Compaq servers through virtualization using VMware ESX Server, CCBC anticipates using VMware VMotion™ technology in conjunction with the IBM SAN and a Layer 4-7 switch from Nortel Networks™, which will be part of the IBM BladeCenter, to improve load-balancing capabilities between servers and maximize retrieval and performance from its production database. Because VMotion enables the dynamic reallocation of critical resources between VMs, it can help engineers more effectively assign processing power to further increase server utilization. It can also accelerate disaster recovery efforts in the event of system downtime by enabling IT staff to shift a software stack to a live server without requiring certain hardware reconfigurations.

CCBC is also exploring the use of VMware in non-persistent mode to protect applications from unauthorized tampering. In the event an application running on a VM is compromised or changed without permission, a simple system reboot will restore the application to its previous state.

"VMware is so efficient that we are going to end up with it almost everywhere," predicts Thompson. "In fact, it won’t be long before all our users will log into some server using VM functionality for some reason during the day."
Texas State Technical College Provides Students with Extra Hands-on Training Using VMware Workstation

VMware Software Multiplies the Capabilities of TSTC Waco Computers for Increased Learning and Simplified Systems Administration

The Need for More Hardware

The Texas State Technical Colleges (TSTC) are a system of statewide public two-year institutions of higher education. With four colleges and three extension centers, the system offers more than 100 degree and certificate programs in subjects including computer maintenance technology, computer networking and systems administration, computer science technology and network security technology.

TSTC Waco carefully designs coursework and computer labs so students get the hands-on training they need. In 2001, TSTC Waco experienced a growing demand for more desktop computers to accommodate the curriculum. "We have classes where students need to interact with various operating systems," says Alvin Packard, TSTC Waco’s network security technology network administrator and lab assistant. "We needed to buy separate hard drives for each operating system for each student. But we didn’t have the room and we needed to cut costs."

Administration was also troublesome. "We were using multiple hard drives to load different operating systems," Packard says. "The problem was that if something didn’t work correctly, you’d have to wipe the hard drive and reload it. It started to become a big hassle, and it was time consuming."

So Packard and the Network Security team searched for a solution that would meet the college’s needs. They found VMware® Workstation and a similar product from Connectix. "VMware Workstation supported more of what we needed it to do, so we downloaded the trial version. It worked well, so we bought the licenses we needed."

The Benefits of Virtualization

From a network administrator’s point of view, setting up coursework and a facility to train students can be nerve-racking. An ideal training situation allows students to experiment with operating systems, even occasionally crashing them. When students work directly on hard drives, such crashes are a problem. With VMware Workstation, administrators can set up numerous virtual machines on a single piece of hardware, allowing multiple operating systems to reside on the same physical machine, immune to crashes on other virtual machines because they are isolated from each other.

"We have an instant response and handling class, where you use hacker-like tools," explains Packard. "To test different operating systems, define their weakness or level of security, it is easier to allow students to attempt hacking on virtual machines instead of hacking on other computers. We don’t need to worry about damaging hard drives because the work is contained. Each student can also do all of their work on one computer instead of switching to different physical machines to work on different operating systems."

"With Workstation, we are able to give students the in-depth, hands-on training they need without buying another roomful of computers, plus we’ve saved time, space and money," Packard says. "You can do more with a computer running Workstation than you can with five different physical machines."

“With Workstation, we are able to give students the in-depth, hands-on training they need without buying another roomful of computers, plus we were able to save time, space and money. You can do more with a computer with Workstation than you can with five different machines.”

Alvin Packard, CWNA Network Administrator/Lab Assistant
Network Security Technology
Texas State Technical College Waco
Other benefits of Workstation for TSTC Waco include:

- **Cost Savings of More Than $800 Per Virtualized Computer.** Packard finds that instead of buying a new computer for about $1,000, he can upgrade the RAM and add Workstation licenses to his current computers. “For a lab with 21 computers, that's a savings of about $17,000, plus we save room, which we don't have to spare.”

- **Time Savings and Ease of Use.** From the moment Packard evaluated Workstation, he appreciated its ease of use. “When we first played with it, it was pretty straightforward, point and click,” he says. “In the classroom, instead of having to pull out a hard drive; you point and click and in minutes you're setting up another machine.” The TSTC Waco team uses compressed images for fast and easy set up. “In the beginning of a semester, if a class needs certain tools or search-specific applications, I'll load all of that and compress the image,” Packard explains. “I can set up the images on all of the computers and have everything loaded.” This also means that if a system crashes, a systems administrator can reboot the system quickly.

- **Versatile Learning Tool.** By allocating 256–368MB RAM to each virtual machine, TSTC Waco is able to run multiple virtual machines in each computer, without sacrificing performance. “Students can learn how to install a Windows domain, install a client, connect them, join the domains, do policies—all on one machine instead of using two or three machines to accomplish the same task,” says Packard.

- **Increased Learning Opportunities.** Packard says that before using Workstation, the inconvenience of loading operating systems on separate computers limited use of less common operating systems. “Before using Workstation, we used a lot of Windows,” he says. “With Workstation, we were able to expand to using different flavors of Linux—SUSE, Mandrake, RedHat, Slackware, FreeBSD, OpenBSD, plus more versions of Windows.”

- **Segmented, Secure Network.** For courses such as the instant response and handling class, encouraging students to hack or crash a system was a nightmare for systems administrators. TSTC Waco has set up segmented networks so activities in virtual machines do not affect the school’s network. “Before we had virtual machines, someone watching the network might see something suspicious going on and get worried about it. With VMware Workstation, we can contain our virtual machines in one room. If something goes wrong, you just reboot, without affecting other machines.”

- **Product Testing.** TSTC Waco also uses Workstation to test software applications. “We test everything in virtual machines set to non-persistent mode to make sure it will work,” Packard says. “If something is wrong, we can turn it off and start over again.”

- **Expanding Capabilities With VMware Software.** Students, instructors and staff are increasing their use of VMware software due to its multiple benefits. “The software’s advantages are important to us, especially with budget crunches,” Packard says. “Because the software is reasonable in cost and saves money in the long run, we are using it more and more.”

The benefits to students are the most compelling reason for the growing use of Workstation. “With Workstation, our students get more hands-on training than they would be able to receive otherwise,” he says. “Without Workstation, the only way we could teach them as much material would be to divide the students into groups and let them share hardware. With Workstation, students can experience and learn much more.”
AIG Technologies (AIGT) is a leading supplier of information technology solutions, including applications geared to the insurance industry, managed IT infrastructure services and technology consulting services. AIGT is a member of American International Group, Inc. (AIG), the world’s leading international insurance and financial services organization, with operations in approximately 130 countries and jurisdictions.

As a managed services company, AIGT supports back office operations for AIG business units and third-party customers. “We wanted to free up data center space for additional projects, and we knew that replacing physical machines with virtual machines would accomplish that goal,” says Joseph Nadan, AIGT Chief Technology Officer.

Jon Stumpf, Chief Technology Officer of Corporate Infrastructure at AIG, the parent company of AIGT, adds “Virtualizing our servers also would help reduce the time it takes to deploy them—improvements that would ultimately improve our business response to AIGT customers.”

AIGT chose VMware ESX Server as the virtual machine software. ESX Server is designed to allow many virtual servers to reside on one physical server in demanding environments such as enterprise data centers. After a quick prototype phase to evaluate ESX Server, the AIGT team decided to proceed with a virtualization pilot project: consolidating servers at AIGT’s processing facility in Livingston, New Jersey.

**ESX Server Consolidates Physical Servers 20:1, Improves Scalability**

For the pilot, the AIGT operational team determined that the workloads of 37 existing servers could be moved to an equal number of virtual machines residing on only three physical servers running VMware ESX Server. Most were performing as Domain Controllers running the Microsoft® Windows NT® Server or Windows® 2000 Server operating system. The virtual machines ran on three 4-CPU Dell™ PowerEdge™ 6650 servers, with a fourth server as backup.

VMware ESX Server enabled an immediate return on investment (ROI) and improved business response to AIGT’s managed services client base:

- **Decreased hardware costs.** Since the pilot, AIGT has lowered its costs by reducing the number of physical servers it maintains by a 20:1 ratio. The company also has achieved an 8:1 rack space reduction by consolidating servers, providing the scalability to accommodate additional projects without physically increasing the size of the data center.

- **Substantially increased server utilization.** By allowing multiple applications to co-exist on one physical server, virtualization enabled AIGT to use resources more efficiently and harness more of each server’s capacity, increasing server utilization.

- **Reduced server provisioning time.** Virtualization also has reduced server provisioning time by 50 percent, which enables AIGT to be much more responsive to customer needs. Previously, server deployment took more than six hours when an appropriate physical server was available onsite. Now it takes only three hours to deploy a virtual machine. The savings are even greater when you factor in the additional time to obtain a physical server; the procurement process typically consumes six to eight weeks.

- **Remote management of VM instances.** Trouble shooting servers can be done anytime, anywhere on the network, which has eliminated the need for AIGT technicians to physically be in front of the machine. As a result, AIGT can support VM instances throughout the world from a central location without the need for “smart hands” to be dispatched to the physical servers’ location.

**RESULTS**

- Reduced server provisioning time in half, from 6 hours to 3 hours
- Substantially increased server utilization
- Consolidated servers 20:1
- Reduced data center rack space 8:1
- Increased quality and reliability of IT environments through built-in redundancy
- Improved response time to customers

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AIGTECHNOLOGIES

C U S T O M E R  S U C C E S S  S T O R Y

AIG Technologies Uses VMware ESX Server to Boost ROI, Enhance Business Response

VMware® ESX Server helps AIG Technologies achieve a 50 percent increase in server deployment speed and 20:1 reduction in the number of servers

“Our customers are our highest priority. Product quality and customer service are two key metrics by which we measure success at AIGT—and VMware has helped improve both.”

Joseph Nadan
Chief Technology Officer, AIGT
AIGT Improves Product Reliability, Customer Service with VMware

According to Stumpf, the increase in deployment time has led to a dramatic improvement in customer service. "VMware provides AIGT with the capability to quickly address customer needs," he says. "It also helps us position ourselves for the future with respect to utility computing models."

"Flexibility is an example of how virtualization has enabled AIGT to improve the reliability of the services it provides to customers," says Nadan. "Our customers, whether AIG business units or third parties, are our highest priority. Product quality and customer service are two key metrics by which we measure success at AIGT—and VMware has helped improve both."
VMware Helps Guardian Retire Unsupported Hardware, Migrate Applications Without Reinstallation

VMware’s P2V Assistant Saves Time and Costs, Lowers Risks by “Virtualizing” Applications in Place, Migrating Systems in Hours Instead of Weeks

Legacy Applications Complicate Guardian’s Efforts to Consolidate

The Guardian Life Insurance Company of America (Guardian) is the fourth largest mutual life insurance company in the United States and is listed among Fortune magazine’s top 500 businesses. Guardian and its subsidiaries protect individuals, businesses and their employees with life, disability, health and dental insurance products, and offer 401(k), mutual fund and annuity investment products, and trust services.

Guardian wanted to retire servers that were running on unsupported hardware. The company hoped to:

- Decrease dependence on unsupported hardware
- Consolidate underutilized resources
- Ease the challenge of managing legacy operating systems, to provide time for an orderly migration to Microsoft Windows 2000
- Accomplish these objectives with minimal reinstallation expense and downtime of production systems

VMware Helped Guardian Meet Its Goals in Hours

With the assistance of VMware® P2V Assistant and Professional Services team, Guardian was able to migrate machines in hours, rather than the weeks or months it would have taken to re-install applications and rebuild systems. An added benefit was the lowered risk of accidentally corrupting applications.

VMware P2V Assistant provided:

- Efficient movement of complete physical server environments into virtual machines
- Legacy Application Support: Instead of re-installing legacy applications and attempting to recreate operating configurations, Guardian was able to continue running legacy applications in their original environment and maintains status of systems
- Snapshots of unstable systems, “Bug for Bug” offline examination within single physical machine environments, so staff can conduct parallel analysis
- Reduced total cost of ownership (TCO): Lower hardware development, QA and management costs

“Without VMware, migrating these machines would have taken months to years because we’d have to rewrite everything. With VMware, it took only hours, and our systems and configurations were preserved as-is. P2V Assistant really makes life so much easier.”

Sanjay Dalal
Senior Systems Engineer, Guardian
VMware P2V Assistant and Services Provided Automated Migration of Existing Applications

Guardian’s goal was to retire servers that are currently running on unsupported hardware. Many application servers were targeted because they housed single applications to avoid application conflicts, and were running at very low utilization rates. The applications themselves run in Windows NT 4.0 operating environments, and support backoffice tasks such as life insurance application processing and account inquiry and management. Migration to Windows 2000 has been problematic for many of these applications, which were developed years ago and no longer have documentation or installation files in existence. Many also have memory leaks.

“We faced the challenge of consolidating over 100 servers running legacy and/or ill-behaved applications that needed a dedicated server,” said Suraj Dalal, Senior Systems Engineer for Guardian. “Without VMware, migrating these applications would have taken months to years because we’d have to rewrite everything. With VMware, it took only hours, and our systems and configurations were preserved as-is. P2V Assistant really makes life so much easier.”

With VMware P2V Assistant Guardian was able to capture the existing physical environment and migrate it into a virtual environment, automatically – saving months to years of work, production system downtime, and risk of systems failure.

Moreover, VMware provided Guardian with more than Virtual Server technology. With the assistance of VMware partners, Professional Services, and additional software using P2V Assistant, VMware was able to help Guardian with planning, hardware selection and purchase, application migration, training, deployment, and post-deployment support 24x7.

Only VMware provides more than just the virtual machines.

“With VMware, we gained efficiencies on many levels, from optimizing the utilization of hardware resources and consolidating server platforms, to establishing more effective platforms for testing and business continuity/disaster recovery. Ultimately, the implementation minimized our infrastructure needs as compared to the traditional ‘server sprawl’.”

Warren Jones
Vice President, IT Operations, Guardian
Merrill Lynch’s Investment in VMware Technology is a Win for Jacksonville Campus

VMware Virtual Infrastructure Increases Employee Productivity by Speeding Server Deployment and Improving Application Availability

Development Servers Present Provisioning Problems
With private client assets of approximately $1.6 trillion, Merrill Lynch is one of the world’s leading financial management and advisory companies. The Merrill Lynch campus in Jacksonville, Florida, supports the operations for more than 2,200 users in 25 different business groups.

In the results-oriented arena of financial management, return on investment is a driving force. When Vice President Keith Leahy addressed the problem of provisioning costly development servers, he made sure to run the numbers. Network Services and Technology Support (NSTS) managed 40 development servers, many of which were below the campus standard, more than three years old and no longer supported by the vendor.

In addition, the servers were underutilized and application availability was an issue. “Development servers require significant effort to provision,” Leahy explains. “They are costly to support from many perspectives, including software licensing, hardware support, operating system management, network charges and physical space.”

Leahy needed a way to consolidate the servers while speeding up the provisioning process. The NSTS team recognized that VMware virtual infrastructure technology would save the campus both time and money by reducing hardware costs and decreasing server deployment time. VMware® ESX Server proved to be a low-risk investment with a high potential for future growth.

The NSTS team was able to leverage the firm’s existing End User Licensing Agreement to acquire VMware ESX Server licenses and provide training to personnel in Jacksonville. Leahy says, “The support staff took an advanced ESX Server class onsite that was very beneficial. It was great hands-on training to get us started.”

A Successful Deployment
The team first created virtual lab environments with Windows 2000 server hosts to prove the concept. They quickly built numerous development servers in virtual machines, allowing them to consolidate and retire old and underutilized hardware. The campus was able to donate more than 15 servers to local schools and, according to Leahy, “it wasn’t too long before we went from zero to 50 virtual machines.”

As expected, with a server consolidation ratio of 25:1, hardware utilization jumped dramatically from below 10 percent before virtualization to more than 60 percent after. The campus’ provisioning issues were also solved, reducing development server provisioning time from weeks—the time it took to procure and configure physical servers—to a mere two hours to deploy virtual machines. They also enjoyed other immediate benefits from the server consolidation, including:

- Centralized management. With VirtualCenter, Leahy says, development server management is easy. NSTS now has the capacity to restrict access and delegate permissions to administrators and users. “We can delegate virtual system management using VirtualCenter security, which enables the workstation and server support teams to leverage the same infrastructure,” says Leahy.

- Increased server portability and availability. While NSTS initially chose VMware virtual infrastructure to address hardware problems, the campus soon discovered additional benefits to adopting the technology including server portability, protection and availability. “Once you virtualize a server, it becomes portable,” Leahy says. “So you don’t have to physically move servers anymore.” He explains how, in the event that a server is required in another physical location, the campus would not have to physically transport the server between locations—a complex and time-consuming process. Instead, the virtual machines can be copied like files and moved to alternate hardware with ease.
- **Recoverable server configurations.** Backing up Windows operating systems and server configurations is a complex and time-consuming task. Previously, NSTS only backed up development data stored on the servers, but not the server configurations themselves. Now, the operating system for all development servers is backed up weekly. "Since the server is now a file, we can get bare metal backups of the entire server configuration and restore from tape easily," he adds.

**VMware Virtual Machines Create Dream Environment for Developers**

Prior to the introduction of virtual technology, the campus’ development servers were not highly available and servers could not easily be brought back to baseline configurations. This was unfortunate because developers generally like to start with a baseline, introduce changes, and then choose to discard or apply changes. With VMware software, Leahy explains, "Configuration snapshots can be taken using redo files, and then changes can be rolled back to the baseline configuration."

Application availability has also improved with VMware ESX Server. All the virtual machines reside in a fully redundant environment with server definitions on both physical hosts. "In case of a hardware failure on one host, the virtual machine can be brought up on the other host in a matter of minutes," says Leahy, adding that he expects even better results later this year with the introduction of VMotion, which will enable NSTS to move virtual machines across physical hosts without downtime. These advantages create an ideal work environment for developers, allowing them to develop applications more efficiently. "With virtual machines, developers avoid downtime and bring products to the market faster," says Leahy.

**Embracing the Virtual Environment**

NSTS plans to add three VMware ESX Server Virtual Infrastructure Nodes with VMotion and Virtual SMP to create a multiple processor virtual farm. The campus plans to begin provisioning virtual desktops as well. Leahy envisions the flexible and efficient virtual infrastructure will allow “even greater disaster recovery options, virtual labs, training and desktop portability.”
VMware Insures Improved Customer Service for Prudential

VMware® ESX Server Enables Substantial Cost Savings for Prudential UK

Equipping a Remote Service Centre in Less Than Six Months

Prudential UK is part of the Prudential group and provides a range of financial products and services including annuities, corporate and individual pensions, savings and investment products to around seven million customers. The company currently employs some 7,400 staff.

In 2002 the company decided to establish an off-shore service centre in India to improve customer service levels and reduce costs for the UK insurance operations. Andy Ruby, Manager of Infrastructure Design, faced the challenge of providing 850 employees in the new Mumbai centre with the complete application suite on a standard Prudential desktop, which comprises over 100 applications needed to service customers – including custom-built policy and service systems.

Ruby and his team soon discovered that running these applications over the WAN was problematic due to high latency on the network. Compounding the difficulty, the time scales that Ruby had to work to were highly aggressive: the centre had to be up and running, including all IT systems and telecommunications, within six months. This meant that there was no time to rewrite any applications.

VMware ESX Server Helps Prudential Save Costs

Having looked at various remote access solutions, Ruby decided that employees from India would need to log on to PCs based in the UK, but the physical space, power and cost of running 850 PCs was prohibitive. Ruby therefore designed a highly innovative system using VMware ESX Server virtualisation software to allow servers to be split up into multiple virtual machines, each running an instance of the Prudential standard desktop, which employees outside of the UK could log onto from their location. Ruby was able to meet his deadline for deployment, as well as achieve other benefits such as:

- **Cost savings.** "We’ve seen significant cost savings from the implementation," said Ruby. "Being able to quickly provide access to applications using ESX Server has played a significant part in this.”
- **Simplified IT management.** All management of the environment is done in Prudential’s Reading location, with need for only limited IT support in Mumbai.
- **Enhanced customer service.** Customer service has been improved with easy access to tools for remote service centre representatives.

“Without a means to host our existing standard desktop in the UK, we would not have been able to provide remote access to our Mumbai employees in such a short space of time, and VMWare server virtualisation proved to be the most flexible and cost effective approach. We can now run our standard desktop remotely and we haven’t needed to rewrite any of our applications.”

Andy Ruby
Manager of Infrastructure Design, Prudential UK
How VMware ESX Server Provided a Fast and Cost-effective Remote Access Solution

Using ESX Server, Prudential has been able to quickly construct multiple virtual machines that run Microsoft XP Professional, as well as over 100 applications, and simply send screen, keyboard and mouse information over the network using Microsoft’s RDP protocol. VMware ESX Server runs on 60 HP DL360s, each with 2 processors and 4 GB RAM. Three hundred service centre employees in Mumbai are currently using the system to access applications remotely, but the number will ultimately grow to 850. The first deployment happened within 4 months, with the complete deployment to 850 users expected to follow within 12 months.

"Without a means to host our existing standard desktop in the UK, we would not have been able to provide remote access to our Mumbai employees in such a short space of time, and VMware server virtualisation proved to be the most flexible and cost effective approach," commented Ruby. "We can now run our standard desktop remotely and we haven’t needed to rewrite any of our applications."

Ruby first became aware of VMware ESX Server when looking to consolidate some of the company’s model office and development servers to save buying more hardware, as well as reducing the physical space, heat and power that is associated with a large number of servers. Prudential expects to consolidate 60 servers on two HP DL740s with VMware ESX Server enabling them to run multiple operating systems on these two machines. The company is also considering consolidating some of its production application servers onto virtual machines.

"Virtualisation brings the best practises of the mainframe into the 21st century," said Ruby. "Consolidating our servers will allow us to manage resources more effectively and react to business pressures more quickly – it will give us more agility as a company."

In the future, Prudential is planning to extend the remote access Ruby has achieved in Mumbai to other areas of the business, including selected third parties or remote users, such as homeworkers who access the network using ADSL.

"VMware’s ESX Server has allowed us to provide applications anywhere using our standard desktop," concluded Ruby. "I can now say to colleagues it doesn’t matter to me where you do business."

Conceptual representation of the thin client desktop solution
UMB Financial Corporation Values VMware Virtual Infrastructure for Server Management and Consolidation

Leading Retail Bank Invests in VMware Virtualization Technology for Frontline Applications

Building on a Tradition of Growth and Innovation

UMB Financial Corporation began as a storefront bank in Kansas City, Mo., with first-day deposits of $1,100 in 1913, and has since grown to become a multi-bank holding company with assets of $7.2 billion. UMB now owns and operates 165 full-service banking centers in six states. In addition to expanding physically, the company has stayed on the cutting edge of technology—being one of the first banks to offer online banking services to customers. UMB was also the first bank in the United States to create Web Electronic Data Interchange service for commercial customers and in 2000 was named one of America’s top 10 banks for e-business innovation by PC Week magazine.

Supported by this foundation of long-term growth and innovation in the banking industry, UMB’s IT team is always on the lookout for ways to maintain and increase the company’s technological and business edge. Senior Systems Engineer Ron Armstrong explains, “We initially brought VMware software into our labs to get a feel for the product and to try deploying new services on it. Then, like most companies, we developed a server consolidation initiative.” UMB’s consolidation plan had three primary objectives: to decrease the number of physical servers in the datacenter, to decommission and replace aging hardware, and to upgrade legacy operating systems. The ultimate goal is to increase the efficiency of UMB’s technology systems.

Retail Banking Demands High Availability and Performance

UMB is a full-service financial organization, and retail banking is a primary line of business. “You can still walk up to the teller and cash your check,” says Armstrong. The bank’s pilot foray into virtualization involved the main retail banking application for all of UMB’s teller lines, which was running on legacy servers. “This equipment was five to six years old and out of warranty,” Armstrong says. “Because the servers were important to our business, we were paying a lot of money to a third-party company just to keep them under maintenance in case they failed.”

“Using VMware VirtualCenter, I can provision and create servers anywhere I can get a VPN connection, including my cell phone. I can manage my servers while sitting in my La-Z-Boy in my living room—I’ve done that!”

Ron Armstrong
Senior Systems Engineer, Distributed Systems, UMB Financial Corporation
The 18 physical servers were migrated to virtual machines with VMware P2V Assistant. The bank moved the teller application onto ESX Server—retiring the old hardware, eliminating third-party maintenance costs and increasing the availability of the teller application. Armstrong says, “We are supporting our front-line retail customer-facing application within our VMware virtual infrastructure. Each virtual machine is now running on a 2.5GHz processor on ESX Server, so we saw an increase in application performance despite shared resources.”

UMB banked other benefits, including:

- **Space savings.** From April to September 2004, UMB introduced 39 virtual machines into its environment and eliminated more than 90 physical servers. The spring cleaning produced striking results in the data center. “After the pilot migrations, we reduced five 48-inch cabinets completely full with servers to just eight units of rack space,” says Armstrong. The environmental clean up resulted in reduced costs for the company too, including savings on power, networking and environmental cooling.

- **Decreased server deployment time.** VMware software has increased UMB’s flexibility in delivering servers to meet business needs. Instead of taking six weeks to order and set up new hardware for new applications, Armstrong is able to deploy a virtual machine within a day.

- **Facilities management on the move.** Using VMware VirtualCenter, Armstrong can provision servers, perform SAN maintenance and distribute server load, and then return to other projects. “Using VMware VirtualCenter, I can provision and create servers anywhere I can get a VPN connection, including my cell phone,” he says. “I can manage my servers while sitting in my La-Z-Boy in my living room—I’ve done that! One night I fired up my laptop, dropped the GameCube controller, moved 25 production servers to totally new hardware, had everything up and running with no interruption to the customer, updated our documentation, turned off my computer and went back to playing GameCube 20 minutes later.”

- **Simplified system upgrades.** “We run a lot of very specific need-type business applications that may not be mainstream or off-the-shelf products,” says Armstrong. “Being able to move those applications from one system to another used to be a very complex task. VMware software took the pain out of this process. With VMware P2V Assistant, we can build new virtual machines and then easily migrate applications and their data for testing upgrades. If successful in testing, we can move forward with the upgrade plan. When done testing, we can easily delete the upgrade and free up those resources. We don’t have to worry about buying new hardware.”
**Adding Flexibility to Data Center Assets**

For UMB, new projects come in based on specific business needs, and they can come from consulting firms or vendors. This can cause errors in server requirement estimates and lead to last-minute requests for additional servers, which could delay a project for weeks. “With VMware software, we can deliver in record time,” says Armstrong. “When we get 11th hour requests, we have the capacity on hand to have a server in 24 hours instead of six weeks. The markedly decreased deployment time keeps projects running smoothly, minimizes budget snafus, and allows UMB to respond quickly to business needs.”

The improved procurement model has also streamlined UMB’s proof of concept testing. In the past, when a new application was needed, the process of bringing in the product and evaluating and testing it was daunting. “We didn’t have the hardware lying around, so we’d have to procure it,” Armstrong says. “Four or five weeks down the road, we would get the hardware in, build an operating system and test the application—only to find that it doesn’t meet our needs or it’s not what we want. Then we’d have hardware we’d have to use for something else. With VMware virtual infrastructure, we can deliver a new virtual machine within 24 hours without wasting hardware resources.”

**Virtualization: Lending a New Standard to IT**

Armstrong says UMB plans to expand its virtual infrastructure base because it brings so many benefits, including cost savings and optimized server management. “Our standard right now is that any new Windows server introduction into our environment is delivered in VMware software,” explains Armstrong. “Our vision for this year is to extend and grow our capacity so we can deliver all new services into the virtual environment.”
Healthcare
A Healthcare System’s Need for Efficiency

Baptist Healthcare System (BHS) is one of the largest not-for-profit healthcare systems in Kentucky. BHS owns five acute-care hospitals with more than 1,500 licensed beds in Louisville, Lexington, Paducah, Corbin and La Grange, and manages a 300-bed acute-care hospital in Elizabethtown.

With numerous applications supporting its hospitals, BHS was constantly deploying new servers. “As a healthcare company with a large number of critical applications, we don’t like running more than one application on the same server,” says Tom Taylor, a senior client server analyst who works on technical infrastructure initiatives as well as application implementation. “But we were having to buy too many and the costs were too high.”

Baptist Healthcare is split between two time zones, with its operations center and four facilities in the Eastern time zone, and the other facility in the Central time zone. Because most of its applications did not have built-in features to accommodate multiple time zones, BHS had to install duplicate servers.

The organization turned to server consolidation to streamline processes and conserve resources. “Like many companies, we’re under a power and networking crunch,” Taylor explains. “We wanted to downsize our hundreds of servers to a considerably smaller footprint to reduce power consumption and simplify networking and overall management.” BHS also wanted to speed up server deployment times for quicker response to business needs. Typical server procurement time was six to eight weeks, from ordering the hardware, to installation, to configuration, to release. “That was a long time to wait to start a new project,” says Taylor.

VMware Product Line Meets BHS’ Needs

BHS was first impressed by the advantages of virtualization with VMware® Workstation when it was introduced in 1999. “We used VMware Workstation for test and development because we were tired of having multiple machines at our desks,” he says. “We knew there had to be a better way. That’s how we got our feet wet with VMware virtualization technology.”

When VMware introduced server products, Taylor realized the technology would address BHS’ server consolidation needs. “We got GSX Server when it came out, focusing on Web development to reuse boxes for testing,” he says. “In November 2003, we looked at ESX Server to go to the next level for a development platform, one that could host more machines. After a few months of experience with ESX Server, we decided it would also be a good production solution.”

Taylor worked with VMware Premiere Partner New Age Technologies to deploy BHS’ virtual infrastructure. New Age Technologies assisted Taylor with planning and strategy design as well as training and implementation of multiple ESX Servers and VirtualCenter. “VMware software is a key element in BHS’ IT strategy, allowing them to optimize resource use, while giving them the scalability to grow,” says Michael Paynter, virtualization practice manager for New Age Technologies.

According to Paynter, working with Tom Taylor and his manager Mark Bos has been a rewarding opportunity for New Age Technologies. “It has been a true partnership because they are so focused on answering the question, ‘How can VMware technology help us help our end users?’”

“Ever since we first looked at VMware technology, each time a new product has come out, we’ve found a role for the software.”

Tom Taylor
Senior Client Server Analyst,
Baptist Healthcare System
VMware software enables BHS to consolidate computing resources by partitioning and isolating server resources in secure and portable virtual machines. "VMware software allows us to combine servers on a single physical host, while each virtual machine maintains its isolation from the others," Taylor explains. "We gain the benefits of having separate machines to meet any of our needs, but we reduce our need for physical hardware. We don't need separate servers for different applications, or different time zones; we just create new virtual machines. We also don't have to wait to order the hardware."

New Age Technologies Senior Engineer Brian Perry, a former healthcare IT manager, VCP and VMware instructor says, "If time to market were a major concern in the healthcare industry then BHS's use of virtualization would truly be the poster child. They've taken a huge amount of time out of the server provisioning process that has allowed them to focus limited resources on activities that improve patient care. That's the most important issue in all of this."

BHS has plans to use VMware's newest product – VMware ACE – to allow 50-60 employees to work from home. "We have some clerical positions that currently take up office space and other resources," Taylor says. "Allowing them to work at home would free up space for patient care. It would also provide flexibility to our employees."

"Ever since we first looked at VMware technology, each time a new product has come out, we've found a role for the software," Taylor says. "Basically, if VMware sells it, we bought it."

Proven Results With Virtual Infrastructure

Taylor explains that the multiple benefits of VMware software include:

- **Hardware Cost Savings.** Taylor estimates a hardware savings of about $5,000 per server, for a total savings of about $300,000. On one application alone, BHS was able to save $45,000 because without VMware software, BHS would have needed to buy eight servers. "That was a $45,000 investment for one test system that we didn't have to incur because we virtualized the servers."

- **Server Consolidation.** Using VMware software, BHS achieves an average consolidation ratio of about 8:1. "It works very well," Taylor says. "In fact, during our proof of concept, we put 28 virtual machines on one 2-CPU ESX Server and ran it for two months with no problems."

- **Resource Cost Savings.** Operational costs have also decreased for BHS. "It saves money on power consumption in the server room, and it saves on contracting electricians, new cable pools and port costs on the SAN; instead of having 40, we can have two," Taylor says.

- **Time Savings.** Before using VMware software, server procurement took six to eight weeks. Now, BHS can deploy servers for testing or production in a matter of minutes.

- **Increased Flexibility.** Taylor says virtualization gives him more flexibility because he can control his resources. "For testing, I have four servers with ESX Server licenses running today," he explains. "I can have as many as 50 virtual machines set up on those servers. If we don't need to use them, we don't keep them running. For production, we have virtual machines running a variety of applications, from a third-party vendor's database to IIS Web. I am able to allocate memory, CPU, and network resources to each virtual machine according to what it needs."
• **Ease of Management.** VMware VirtualCenter gives BHS a central point of control for workload management, provisioning and availability. “We take full advantage of the technology so we can leverage our SAN storage and our network, and manage our resources,” says Taylor. “It maximizes efficiencies, increasing our responsiveness to business needs.”

• **Increased Uptime.** VMware VMotion technology and ESX Server features allow BHS to meet its goals of maximum uptime. “With VMotion and ESX Server, we have an abstract hardware layer so we can move virtual machines from one place to another to do hardware upgrades and other updates without having to take systems or servers down,” he says. “If there is a server failure, we have a quick mediation plan to get those servers up and running because we can move resources around in our farmed environment.”

• **Streamlined Networking.** BHS' ESX Server virtual machines are dual-path connected to an HP EVA SAN for virtual disk sharing. There are six NICs in the ESX Servers: one for the service console, one segmented backup network for backup traffic, one for VMotion and three NICs bonded within an ESX Server virtual switch. “We take advantage of VLAN tagging technology so we're tagging multiple VLANs to the three-NIC bond. It is a lean system.”

• **Disaster Recovery.** Although BHS has more extensive plans for its disaster recovery process using VMware software, New Age Technologies has worked with the hospital system and implemented Snap Enterprise Data Replicator scripts to do automatic backups of virtual machines as they run. “Instead of restoring from tape, we were able to recover and replace a server in minutes instead of waiting hours for the restore,” says Taylor.

**Future Plans for VMware Software**

Because of the flexibility VMware software provides, Taylor says he expects virtualization at BHS to grow ten-fold by next year. Plans include building out the disaster recovery process, implementing VMware ACE, and migrating more physical servers to virtual machines. “By the end of February, we will be supporting the lab and pathology systems in virtual machines,” he says. “We used to have a well-defined line separating clinical and financial systems, but we’re progressing toward having everything on one network. The maximum uptime will be valuable to the medical staff accessing clinical applications.”

Taylor adds that he is constantly finding new ways to take advantage of VMware’s product innovations. “We use it for all kinds of things,” he says. “If a vendor needs a station or needs to come in through the VPN to do support, we create a virtual XP station for the vendor, lock it down, and they use it as their toolbox.”

He also recommends that others utilize a VMware virtual infrastructure to maximize scalability. “VMware software is great,” he says. “VMware keeps improving each product. It’s best to keep up with all the latest products to see how it can fit into your infrastructure.”
Clark Memorial Hospital, a 241-bed, acute care hospital in Jeffersonville, Indiana, is focused on becoming the nation's best community healthcare provider. The hospital, which has achieved state and region-wide recognition for its medical services and employee satisfaction, wanted to build a strong IT infrastructure that would maximize efficiency at the hospital in order to deliver the highest quality healthcare.

Clark Memorial had a large number of servers leased from different vendors. As the leases ran out, the IT department wanted to standardize on one server maker, and considered buying many dual- and single-processor machines. "It would have served us well because we had so many applications that need to run on separate servers," says Jere Roché, network manager for Clark Memorial Hospital. "But we realized that it would not be the best use of resources because it would be quite a few boxes. Heating and cooling was a concern, and it would be expensive to buy host bus adaptors to connect each system to our storage area network (SAN)."

Clark Memorial realized VMware virtualization software would meet its needs, and provide a number of benefits as well. The software enables IT departments to create multiple virtual machines within one physical server, meaning fewer highly scalable, reliable enterprise-class servers could be used to remake the hospital's IT infrastructure. "It was attractive to run everything on bigger, faster hardware, which VMware enables us to do," Roché explains. "With VMware, we could share resources among servers. If one application is idle, its resources can be used for something else. It maximizes resource utilization and saves electrical circuits."

"VMware simplifies server management," Roché says, "and we are now able to buy more sophisticated hardware – four IBM x440s so far. That’s one type of machine. We had seven types before. Every time we wanted to buy more memory or hardware, we had to do research and learn what we needed. It took a lot of time and resources."

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**Too Many Applications, Too Many Servers**

Clark Memorial Hospital had a large number of servers leased from different vendors. As the leases ran out, the IT department wanted to standardize on one server maker, and considered buying many dual- and single-processor machines. "It would have served us well because we had so many applications that need to run on separate servers," says Jere Roché, network manager for Clark Memorial Hospital. "But we realized that it would not be the best use of resources because it would be quite a few boxes. Heating and cooling was a concern, and it would be expensive to buy host bus adaptors to connect each system to our storage area network (SAN)."

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**Results**

- Increased CPU utilization from about 10 percent to 65 percent
- Server provisioning in 15 minutes instead of two or three months allows IT staff to fully accommodate hospital staff needs
- Were able to buy fewer higher end, larger servers instead of many small servers
- Saved physical space for servers
- Reduced heating and cooling costs for servers
- Conserved resources, including connections to Storage Area Network (SAN)

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"The weekend is not a good time for system maintenance when you have an emergency room. For continuous medical care, no time is convenient to shut down. We went into production with VMware as soon as we saw its capabilities and realized it would help our IT department fully support the medical staff. The software and its features are important to us because we’re using it for healthcare and services. We need those features."

Jere Roché
Network Manager, Clark Memorial Hospital
VMware Enables IT Department to Fully Support Medical Staff

Chris Briney, network engineer for Clark Memorial Hospital, originally loaded ESX Server onto an IBM x330 server and created three virtual machines running one or two applications each. "One month later, we went into production," Briney says. "We realized this would do 90 percent of what we wanted to do, and that was just the beginning. When we learned more about the product and its features we found that it would actually do 115 percent of what we had hoped for."

The hospital is using VMware virtual machines to run a variety of applications. For example, the hospital has created virtual machines for infrastructure servers, including the print server, Citrix for portal-like services, SQL databases, a radiology picture archiving system, home health systems, centralized scheduling, pharmacy, occupational medicine and others. "Almost every department requires applications and a server," Roché says. "There's everything from financial applications to clinical applications, such as operating schedules and patient scheduling, and all of these can benefit from an individual server."

The hospital can run more applications on a single piece of hardware, while gaining a number of benefits, which include:

- **Reduced TCO** VMware saves us from going down the expensive path of having one server per application; with VMware, we don't have to buy more servers," explains Briney. "As old servers come off their leases, we just get rid of them. Because of the workload, we probably consolidated 14 boxes that were running one or two applications each, and put them all onto one physical server, with each application on a virtual machine."

- **Application Availability.** Multiple applications can run together on the same physical server, with critical data secure and isolated in virtual machines. "Virtual machines can be rebooted without affecting other applications on the same physical server,” Briney says.

- **Improved CPU utilization.** With separate servers, CPU utilization was about 10 percent. With VMware, it is about 65 percent.

- **Reduced Deployment Times for Servers and New Applications.** IT staff can accommodate requests for new applications and servers in 15 minutes instead of as long as two or three months to acquire and configure new hardware.

- **Resource Savings.** VMware allows Clark Memorial to save server rack space, circuits and connectors. "We can recover circuits and equipment that were connected to the machines we’re getting rid of," says Roché. "Also, the old servers sometimes overheated. The x440s are better at cooling themselves."

- **Minimized Downtime.** "The potential for nonstop computing lets us do our work and keep everything up and running. Doctors need information ready at their fingertips. It's critical. They don't need distractions; they need to concentrate on the healthcare they're delivering."
Quickly Responding, Confident IT Staff Makes a Difference

With VMware software, the Clark Memorial IT staff gains a powerful tool that enhances its part in creating a successful, efficient hospital. When a department needs a new application or server, the IT team can quickly and easily accommodate the requirement. “It’s nice to be able to quickly provide the IT services needed by our staff,” Briney says. “When a department calls us and tells us, ‘here’s what we need, here are the specifications’, we can set it up in 15 minutes instead of two or three months. It makes our job a whole lot easier, and it frees up a part of the planning calendar because we know we’re ready for other projects.”

Because the hospital staff relies on the IT department to keep its systems running smoothly, the IT department takes pride in being able to fully support the hospital’s needs.

“Everyone here spends a lot of time making sure we take care of visitors and family members,” Roché says. “Clark Memorial Hospital team members have a sense of ownership – the feeling that what they’re doing is important. We want to provide the best IT services for a seamless system. We want to be transparent to those using the applications – doctors, staff – so they can focus on providing healthcare and have all the computing tools they need at their fingertips. VMware helps us do that.”
Addleshaw Goddard Outlaws Data Center Inefficiencies with VMware Software

VMware® ESX Server, VirtualCenter and VMotion™ Transform System Management, Reduce Server Sprawl and Underpin Disaster Recovery Strategy

Addleshaw Goddard Faces Sprawling Server Farm
Addleshaw Goddard is one of the UK’s leading law firms, acting for more than 80 FTSE 350 companies and nearly 100 public sector organizations. Its 1,220 employees, including 162 partners, are based in three UK cities—London, Leeds and Manchester. With revenues of £125.2 million, Addleshaw Goddard ranked 10th in the 2004 Legal 500 listing of top UK law firms.

Daniel Simms, head of IT operations for Addleshaw Goddard, is responsible for managing the firm’s entire IT infrastructure and leading strategic IT projects. Assisted by a 10-person technical team, Simms must assess and implement innovative technologies that generate time and cost savings, improve efficiency and increase Addleshaw Goddard’s competitive edge, while also enhancing the firm’s client services.

A core aspect of Addleshaw Goddard’s business is document production and client communication. To support these activities, the firm requires a reliable IT system that performs well. However, Simms’ IT department faced a constant problem; each time a different application was deployed, a new server had to be purchased and integrated with the data center. This method was cost-prohibitive, a poor use of resources and adversely affected IT infrastructure performance. In addition to solving this issue, the technical team found itself with several other challenges to address:

- Reduce data center management time and complexity
- Ensure consistent infrastructure across all sites
- Control spiraling hardware costs
- Deliver a cost effective testing environment for future application rollouts
- Meet demand for the quick deployment of a training environment

ESX Server: Tackles Tactical and Strategic Issues
Addleshaw Goddard first assessed VMware software as part of a tactical project to build two high-performance training and development systems quickly and cost-effectively. VMware ESX Server was the only product on the market that allowed Simms and his team to achieve this goal without purchasing additional hardware.

Running entirely on ESX Server, the initial VMware implementation hosted Interwoven’s Worksite Document Management System (DMS) and trained more than 1,000 users. The deployment was such

“We first implemented VMware ESX Server to avoid the high costs of purchasing multiple servers and our use has grown organically ever since. VMware is now part of every major IT rollout and we actually treat ESX Server as if it were hardware. VMware software is a critical building block of our infrastructure that has introduced an unprecedented level of flexibility by making our applications portable.”

Daniel Simms
Head of IT Operations, Addleshaw Goddard
a success that Addleshaw Goddard has since used VMware software strategically for every major IT project. This includes company-wide implementations of Windows Exchange 2003, an HR system and a library management system.

Addleshaw Goddard’s virtual infrastructure is comprised of management tools, VMware VirtualCenter and VMotion, which have transformed each of its data centers into a single pool of computing resources that can be tapped into according to demand.

The benefits to Addleshaw Goddard of moving to a virtual infrastructure include:

• **Hardware and Management Cost Savings**
  Existing hardware is used more effectively with servers operating at higher capacity while delivering improved performance. The need to purchase new hardware for each application has been eliminated.

• **Increased Technical Agility**
  Centralized application management allocates computing power to specific applications, thus guaranteeing optimal performance at peak times. Testing time is decreased—new servers can be cloned and provisioned in a matter of minutes.

• **Reduced Server Downtime**
  Virtual machines can simply be moved in real-time from server to server so essential maintenance occurs without any impact to the end-user.

• **Staff Efficiencies and Improved Customer Service**
  Key business applications are quickly deployed. The high-performance and reliability of applications running in virtual machines leads to increased staff efficiencies and better customer service.

**Virtual Infrastructure in Practice**

With staff members accessing applications running in standardized virtual environments, ESX Server enables IT consistency and compliance across the business.

“We first implemented VMware ESX Server to avoid the high costs of purchasing multiple servers and our use has grown organically ever since,” says Simms. “VMware is now part of every major IT rollout and we actually treat ESX Server as if it were hardware. VMware is a critical building block of our infrastructure that has introduced an unprecedented level of flexibility by making our applications portable.”

In addition, ESX Server allows Addleshaw Goddard to move from using an outsourced disaster recovery solution to hosting its own remote disaster recovery center without purchasing multiple servers. This was a strategic decision aimed at providing a more cost effective solution and rapid recovery in the event of server failure.

Controlling IT resources across offices in four different locations as well as a separate disaster recovery site yields considerable management overhead. The centralized control and instant provisioning capabilities of VirtualCenter have simplified this task while reducing administration time.

VMotion provides the ability to move running virtual machines between physical servers in real time and is used by Simms and his team to eliminate downtime and carry out testing procedures. They are frequently able to conduct server maintenance in the middle of the day by simply moving virtual machines between physical boxes.

“We were first off the blocks with ESX Server, and when VirtualCenter and VMotion were introduced, the VMware virtual infrastructure proposition became even more exciting. We have created an infrastructure for the future that gives us greater visibility than we’ve ever had before,” says Simms.
Best Best & Krieger Makes a Case for Growth with VMware ESX Server

Tech-savvy law firm raises the bar on productivity and reliability using virtual machines

Strict IT Challenges Meet Their Match in Server Virtualization

One of the largest full-service law firms in California, Best Best & Krieger LLP (BB&K) serves a diverse client base in both the public and private sector. Today, as the century-old legal giant further expands its business throughout California, BB&K needs to enable its attorneys to manage workloads more efficiently and with added reliability. Part of that process involves advancing its IT infrastructure to respond to the firm's core business needs more effectively.

As part of BB&K management’s commitment to better serving clients through advanced technologies, the firm hired John Weeks as its IT Director. “When I arrived, the firm’s technology base was the proverbial coat of many colors,” recalls Weeks. “The firm’s Executive Committee and I knew we had to start from scratch in order to create the most efficient and reliable infrastructure possible.”

BB&K knew that the new IT strategy would have to meet a set of specific criteria on a specific budget. To begin with, BB&K needed a complete, uniform, and highly scalable IT platform that could enable a significant increase in the number of users while requiring only minor upgrades and enhancements for a minimum of three years. In addition, the infrastructure had to be extremely reliable and fault tolerant, offering each of the firm’s six offices independent internal operations in the event of a wide area network (WAN) outage. Furthermore, the firm wanted capabilities for remote server administration that would enable staff to manage the entire IT infrastructure from the firm’s Riverside, California, headquarters, providing fast, efficient file backup and restore operations.

When BB&K issued a request for proposals from six systems integrators in the hopes of uncovering a cost-effective upgrade strategy, only one response—that of technology engineering and consulting firm Agile360—met all the requirements. “We pitched what we felt was the only logical solution: server virtualization with VMware technology,” explains Omar Yakar, president of Agile360.

“There’s a strong return-on-investment incentive for purchasing ESX Server, but the real benefit lies in how VMware software enables system capabilities that we never could have achieved without server virtualization. These capabilities are helping us further integrate business and IT systems to develop a more advanced infrastructure that will support BB&K’s business needs as the firm continues to grow.”

John Weeks
IT Director, Best Best & Krieger
VMware software enables multiple applications to run independently, each within its own enclosed partition—or virtual machine—on the same Intel®-based server. "Without server virtualization, BB&K would need upwards of eight servers at each location to meet its needs—and some of those offices have fewer than 30 users. That simply was not practical," says Yakar. "A strategy based on VMware® ESX Server enables BB&K to leverage the power of at least four servers on a single piece of hardware, which is much more efficient. Moreover, this approach helps foster the reliability, scalability, and administrative functionality that the firm demanded."

VMware Solidifies New IT Strategy for BB&K

With the help of Agile360, a VMware Professional Virtual Partner, BB&K began a pilot program to evaluate VMware ESX Server, migrating its existing servers and mail applications to new HP ProLiant DL380 and ML370 servers and the Microsoft® Exchange mail platform. The pilot demonstrated that by using virtual machines, BB&K could partition each new server to run multiple independent applications simultaneously, while hosting copies of critical files and applications on other servers. "We created a consolidated, hot-swappable setup," says Weeks, "in which two physical servers could reliably carry the applications and services requirements for an entire office."

Moving ahead, BB&K has since transitioned 54 outdated servers to 16 new servers running VMware software, achieving nearly a 4:1 consolidation ratio, and at the same time providing a fault-tolerant setup to achieve reliable business continuity. This migration has resulted in the following business benefits:

- **Increased scalability at reduced costs.** Capacity for growth is no longer an issue for BB&K. Virtual machines enable the firm’s numerous internal utility applications to share the same physical server, thereby improving server utilization and consolidating purchasing costs. "We run a lot of specialty applications that just do not play well with others," says Weeks. "To get maximum performance, each application typically requires its own server, redundancy, and power supply—yet most of the time, that server sits idle. That’s an expensive proposition, especially for a law firm looking to expand." Using VMware software, the IT team can continue to stack applications onto each physical server until it reaches capacity. This approach enables the firm to double or more than double hardware utilization and provides an extremely scalable foundation that costs less overall to build and maintain.

- **Improved reliability and enhanced disaster recovery.** Another of BB&K’s primary objectives was to provide consistent uptime for each of its offices. VMware ESX Server helps deliver this level of reliability. Not only do virtual servers enable a more advanced hardware infrastructure that is no longer dependent on outdated servers, but the VMware virtual machine platform also provides superior recovery capabilities to help minimize downtime. "VMware syncs nicely with our remote management tools, Altiris and RES PowerFuse," says Weeks. "Now we have a coherent ecosystem that lets us virtually support copies of working environments on additional servers, and then remotely..."
instate those copies as necessary in the event of planned or unplanned downtime. Server provisioning that used to take days now takes minutes. And system recoveries that used to take hours now can take mere seconds. That saves us a lot in support costs, but more importantly, it eliminates the hardship of unstable hardware platforms."

- **Boosted employee productivity.** A law firm makes money through employee productivity. Because VMware helps boost application availability and shrink system recovery time frames, employees have a more efficient foundation on which to work. “Documents are the tangible ‘product’ of a law firm,” says Weeks. “VMware software helps us enable the most reliable access to documents, so that employees have round-the-clock work capabilities.”

**VMware ESX Server Automates Processes to Simplify Core Business Objectives**

For BB&K, the overarching advantage of ESX Server is the way it facilitates server provisioning and deployment processes to create new opportunities that support the firm’s core business. Because VMware software helps create an IT infrastructure based on virtual machines, it allows administrators to create clone environments that can be used in any number of tasks vital to growing the law firm—from production testing to security upgrades—without requiring critical system downtime.

“The speed with which we can test and deploy new applications or security patches, for example, is impressive,” says Weeks. “VMware software solves the logistics problems. We can very easily create another virtual machine and install a new application or patch on it. Then we can test the new function while it resides in its own space. The virtual machine becomes a dedicated development system that the IT team can launch into production when we’re ready—all without disturbing our existing production systems. So even though there’s a strong return-on-investment incentive for purchasing ESX Server,” Weeks explains, “I believe the real benefit lies in how VMware software enables system capabilities that we never could have achieved without server virtualization. These capabilities are helping us build a more advanced IT infrastructure to support BB&K’s business needs as the firm grows.”

Looking forward, BB&K is eager to leverage VMware functionality to further integrate its IT and business systems. “The firm uses video extensively now,” says Weeks, “so we would like to merge video with the data systems, the telephone systems, and the messaging systems. We want to consolidate our business and IT systems into a truly unified platform that enables streamlined administration and maximum efficiency in IT management. We need high bandwidth to handle that, and VMware software will give us the necessary foundation to support this consolidation. This is not necessarily the traditional approach to IT, but nowadays you have to be willing to take the nontraditional steps. Sometimes they are the ones with the greatest potential rewards.”
ALSTOM Powers IT Infrastructure with VMware Software

VMware® ESX Server, GSX Server and VirtualCenter Generate ROI in Less Than Six Months and; Reduce Operating Costs by up to 40 Percent

ALSTOM on the Lookout for IT Innovation

ALSTOM designs, builds and services technologically advanced products and systems for the world’s energy and transport infrastructure. It builds power plants and has supplied around 20 percent of the world’s total installed capacity in power generation. Employing 75,000 people in over 70 countries, ALSTOM also engineers and builds some of the most technologically advanced trains and ships globally including the TGV, the world’s fastest train, Singapore’s automatic metro and Queen Mary 2, the largest cruise ship in the world.

ALSTOM’s Northern European IT Center has high standards for technology innovation and service levels and is responsible for ensuring the highest possible level of IT service in the region. The ALSTOM IT Center operates as a business unit, offering a catalogue of services ranging from the management of 45,000 desktops to supporting multiple intranets and delivering business applications. In order to meet high service level targets and continually improve efficiencies, Director of Technology for Northern Europe, Rob Jones initiated a search for an innovative way to improve the set up and management of each data centre in the region that would generate cost savings and build in flexibility.

The aims and objectives for the new approach included:

- The requirement to get more out of the existing IT infrastructure and support more users and applications
- A need to reduce the amount of time spent on routine server management tasks
- High internal targets for service level agreements demanded a new approach in order to be achieved
- An overall view of regional infrastructure was required
- Testing procedures needed to be accelerated for competitive business advantage

“Our ITIL based model of offering IT services to internal customers in a service catalogue means that we have a very accurate view of the cost to our business. Using VMware virtual infrastructure, we can offer the same levels of service and more flexibility for up to 40 percent lower server and operating system costs.”

Rob Jones
Director of Technology, Northern Europe
ALSTOM
VMware ESX Server and GSX Server
Create Adaptive Infrastructure

In 2002 ALSTOM began identifying how to achieve its ambitious targets for IT improvements by experimenting with the concept of virtualization. Following impressive results with the benefits of using VMware virtual infrastructure immediately obvious, Jones and his team began what has become an ever-evolving, international project to establish VMware virtual infrastructure as the standard platform for ALSTOM’s data centres.

“Our ITIL based model of offering IT services to internal customers in a service catalogue means that we have a very accurate view of the cost to our business. Using VMware virtual infrastructure, we can offer the same levels of service and more flexibility for up to 40 percent lower server and operating system costs,” explains Jones.

By early 2005, ALSTOM had installed VMware software on more than 30 physical servers running 277 virtual machines with ESX Server at its main offices and GSX Server at branch offices. Ninety percent of these host production systems with the remaining ten percent used for testing. A recent project to migrate company intranet sites to Linux has resulted in VMware supporting a population of 40,000 users with the capacity to scale as demand rises. Virtual machines are centrally managed by systems administrators using VMware VirtualCenter and VMotion™.

Taking the virtual infrastructure approach has resulted in the following benefits:

- **Cost savings and quick ROI.** Using VMware virtual infrastructure has resulted in a reduction in annual operating costs of up to 40 percent through fewer servers, SAN and network connections, data center facilities and less administration. In addition, the software investment paid for itself within six months.

- **Existing hardware recycled.** Following the decision to base its IT infrastructure on VMware technology, ALSTOM avoided purchasing a single low-end server for the first 18 months. Instead, multiple applications that previously each required dedicated servers have been consolidated onto high-end machines, freeing up existing servers for reuse and avoiding additional costs.

- **High availability, optimum workload management & reliability.** ALSTOM retains the workloads of servers at optimum levels by allocating computing power to services regardless of where a machine is physically located. As a result, Jones can react to changing business demands quickly, without having to initiate complex buying processes. High application availability of over 99.5 percent and maximum response time of 3 hours can now be guaranteed.

- **Increased staff efficiencies.** Thanks to the management capabilities of VirtualCenter, easy provisioning and a reduction in the total number of servers, IT staff have reduced the time spent on mundane routine tasks and allocated it to services that add more value to the business. More users can be supported and services offered without additional IT staff.
Establishing a Blueprint for the Future

ALSTOM has a strategy of establishing regional IT best practices in order to share knowledge and ease the transition to new systems throughout the organization worldwide. The Northern Europe IT team has become expert in VMware virtual infrastructure and is creating a blueprint for the rest of organization to follow.

“Typically when a new IT system is introduced it takes a time to be accepted and for staff to be fully comfortable. However, VMware has been adopted with unprecedented speed and enthusiasm by the entire team and with minimal formal training. It is now our standard platform for all server builds,” says Jones.

Looking to the future, Jones plans to use a single instance of VirtualCenter to manage the entire Northern European IT infrastructure. This will enable him to have a complete view of ALSTOM’s resources and will be invaluable for capacity planning and responsiveness.
Moen Seeks Streamlined IT Infrastructure

North America’s #1 faucet maker Moen needed an enterprise-wide IT infrastructure that would keep up with business demands. Known for the variety of styles and high quality of its state-of-the-art bath fixtures and accessories, Moen strives to achieve cost savings and maximized efficiency through the most innovative technologies.

Robert Buchwald, technical lead for Moen’s Systems Assurance Team, was looking for a new technology that would help the IT staff respond more efficiently to the company’s growing business demands. “We came to the point where we needed to find a different way of handling our day-to-day operations to keep up with the company’s rapid growth,” he says. “We had about 150 different Windows-based servers. With a couple of exceptions, they were all one- or two-processor systems. If we kept doing things the way we had been, we would need to buy more hardware and increase our headcount in order to manage it.”

Instead, with the help of VMware Enterprise VIP Reseller Champion Solutions Group, Buchwald and his team found a way to cut its operations expenses and better use its resources with VMware software. “We were using VMware Workstation with great success to run Windows and Linux operating systems on a single desktop computer, so we knew its capabilities of consolidating different systems and increasing hardware utilization,” says Buchwald.

Moen Seeks Streamlined IT Infrastructure

VMware Virtual Infrastructure Saves Moen from Hardware Flood

Moen Saves $250,000 in Hardware Costs in Sixth Months

“Champion demonstrated the VMware server software for us, and we knew immediately it was the solution we were looking for.”

Moen’s goals with VMware software were to:

• Reduce the number of servers
• Cut operations expenses by 25 percent
• Reduce maintenance time
• Improve IT agility and ability to react to business needs

Short Evaluation Phase Demonstrates Sophistication of Software

In June 2003, Moen worked with VMware and Champion to get an evaluation copy of VMware® ESX Server. “We just used it,” Buchwald says. “Once we put servers on it and saw the additional tools this gave us, justifying the purchase was an easy step to take.”

To quickly and effectively phase the software into the company’s IT infrastructure, Moen used VMware P2V Assistant to migrate its applications into virtual machines. Champion consultants worked with Moen technicians for a smooth migration.

After a pilot phase, Moen was able to do a production deployment, this time bringing in Champion consultants to help design the system. Technicians also attended VMware ESX Server training classes to maximize their understanding of the software.

“Being able to set up a production server in hours translates into the developer being able to develop instead of waiting, the marketing manager being able to get feedback on marketing projects quickly. They don’t have to wait for deployment or wait for things to be recovered. It greatly contributes to the company’s agility.”

Robert Buchwald
Technical Lead, Systems Assurance Team, Moen
A few months after deploying ESX Server, Moen added VMware VirtualCenter to the virtual infrastructure stack for optimized server management and control of computing resources.

Immediate Results
After only six months of using the software, Moen realized a number of benefits, including:

- **Cost savings.** Moen was able to save $250,000 because it was able to reallocate hardware the company already owned instead of buying 20 new servers. Monthly hardware support costs decreased by 27 percent.

- **Server consolidation.** Moen was able to run 29 virtual machines on three physical machines. “That is 20 percent of our environment,” Buchwald says. “That’s quite a lot, considering we’ve only had VMware software for six months. And we plan to do more.”

- **Improved CPU utilization.** Before using VMware software, Moen had a large number of one- and two-CPU servers running single applications. Now, Moen is able to utilize its CPUs better, with several virtual machines residing on fewer physical servers and the ability to allocate and share resources across the virtual machines.

- **Decreased server deployment time.** In past, if someone needed a new server right away the best-case delivery time was three days due to the time it took to purchase and configure a new server. Now, Buchwald says, “We can deploy servers in a pinch. With VirtualCenter, it takes 10 minutes. It’s absolutely fantastic to be able to deliver a server and have the applications up, have them test and then put them in production in a matter of four or five hours.”

- **Increased agility.** VirtualCenter allows the Moen IT staff to allocate resources based on business demand and remap resources to software for better responsiveness and efficiency. As a result, the IT team can react quickly to support users – including 70 IT and development staff members and the 1,700 employees accessing applications in virtual machines. For example, if a senior researcher needs to do a CPU-intensive deployment, Buchwald and his team can allocate the CPUs to him. “Having this control helps us fulfill requests. Employees are happy that they get what they need, and we can control it in a way that cuts expenses and technician time.”

- **Increased system reliability.** VMware ESX Server and VirtualCenter provide advanced resource management controls, allowing IT administrators to guarantee service levels across the enterprise. This capability has created a reliable, highly-available computing platform for Moen employees.

A Strong IT Infrastructure Impacts Business
Moen is focused on being the best consumer-driven global fashion plumbing and accessory products company. To achieve this goal, the company needs to have the corporate agility to adapt rapidly to business changes. Moen achieves flexibility enterprise-wide with innovative projects and responsive vendor relationships, including its wholesale and retail distribution channels. The company’s ability to achieve such responsiveness depends on a stable, reliable IT infrastructure.

“IT needs to be able to adapt rapidly to any business request that comes to it,” Buchwald says. “The results we’ve been able to achieve give business units confidence in our ability to deliver and help them work more efficiently. Being able to set up a production server in hours translates into the developer being able to get feedback on marketing projects quickly. They don’t have to wait for deployment or wait for things to be recovered. It greatly contributes to the company’s agility.”

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**VMware Workstation, ESX Server, VirtualCenter and P2V Assistant at Work**

- 2-CPU IBM x345 Servers each with 4GB RAM
- Guest operating systems: Microsoft Windows® 2000, Windows® 2003 and Windows NT
- Applications running in virtual machines include: development and sandbox systems, identity management solution, file and print servers, Microsoft Exchange, SAP-related application modules, Citrix domain controllers
- About 70 people in IT and development use VMware software; about 1,700 access applications running on VMware technology
- Developers use VMware Workstation to run Linux and Windows operating systems on the same machine

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VMware Virtual Infrastructure Keeps Production Line Going at Subaru of Indiana Automotive

Subaru of Indiana Automotive Cuts Downtime 40 Percent with VMware Virtual Infrastructure

High Efficiency Ratings
Subaru of Indiana Automotive, Inc. (SIA), is an automotive manufacturing company that builds Subaru models for the global market. With the capacity to produce 200,000 cars in a year, SIA is committed to eliminating environmental risks of its operations, boasting a number of environmental firsts for auto plants. For example, in 1995 it was the first ISO 9000 certified auto plant and in 2004, it was the first auto assembly plant to reach a zero landfill status.

In the summer of 2003, SIA began an initiative to maximize efficiency in its data center. Growing in tandem with increasing car production, the data center was becoming overcrowded with servers. “We couldn’t keep up with them,” says Jamey Vester, a member of the professional staff at SIA. “We did a power study on our data center and found we didn’t have enough power to run the servers we had. We couldn’t replace the servers because most newer servers use even more power. If we didn’t do something different, we would need to rewire everything.”

The company also needed to minimize downtime. “If our SQL server or inventory tracking systems go down, we lose money,” Vester says. “We have hundreds of people working on the production floor. If there is an hour of downtime, we lose about $20,000 in salaries, plus we miss deadlines and need to pay overtime to make it up.”

Performance Testing
To address these challenges, IBM representatives suggested software from VMware. “We ordered an evaluation copy and tested it out,” Vester says. “We realized that in addition to addressing our server consolidation needs, we’d be able to copy a machine and provision a server in a couple of hours instead of the weeks, or even months it usually took if we needed physical hardware. It would also save us from having to rewire our datacenter.” The VMware software, along with IBM servers and a new SAN, would also be key to reducing downtime and creating a viable disaster recovery strategy.

Vester attended a VMware® ESX Server training class and took about six months to evaluate the solution. “We did a trial with our IBM vendor and learned how to use the VMware software,” Vester says. “We set up an evaluation environment by moving some nonessential servers into ESX Server, then installed some production applications into the virtual machines and played with it. We found that for all intents and purposes, virtual machines were no different than physical servers.”

“Our downtime number last year was under three hours. The year before, when we didn’t have VMware software, it was 28 hours. We made other improvements to reduce the number, but I would say 40 percent is attributable to VMware software.”

Jamey Vester
Member of Professional Staff, Subaru of Indiana
Assembling a Virtual Infrastructure
At the end of 2003, SIA began building a virtual infrastructure with ESX Server. “After the first implementation, we decided we wanted another ESX Server, and we pushed our management to let us put production apps into virtual machines,” Vester says.

SIA also deployed VMware VirtualCenter and VMotion™ technology for optimal server management and control in its production environment. In December 2004, it added a third ESX Server. “We were able to get the new machine and migrate the servers in about two weeks,” says Vester. “We worked during the holidays and got another 10 or 11 virtual machines done by January 3.”

Turbocharged Servers
Now, with VMware software, SIA has a scalable virtual infrastructure, achieving benefits that include:

- **Server consolidation.** SIA has consolidated 50 physical servers on 10 42U racks onto four racks and just 15 physical servers.

- **Server containment.** The efficiency of VMware virtual infrastructure saved SIA from purchasing an additional 5-10 servers. “We’ve saved $20-30,000 in hardware by not having to buy new servers,” says Vester.

- **Faster server provisioning.** When a new server is needed, SIA does not need to order and set up new hardware because it can just provision a new virtual machine. “We can make a machine in a matter of minutes,” explains Vester. “It used to take us a couple of weeks, or even months, to order and deploy the hardware.”

- **Reduced server and application development times.** VMware software also saves SIA hours each time they need to set up a new server. “We can have a new server fully gassed up and ready to go in under an hour,” Vester says. “Before, even if we had the hardware, we’d have to load the operating system and then apply the patches, which could take all day.”

- **Reduced downtime.** Since deploying VMware software, SIA has dramatically reduced downtime. “Our downtime number last year was under three hours,” says Vester. “The year before, when we didn’t have VMware software, it was 28 hours. We made other improvements to reduce the number, but I would say 40 percent is attributable to VMware software.”

- **Reduced resource use.** The move to VMware software allows SIA to conserve power and space in the data center. “We saved space, we didn’t need to upgrade our cooling system and we had minimal power rerouting,” Vester says. “With physical servers, we would have had to rewire everything.”

- **High availability.** With VirtualCenter and VMotion, Vester is able to manage servers for maximum uptime. Vester explains: “We’ve implemented a system with our plant control so we have ISX applications that run our physical machines. Virtual machines can take over the work of a physical machine if it fails. We can also reboot problem applications. We also use VMotion, so if there is a problem with a server, we can move a virtual machine to another physical server, apply a patch, and move it back without any service interruption. It’s something I would never be able to do before.”
• **Improved disaster recovery.** SIA used to use Ghost images for server backup. "The big issue was having 50 servers that weren't all the same," he says. "We had 10 of one kind, 10 of another. It is difficult to restore a Ghost image on different hardware, so it made our job difficult if something failed. Now, with virtual machines, we're not dependent on hardware. We can copy DSK files once a month onto a separate partition of our SAN and that's our backup image. We've also been able to create a separate disaster recovery site, so in the event of a major disaster, we can bring everything back up with no problem."

**A Smooth Ride, Plus Faster Response**

While the VMware virtual infrastructure has increased the capabilities of the Production Control Team, it has greatly eased the administrative burden of server management. "Two people have left our group since we've implemented VMware software, but we haven't increased our workload because now the administration of the machines takes a lot less time. If we had gotten more physical machines, it would have been out of control and I don't think we could have kept up with our growth levels."

With VirtualCenter, Vester and his team can view server resource use and performance data from a central view. "Because our operators can view all of the servers at one time and we have immediate access to all of the machines with remote access, we can respond much more quickly if there is a problem," says Vester. "The fact that I can immediately supply other departments with servers without any work impresses them."

**Crash Tests**

SIA has also found that it is easier to test a system in virtual machines before pushing it into production. For example, when Vester was moving from mixed mode of Active Directory into full Active Directory for more functionality, he was able to use an extra ESX Server license on an old server, copy DSK files to the server and create a mini network, migrate the data out of mixed mode, and check if there were any problems. "I was able to duplicate our network so we could fully test it before I did the migration."

**Built to Last**

With its virtual infrastructure in place, Vester says he has a scalable platform that will accommodate the company's growth. "We can maintain what we have now, continuing to move everything onto ESX Server," he says. "We have a good-sized SAN, and our virtual infrastructure in place, so we can keep adding to it without interruption."
The E.W. Scripps Company Tests and Documents Enterprise Active Directory and Server Migration Project Using VMware Software

E.W. Scripps Completes Migration Patterns for 35+ NT 4.0 Domains and 10,000 Users in Six Weeks

Big Project, Limited Resources

The E.W. Scripps Company operates 21 daily newspapers, 15 broadcast TV stations, four cable and satellite television programming networks and a television retailing network, including: Home & Garden Television, Food Network, DIY — Do It Yourself Network, and Fine Living. The company’s television retailing subsidiary, Shop At Home Network, markets a growing range of consumer goods directly to television viewers and visitors to the Shop At Home Web site, www.shopathometv.com. Scripps also operates Scripps Howard News Service and United Media, which is the worldwide licensing and syndication home of PEANUTS and DILBERT.

In August of 2003, Scripps began an enterprise IT project to migrate systems and 10,000 users from Microsoft® Windows® NT4 and Exchange 5.5 to a single Windows 2000 Active Directory (AD) domain model. Once the AD domain migration is completed, the teams will shift their focus to migrating the mail data and users to Exchange 2003.

Gene-Paul Rosenacker, manager of the Messaging Systems Group for E.W. Scripps, worked alongside Andrew Baker, senior systems administrator for the IT Operations and Engineering group and program manager of the AD project, to develop the processes and patterns for the migration. Prior to joining the E.W. Scripps team, Gene was a senior consultant with Xerox Global Services, where he managed a similar migration. When contracted to assist in the migration design and preparations in December 2002, Gene assessed the Scripps environment for lab testing purposes and realized the company did not have enough hardware to properly test the migration and document processes and patterns.

“We couldn’t have completed migration patterns for nearly 40 NT 4.0 domains and 10,000 users in six weeks if we didn’t have VMware software.”

Gene-Paul Rosenacker
Manager, Messaging Systems Group
E.W. Scripps Company

“When ramping up for the project, it was discovered there would be access to three servers, five Intel desktops, and one Macintosh,” he says. “We quickly saw that it wasn’t enough. We needed machines for a domain controller for the forest, a child domain and a migration workstation. There also had to be machines for providing the networking services, member servers with file shares, clustered Exchange 5.5 servers and client machines, ranging from Windows 95/98 to Windows XP Professional.”

Rosenacker had used VMware® Workstation and GSX Server in several previous projects with great success, making it easy to explain and justify to the group. The ability to set up multiple virtual machines on the existing hardware, with little more than a memory upgrade investment, meant Scripps could fully utilize the systems they had in place to fulfill the lab requirements.

“Even if we could physically find the number of machines we needed, there was the issue of space, power, and network connectivity to handle them,” Rosenacker says. “With VMware software, we could use the hardware already in the lab, and create the virtual machines to do all of the testing. When Scripps saw what the VMware software could do, they immediately purchased the necessary licenses.”
It was easy for the team to justify the expense of VMware software licenses because it would save them money. “When you can buy a VMware Workstation license and create three or four virtual machines, as opposed to spending at least $3,000 on a new laptop, it’s easy to justify the cost of VMware software. It’s worth its weight in gold.”

**The Ideal Test Lab**

Using VMware Workstation and VMware GSX Server, Rosenacker is able to maintain a mirror image of the production environment. The company can continually test everything from security patches to user administration scripts and security scripts for new software migrations. “The lab environment is invaluable to us because it’s so close to our everyday live production environment,” Rosenacker says.

With VMware software, the AD migration project has been a great success. “Our primary purpose for getting the VMware software was to build the environment from scratch and document every procedure step by step,” Rosenacker says. “We were able to build a 220-page migration document, along with screenshots, for the remote administrators to reference during completion of the necessary pre-requisite steps. It’s invaluable in saving us travel and resource time in migrating one site, while having others prepare their location prior to implementation.”

The company has realized a number of benefits from using VMware software for the AD project and other initiatives. “With VMware software we were able to build a lab where we could test everything we needed to test within our physical space and hardware constraints,” Rosenacker says. “We were able to cut our costs, conserve our resources, and document procedures.”

- **Saved Resources.** The company did not have the space, power, or network connections to accommodate the number of servers and desktop machines it would take for the AD migration project. “It’s a lot easier and more cost-effective to buy VMware Workstation or GSX Server licenses, and additional memory for machines you already have, than it is to pay for all the additional devices, space, power and connectivity that may only be used in a lab environment.”

- **Stress and Load Testing.** Rosenacker says VMware products enable the company to test systems effectively and create hardware specifications for other locations. “When we have a physical machine going out to a business location, we can use virtual machines to figure out the server requirements and ensure it can handle its anticipated workload,” he says. “We’re able to spec out the hardware more closely now, in terms of disk and processor allocations, to use for different projects.”

- **Higher Performance.** The company has observed high levels of performance in virtual machines. “We noticed in some cases with VMware Workstation that virtual machines ran quicker than several of the workstation-class desktop machines running as a server in and of themselves,” he says.

- **Ease and Speed of Virtual Machine Provisioning.** Because E.W. Scripps can easily create virtual machines in the lab environment, it can react quickly to meet enterprise-wide testing demands. “When we have a new project, we are more prepared to set it up and test it. The snapshot feature has allowed us to move more quickly in testing and responding to various patches, threats, and new technologies,” Rosenacker says.

- **Web Management with GSX Server.** Rosenacker says he enjoys the Web management features of GSX Server. “You don’t have to be in the lab space to work. You can easily sit at your desk to work or monitor the virtual machines. The Remote Console feature has made it even easier to remotely manage the virtual-based lab.”
• **Disaster Recovery and Security Testing.** E.W. Scripps now uses VMware software to test its disaster recovery system and troubleshoot security and critical patches as they are released. “Using VMware software, we can do it with minimal equipment and zero impact to production,” says Rosenacker.

• **Snapshot Feature Saves Time.** With VMware software, test engineers can take snapshots, which are saved point-in-time copies of the virtual machine state. If integration fails or if there is a need to step back to a previous configuration state, they can revert to a recent snapshot instead of having to start over. “If we break something, it’s easy and quick to roll back to the last good known working state for the entire environment,” Rosenacker says.

• **Built Long-Term Lab Solution.** With VMware software, E.W. Scripps has a lab environment that accommodates the company’s testing projects and initiatives.

**Breaking the Bonds of Hardware**

Using VMware software, E.W. Scripps has created a sophisticated test lab despite limited space and hardware. “There are no more system resource obstacles that prevent us from taking on a project,” Rosenacker says. “We aren’t limited by hardware availability. We can turn anything with half a gigabyte of RAM into a virtual host.”

Since discovering VMware and virtualization technology several years ago, Rosenacker has advised engineers to buy Workstation licenses instead of multiple physical machines. “When I taught certification training classes, students had just paid for training, and couldn’t afford to buy a $2,500 system at home just to test on it,” he says. “I told them ‘Buy a copy of VMware Workstation and put it on your existing machine. With that investment, you’ve just gained the ability to do all of your hands-on testing and verification procedures to get ready for certification tests and real world situations.’”

VMware software has worked for The E.W. Scripps Company, paving the way for a successful enterprise-wide AD migration. “Without VMware software, it would have taken several months to prepare for the migration and the documentation would have been much more difficult to complete,” he says. “We couldn’t have completed the migration patterns for nearly 40 NT 4 domains and 10,000 users in six weeks if we hadn’t used VMware software.”
Pharmaceutical
GEHIS Simplifies Complex Computing Infrastructure with VMware ESX Server

European Pharmaceutical Company Consolidates the Workloads of 20 Servers on Two IBM xSeries 440 Systems

Complex Computing Environment Is Challenging To Administer and Sustain
With a turnover of 17 billion Euros in 2001, GEHE Aktiengesellschaft is today the European market leader in the field of pharmaceutical distribution.

GEHE Informatik Services (Gehis) manages all IT investments and services for GEHE AG, which includes a complex network of 2,000 individual workstations all over Germany, 45 Intel servers, and 30 UNIX servers in its data center. As this computing environment was growing, it was becoming more difficult to support.

Gehis needed a solution to:
• Consolidate several small heterogenous servers and applications running on various operating systems onto fewer servers.
• Create a standard platform upon which the company’s development, test, and production environments could be safely deployed.
• Simplify server administration.
• Guarantee high availability and provide for disaster recovery.

VMware® ESX Server Simplifies Server Management and Deployment
With VMware ESX Server, Gehis consolidated the workloads previously running on 20 servers down onto two IBM xSeries 440 machines. By partitioning and isolating server resources in secure virtual machines, Gehi’s multiple servers all running various operating systems, as well as the company’s proprietary applications were consolidated onto fewer, highly scalable and reliable enterprise-class servers. Using VMware ESX Server has resulted in:
• Lower Total Cost of Ownership (TCO). VMware ESX Server minimizes the TCO of Gehis’s computing infrastructure by increasing resource utilization, expanding computing capacity, and maximizing server manageability. It has saved environmental costs by preserving space in Gehis’s data center.
• Increased Efficiency. VMware ESX Server simplifies server administration and maintenance.
• Cost-effective High Availability. VMware ESX Server protects critical data in secure, isolated virtual machines that support standardized clustering technologies for high availability. The company’s systems are protected against non-hardware errors and single point of failure, delivering more baseline availability.
• Simplified Backup and Recovery. VMware ESX Server lets Gehis create virtual machine images that can be rapidly deployed and moved between machines easily. Virtual machines are used to mirror physical servers and act as failover servers, providing a cost-effective disaster recovery solution.
VMware ESX Server Ensures High Availability and Creates Scalable Platform for Future Growth

Gehis had many small, heterogenous servers with various operating systems on Intel hardware. These servers ran different applications, including:

- Microsoft Exchange
- Lotus Domino
- Windows Domain Controller
- Squid Proxy Server
- Several proprietary applications

Although the workload could have been handled by a single IBM xSeries 440 system, Gehis chose to implement this solution on two systems in the first phase of deployment to take advantage of the software’s disaster recovery capabilities. “VMware ESX Server allows us to store image files of the virtual machines on a backup machine,” said GEHIS Infrastructure Manager Michael Lutschewitz. “In case of hardware failure, this machine could take over immediately.”

VMware ESX Server created a standard platform upon which the company’s development, test, and production environments could be safely deployed. Furthermore, VMware ESX Server’s fully dynamic resource controls adapt to the needs of mission-critical applications to guarantee service levels.

VMware ESX Server mainframe-class architecture provides unprecedented scalability, and the IBM “pay as you grow” approach for high-end Intel servers was important for Gehis’s investment protection. With 20 virtual machines running on a 4-CPU system, there was plenty of headroom. The combination of VMware ESX Server and IBM xSeries 440 systems proved to be an ideal platform for server consolidation and for future growth of the company’s computing infrastructure.

“The combination of VMware ESX Server and IBM xSeries hardware was the ideal solution for Gehis. Different servers can now run on stable and scalable hardware. This simplifies backup and recovery because we can store image files of the virtual machines and deploy them instantly.”

Michael Lutschewitz, Infrastructure Manager GEHIS
Purdue Pharma L.P.

Mission-critical reliability in the data center and QC lab with Stratus® ftServer® systems

Purdue Pharma L.P. of Stamford, Connecticut is recognized for its pioneering research in managing chronic pain caused by cancer and other serious illnesses. Innovation is a priority for a pharmaceutical firm that focuses on pain-fighting treatments, and that drive extends to the information technology behind Purdue Pharma’s operations. Facing challenges in two areas where Windows®-based servers were deployed — the data centers for corporate and manufacturing — the IT staff examined the commercially available options. The need for a “rock-solid” platform led to an approach that would be new to the company: Stratus® ftServer® systems, Stratus Technologies’ ultra-reliable family of Intel® processor-based servers for Microsoft® Windows server environments.

“When you start virtualizing Windows servers, as we do in our data center, the need for Stratus’ fault tolerance really becomes obvious. The other important area is where manufacturing data is collected and maintained. We have to secure the batch history and data to avoid having to reject a batch that may be valued at more than a million dollars,” says Stephen Rayda, director of architecture at Purdue Pharma.

Consolidating on reliable servers

The number of Windows-based servers in Purdue Pharma’s corporate data center had reached a point where the facility would soon be outgrown. The increasing server population also used power and cooling to an extent that almost consumed all of the existing capacity.

The IT staff set out to consolidate or virtualize Windows-based applications onto fewer servers. This significantly raised the requirement for server reliability in the data center. “When you have a lot of eggs in one basket, you need a very strong basket to put those eggs in,” Rayda notes.

Experience prompted the IT professionals to resist clustering multiple servers to boost reliability. They knew a system administrator needed considerably more time to set up a cluster compared with a standalone server — if a single server takes an hour, a cluster may need a day. Worse yet, when there was a problem, they found that a cluster didn’t always failover properly between servers.
After reading about the fault-tolerant ftServer family and making a fact-finding visit to Stratus Technologies’ headquarters, it became clear to Rayda and the rest of the team that ftServer systems could supply the high levels of system uptime and data integrity demanded by server consolidation and other essential Windows-based applications.

The team viewed Stratus Continuous Processing® features as a three-pronged defense for the reliability and availability of mission-critical systems. The systems’ lockstep hardware, fail-safe system software, and ActiveService™ capabilities automatically benefit off-the-shelf Windows server applications. With uptime protection built in, ftServer systems have met or exceeded the computer industry’s defining measure of 99.999% availability in real-world customer installations.

Purdue Pharma was especially pleased with Stratus Technologies’ emphasis on device driver reliability. To counteract what can otherwise be a root cause of operating system instability, Stratus works closely with third-party suppliers to harden device drivers for ftServer systems and recommends that customers use only hardened drivers. Stratus has also worked with Microsoft to incorporate Stratus knowledge and expertise into Windows driver standards and recommendations.

**24/7 uptime for QC**

Compliance with the U.S. Food and Drug Administration’s 21 CFR Part 11 rule mandates that all data associated with producing a pharmaceutical batch must be recorded, maintained, and accessible. Lose any part of that data, and a pharmaceutical maker may be compelled to destroy a batch that can be valued at more than a million dollars for a prescription drug.

“A lot of potential points for data loss exist in a lab because there are many different types of equipment involved in data collection — from HPLCs (high-performance liquid chromatography systems), to PDAs (Photo Diode Arrays), to 486 detectors — and you do not need the data collection server to be one of the points of failure.”

Matthew Flood
Associate Director, Plant IT
Purdue Pharma L.P.

“Availability as prescribed”

Having achieved the availability level necessary to support the Windows server virtualization, Purdue Pharma currently runs five ftServer systems in its data center. These are capable of replacing more than 100 physical servers when fully loaded. The savings will repay the company’s investment in fault-tolerant servers many times over. Purdue Pharma also expects to benefit from the ftServer systems being deployed in its QC lab.

Mission-critical applications that may emerge in the years ahead include radio frequency identification (RFID) tracking of medication bottles, a step the pharmaceutical industry is considering to foil drug counterfeiters. The firm’s IT team believes the ftServer systems show promise for future applications like these. “When a vendor can demonstrate the rock-solid reliability we need in a Windows environment, that is compelling,” Rayda notes.
Recreation
Delaware North Companies Cuts Costs and Boosts Performance with VMware Virtual Infrastructure Software

Delaware North Lowers Costs and Centralizes IT Management with VMware Server Products

Growing Company Makes No Concessions for a Strong IT Infrastructure

From sports venues to national parks to Kennedy Space Center to the world’s leading airports and gaming destinations, Delaware North Companies share the vision of providing the highest level of customer satisfaction while maximizing returns to stakeholders. With its dedication to high quality products and services, the company landed a 25-year contract for complete food services operations at the new, yet-to-be-built 90,000 seat Wembley Stadium in the UK while Delaware North Australia completed another successful Australian open, doing a record $11 million in business.

To win this kind of business and offer the best customer service means having a lean, mean IT infrastructure. “Four years ago, our company took the path of centralizing our IT because the field units, for the most part, don’t have technical people on staff to manage the systems,” says Bob Armstrong, IT director for Delaware North.

But creating a central datacenter for the company was a challenge. “Every time we brought in a new application or worked with a new vendor, they requested a standalone separate environment that was specific to their software and was not commingled with other software or applications,” Armstrong says. “But when we built a new data center in 2000, we soon exceeded space, power and cooling capacity due to demand for a server for each new application. We realized that if we didn’t do something quickly, we were going to run out of capacity and have to invest a lot of money into upgrading our datacenter again.”

Delaware North Companies needed to find a way to create an IT infrastructure that would scale with the company’s growth while keeping costs down. “The charge we had was to reduce our footprint in the datacenter, find a way to manage the systems, and find a solution endorsed by hardware and software vendors so we would eliminate a need for a physical server every time we bring something new into our datacenter. This brought us to VMware® and server virtualization.”

A Successful Test Phase

Armstrong and his team found that VMware was the only company that could satisfy their requirements. “We knew VMware was the industry leader, so we got an evaluation copy of GSX Server and gave it a try,” he says. VMware® GSX Server and ESX Server allow companies to run multiple applications independently, each within its own isolated partition – or virtual machine – on the same Intel-based server.

Delaware North Companies began with a proof of concept (POC) in a development environment in August 2003. “We wanted to start slowly and start in development so people would not see the new technology as a hurdle. Once people saw what it was, what it could do and its benefits, deciding to use it in production was a slam dunk.”

“We can react much more quickly to business requirements; we can quickly set up applications that positively impact the business... With VMware software, we can quickly deliver for new ventures and we’ve eliminated the headaches of IT.”

Bob Armstrong
IT Director, Delaware North
To test the VMware products, in August 2003, Armstrong and his team, led by DNC Network Engineer Todd Bekiel, created seven development virtual machines on GSX Server to run applications, including IBM® Lotus® Domino and a Web interface. “Everything went tremendously well. We didn’t have any problems. We found it to be so seamless, the software vendors were unaware that their systems were operating in virtual sessions,” says Bekiel.

Then Delaware North put GSX Server to the real test. “We’re cautious with whatever we do, so GSX Server running our reservation system was our first big test,” says Armstrong. Delaware North Companies manages over 5,000 hotel and resort properties in the United States and Canada. The company’s online reservation system accounts for over 25 percent of reservations. “It’s critical that it operates and has real time availability,” says Armstrong. “In two months running on GSX Server, our response rate was better and systems were more available than previously with server-based hardware.”

**Higher Performance at Lower Costs**

With the success of the test phase, Delaware North Companies began placing systems in production in October. First, the front end of the Web reservation system was installed in virtual machines. “We manage many properties and hotels for national parks,” Armstrong explains. “We also have some standalone properties. Those were the first servers we put in production.”

Since then, Delaware North has slowly added to its production environment. It now has two production servers running ESX Server, each with seven virtual machines. Moving forward, the company expects to place 14 virtual machines on each physical server.

Since moving to a virtual infrastructure, the company has seen numerous benefits including:

- **Hardware Savings.** Delaware North has cut its hardware spending by 33 percent. “Had we gone the traditional route of one server for each system, we would have spent around $88,000,” Armstrong says. “We spent about $60,000 to build our production environment, which includes licensing and hardware.”

- **Reduction in Labor Costs.** Before using VMware software, it took an average of six hours of labor to stage a new server. Now, it takes less than one hour to stage a virtual machine, meaning an 84 percent reduction in labor costs.

- **Lowered Hardware Maintenance Costs.** Hardware maintenance on each blade server is $800 or $900 a year, instead of $1,500 for each standard server. With the high number of virtual machines per server, Armstrong estimates an 84 percent savings in maintenance fees.

- **Better Performance.** Delaware North has noticed better performance in the applications running in virtual machines. Internet Reservations realized a 50% reduction in response time by leveraging multiple virtual environments. “We looked at our hotel reservations application and some other transactions and saw that performance has increased,” Armstrong says.

- **Faster IT Response.** With its systems virtualized, the Delaware North IT team can respond faster, with shorter turn-around times. “We were able to bring up a brand new Bally’s Player tracking application and deliver it ahead of schedule,” he says.

- **Reliable Storage/Data Management.** Delaware North has both of its ESX blade servers connected to the same SAN, with single paths to storage from each server for redundancy. “Key to our rollout is our storage device to manage the whole thing.”

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**VMware ESX Server and GSX Server at Work**

- **Production servers:** ESX Server on HP BL20ps, each with 8GB RAM, dual 3.06GB processors, 4 NIC cards per blade
- **Development server:** GSX Server on HP LT 6000 with four 550MHz processors, 4GB RAM, 1 NIC card
- **Development sandbox server:** GSX Server on HP DL360 Generation two, dual 1.4 processor, 1GB RAM, 2 NIC cards
- **GSX Server host operating systems:** Microsoft®, Windows® 2000, Windows 2003
- **ESX Server guest operating systems:** Windows NT, Windows 2000, Windows 2003, Novell 6
- **GSX Server guest operating systems:** Windows 2000 and Windows 2003
- **Applications in VMs include:** Microsoft Active Directory®, CME Shift4, Crystal Reports®, and Kronos®, Bally’s Casino Marketplace Player Tracking
- **EMC® Symmetrix SAN**
Meeting Company Goals

Delaware North is running key business applications in virtual machines. For example, it runs central messaging engine (CME) software for its credit card and casino player database on a virtual machine in order to have information on where customers stay, where they ate, and to collect customer preferences. Other applications running on virtual machines include Shift4, a credit card processing application for hotels and properties, and Kronos, a time-keeping and attendance application. The company’s Active Directory and Crystal Reports applications also reside in virtual machines.

“We’re doing things now in QA and in a test environment that weren’t possible before, either due to physical restraints, or because we were limited in man hours,” Armstrong says. “We can react much more quickly to business requirements; we can quickly set up applications that positively impact the business. From a cost standpoint, we feel pressure to cut costs, reduce labor and bring things to market faster. With VMware software, we can quickly deliver for new ventures and we’ve eliminated the headaches of IT.”

He added that VMware software is helping the company meet its goal to effectively manage its large family of subsidiaries. "Delaware North was started in 1915 and has expanded its lines of business. As an IT department, we want to assist headquarters in effectively managing our subsidiaries and provide our companies with the tools to increase their business. A VMware virtual infrastructure strategy is the only way we’ve found we can get there."
VMware Increases Overhead Storage for TQ3Navigant

VMware Software Frees up 80 Percent More Space; Provides Easier Trip to Managing and Delivering New Systems

TQ3Navigant Checks in on VMware

Navigant International, Inc., doing business as TQ3Navigant, is the second largest provider of corporate travel management services in the United States based on airline tickets sold. TQ3Navigant currently employs approximately 5,200 Associates and has operations in approximately 1,000 locations in 23 countries and U.S. territories.

TQ3Navigant’s products include corporate airline, hotel and rental car bookings; travel pattern analysis and dynamic reporting tools; travel policy development; travel management consulting; meeting and convention planning; and leisure travel products.

TQ3Navigant Systems Engineer Mark Chandler works on an IT engineering team of 10 people who handle requests and development for new IT products from all 5,200 Associates. The team finds or develops the solution and rolls it out before turning the ongoing support function over to another team.

Dropping off Excess Baggage

TQ3Navigant’s data center housed more than 200 standalone Cubix blade servers, each server with its own network card, on five racks. This number was growing rather consistently and the IT engineering team was running out of room. “Our data center was only built four years ago and we were nearly out of space,” states Chandler.

“We knew we had less than a year before the original boxes were going to come off lease,” Chandler explains. “We had to start thinking about what we were going to do. We had some space available, but to keep up with company growth, we needed to figure out how we could replace all of the systems in less space.”

VMware Test Pilot Flew Solo Earlier Than Expected

An IBM reseller suggested VMware software to TQ3Navigant as a possible solution. “We also looked at the possibility of using other hardware, but still using VMware® ESX Server,” explains Chandler.

The IT engineering team started with an evaluation IBM BladeCenter, stocked with three blades running VMware ESX Server. They built test machines to test functionality, and the project accelerated from there.

“We could see that it was going to work and we didn’t want to keep buying more of the old solution,” says Chandler. “We were out of space and needed to put new systems somewhere. So, we just started putting systems on the VMware virtual machines and ended up running production applications in them even before we were done testing.”

TQ3Navigant started by deploying the Web interface for virtual machine management, and then immediately added VMware VirtualCenter. “There was little time between the two,” Chandler says. “We knew we were going to do this, we just didn’t have it set up at the time,” adds Chandler.

“Aside from the incredible space savings, it’s nice that I can do builds from home, travel or wherever. I’ve gotten calls at home when I would have previously had to come into the office in the middle of the night to rebuild a machine or even evaluate whether someone could function without it temporarily. Now I can easily rebuild a server from home in just a few minutes.”

Mark Chandler
Systems Engineer, TQ3Navigant
VMware Gets TQ3Navigant to Its Final Destination

The IT engineering team took a year to transfer its datacenter to a VMware virtual infrastructure. "There were so many physical systems that we just did it a handful at a time," explains Chandler. "We'd put them on VMware software and turn off the physical machines."

TQ3Navigant moved the BladeCenter onto a new rack and filled it in with more blades and VMware ESX Server licenses. As requirements continued to grow, TQ3Navigant bought more BladeCenters and VMware ESX server licenses. The team started building replacement machines for the ones that were in production and the ones that weren't in use were turned off.

First Class Benefits with VMware Software

The VMware virtual infrastructure yielded a number of benefits for TQ3Navigant, including:

- **Server consolidation: reduced baggage.** "We cut the footprint for the project to a fifth of the size," says Chandler. "That was our biggest goal. What was taking up five racks full of Cubix blades is now on one IBM rack that still has room for another BladeCenter, possibly two."

- **Cost savings.** TQ3Navigant compared the cost of acquiring physical hardware (not counting power savings, networks savings, and other incidental costs) to the cost of implementing the VMware virtual infrastructure and discovered that it cost less money while using only a fifth of the space. In addition, the cost of upkeep and power is lower because of the consolidation of power and network cables, which previously had to be run to every box individually.

- **Increased capacity: more seats, full flights.** TQ3Navigant runs an average of 15 virtual machines on each blade. If someone requests 10 new servers, the team can provide the resources and has somewhere put them. "It's nice to see we're not wasting CPU power," says Chandler. "Each machine was probably running at 20 percent utilization before using VMware software. Now everything runs at 80 to 90 percent all of the time."

- **Speedier deployment.** "If I have space available, rolling out a new server or application is a much easier process compared to what it was with physical machines," says Chandler. Instead of having to find or buy hardware, TQ3Navigant has built virtual machine templates that are cloned to create new servers. It only takes about 15 minutes to clone a system.

- **Remote management: increased travel.** With VMware VirtualCenter, the IT engineering team can deploy virtual machines from anywhere; previously, engineers would have to go to the physical server location and manually boot up a disk to pull the image down from the server. The engineer simply makes a clone of the machine, boots it up, and it's ready to go.

- **Decreased downtime.** With its virtual infrastructure, TQ3Navigant can move virtual machines to different physical servers to eliminate planned downtime. "We can move everything off quite easily and it's easier for us to plan maintenance," says Chandler. "We can shut down one machine at a time instead of having to take the whole system down. For rebuilds, I can just clean off one host and rebuild that host. And, I can do it from anywhere."

- **Added security.** An unexpected bonus was additional system security. Before, someone in the data center might have been able to access the corporate network by using a physical machine. Now, there is no physical interface, and access rights must be given through VMware VirtualCenter.
Future Destinations
Chandler explains that although he was skeptical at first, he now considers virtual infrastructure an integral part of the company’s IT strategy. “We had some reservations about the whole idea behind the virtual machines – putting software on top of software,” explains Chandler. “I wasn’t against it, but it was something we hadn’t done so I was a little worried about how it would work, performance and so on. The evaluation showed us there was nothing to worry about. I was pretty surprised.”

TQ3Navigant plans to continue moving applications onto virtual machines, starting next with applications that don’t require the power of a whole server. TQ3Navigant is also considering VMware ACE for secure desktop environments, and plans to expand use of VMware Workstation on its development lab desktop computers.
7-Eleven Inc. Speeds Deployment and Consolidates Servers with VMware Virtual Infrastructure

VMware® ESX Server, GSX Server, VirtualCenter and VMotion Exponentially Speed Deployment and Help Fully Utilize Server Resources

**Deployment Delays Slow Productivity**

7-Eleven, Inc. is the largest chain in the convenience retailing industry. Headquartered in Dallas, Texas, the company operates, franchises or licenses more than 26,000 stores throughout the world. During 2003, 7-Eleven stores worldwide generated total sales of more than $36 billion.

As with many organizations, 7-Eleven’s process for deploying new servers was lengthy and costly, frequently hindering the allocation of server resources for development and testing. Senior Business Analysts Matt Ramseyer and Kirk Mears were not happy with the impact of the lengthy server procurement process on the timeline for meeting business needs with technical solutions. Also, server resources to develop and test applications were limited, increasing the number of issues that had to be corrected on production servers.

**VMware GSX Server Speeds Delivery of Better Technology Tools**

Ramseyer and Mears looked at various hosting companies for a low-cost solution. After learning about VMware GSX Server, they saw the benefits of a server consolidation strategy using VMware virtualization software.

“We get an exponential cost savings because of the way VMware pools server resources to optimize hardware utilization,” says Ramseyer. “A hosting company without a VMware solution couldn’t compete with what we could do with VMware software.”

When Matt and Kirk obtained an evaluation copy of VMware GSX Server, the two quickly realized benefits they hadn’t expected, running five virtual machines on a single physical system. “All we really needed to do at the time was evaluate how different browsers affected our Web sites,” says Ramseyer. “Because hardware cost was an issue, we needed to figure out how to run multiple operating systems on a single physical machine. Once we started to evaluate VMware software, we realized that being able to quickly deploy servers helped development teams get their jobs done.”

Taking the next step, 7-Eleven deployed GSX Server on six repurposed HP Proliant servers. “I saw what Kirk and Matt were doing with VMware and realized that it could help make everyone’s lives easier,” says Kenny Nichols, 7-Eleven’s hosting manager. “We owned some older Proliant servers that weren’t fully utilized at our hosting facility so we had them shipped to our corporate office.” The team rapidly had more than 60 virtual servers running on VMware GSX Server, addressing some of the needs developers had for a dynamic environment that resembled production.

“VMware does for Intel servers what Henry Ford did for the automobile. In the same way more people were able to afford a Model-T because of the innovation of the assembly line, VMware enables us to allocate more server resources to developers. It has been a pleasant change now that getting a server up and running for a new project is not the delay it once was.”

Matt Ramseyer
Senior Business Analyst, 7-Eleven
VMware eXtreme Server Meets the Next Set of Requirements

As the number of developers and projects requiring the VMware environment increased, the team was faced with higher demands for performance.

“Our host machines were simply not fast enough to handle new development projects,” says Mears. “What we had was fine for some of our existing applications, but when more resource-intense, mission-critical applications needed development and user-acceptance testing, we realized we needed to get new hardware.”

In the fall of 2003, 7-Eleven added four new host machines with ESX Server to its VMware environment to deploy systems with greater scalability. “We knew with ESX Server on new hardware we could power up new servers to meet all of the development and test-hosting needs of the enterprise,” says Ramseyer. “We needed assistance from our internal infrastructure team in order to increase the size and reliability of the operation.”

Steve Ross, manager of 7-Eleven’s corporate server team, was happy to help take the successful project to the next level. “We had the storage and data-center infrastructure that the ESX Server host machines needed to be an effective solution,” says Ross. “Now that we have proven that we can meet the development and test-hosting needs of the enterprise, we are looking at opportunities to run production applications on VMware.”

VirtualCenter Adds Another Level of Efficiency

In May of 2004, 7-Eleven added VMware VirtualCenter and VMotion™ technology to its virtual infrastructure. With VMware VirtualCenter and VMotion, 7-Eleven has created a virtual infrastructure for optimal server administration, managing servers centrally, providing new servers and moving virtual machines to different physical servers as resource needs dictate.

“We just move the virtual machines around when we need to,” says Ramseyer. “Because all of the virtual machines are centrally managed by VMware VirtualCenter, we can allocate a server whatever resources it needs at the time it needs it.”

Running IT Like a Business

“We can do more, and we can do it faster,” says Ramseyer. “VMware software enables us to get the performance we pay for out of every Intel server we buy.”

Stephen Kinch, manager of Web development for 7-Eleven, agrees. “Getting development teams server environments to work in is so much easier. We can have multiple teams and multiple projects working at the same time, which means we are rolling out new applications faster.”

The benefits include:

- **Dramatic Cost Savings.** 7-Eleven has saved thousands of dollars on hosting development and test servers during the last two years. 7-Eleven also saves money with server consolidation and elimination of server sprawl. “The solution has also lowered power and cooling costs by reducing the number of physical servers we have,” says Mears.

- **Faster Server Deployment.** Deployment time has been substantially reduced. It used to be six to eight weeks to provision a new server; now 7-Eleven can roll a new server out in a day.

- **Increased Server Utilization.** 7-Eleven’s CPU utilization averages 50-70 percent on its VMware servers, compared to 6 to 8 percent on most other servers.

- **Standardized Windows Platform.** 7-Eleven has been able to take advantage of a new operating system platform more rapidly than in the past. “VMware has helped us adopt Windows 2003 as our standard server platform and take advantage of the new technology it has to offer,” says Mears.

- **Scalable IT Infrastructure.** The virtual infrastructure gives 7-Eleven the flexibility to react rapidly to changing business needs and meet demand for new applications. “VMware helps us by enabling an IT infrastructure that meets the dynamic needs of the 7-Eleven business community,” Ramseyer says.
• **Optimized Server Management.** VirtualCenter allows administrators to view dashboards showing server statistics, such as resource use, and manage workloads across multiple systems. They are able to reallocate virtual machines to different physical servers, without downtime, to give them an appropriate level of hardware resources.

• **Better Customer Service.** 7-Eleven Information Systems can now respond more quickly to the technology needs identified by the business groups without the previous lag in server procurement.

The VMware virtual infrastructure is ideal for accelerating software development and testing operations with easily-provisioned and managed server-based virtual machines.

"VMware does for Intel servers what Henry Ford did for the automobile," Ramseyer says. "In the same way that more people were able to afford a Model-T because of the innovation of the assembly line, VMware enables us to allocate more server resources to developers. It has been a pleasant change now that getting a server up and running for a new project is not the delay it once was."
CDW Combats Server Sprawl and Saves $25,000 a Month with VMware Virtual Infrastructure

Industry Experts Look to VMware Virtual Technology for Server Solutions

Leading by Example When Solving Technology Problems
CDW is one of the largest direct providers of technology solutions for business, government and education. CDW sells a wide range of products and services including storage networking, IT security, bandwidth and power.

CDW utilizes cutting edge technology to be better able to anticipate and respond to customers’ needs. Manager of IT Infrastructure Doug Zelinka and his 27-member IT team ensure that the company’s servers, network and datacenters all function smoothly. His team deployed more than 100 servers in 2004, and physical space limitations had begun to impact the pace of server growth.

Virtual Infrastructure Eases Growing Pains and Adds Functionality
Server sprawl was a severe drain on the company’s resources, including power, cooling, space and finances. “We were going to outgrow our datacenter this year,” says Zelinka. A CDW network engineer took the initiative to obtain an evaluation copy of VMware ESX Server and give it a test run.

After the successful trial, CDW deployed its virtual infrastructure and contacted VMware Authorized Consulting Partner RapidApp to assess the robustness of the implementation. RapidApp is an IT infrastructure consulting firm with significant experience designing, planning, deploying and managing IT network and systems infrastructures, including cutting-edge virtual infrastructure solutions.

“CDW needed a scalable IT infrastructure to give it the agility to respond to growing business needs,” says Mitch Northcutt, CEO for RapidApp. “We knew that the benefits of VMware virtual infrastructure, including rapid server deployment and the ability to manage server resources, would increase IT responsiveness to accommodate CDW’s rapid growth.”

With a virtual infrastructure in place, the company’s server numbers have continued to increase, but now most of the servers deployed are virtual rather than physical. “We calculate that it’s about $2,000-$2,500 cheaper to deploy a virtual machine than a physical one,” Zelinka says. “Based on our server growth rate, that’s a savings of about $25,000 a month.”

“We calculate that it’s about $2,000-$2,500 cheaper to deploy a virtual machine than a physical one. Based on our server growth rate, that’s a savings of about $25,000 a month.”

Doug Zelinka
Manager of IT Infrastructure, CDW
In addition, CDW has been able to avoid outgrowing its datacenter. Zelinka explains, “Now we have another year to grow out of it. We’re still expanding, but now we’re more likely to run out of room for storage frames than we are to run out of room for servers.” Zelinka estimates that CDW is currently running 25-26 virtual machines on the two-node cluster, which will be increased to 38 virtual machines per host in the near future. The company has been able to decommission and dispose of many fully-depreciated physical servers and repurpose others for test labs or other functions.

CDW saw many other issues resolved with the VMware software implementation, including:

- **Wowing the software developers.** CDW develops most of its applications in-house. “There’s a constant pressure from the business side to add features and functionality to CDW.com and to the environments that run the warehouse and inventory control,” says Zelinka. With VMware virtual infrastructure, IT can be more responsive to developers’ needs because it can easily provision development and test environments without having to build physical servers. Zelinka explains, “The environment is already there. We just provision a new virtual machine from a template. We’re done.” The VMware virtual infrastructure has helped the IT team become more responsive in meeting the needs of developers. “When the developers see that we can give them an environment that works just like a physical environment in a fraction of the time, they say ‘wow,’” says Zelinka.

- **Increased application availability.** With VMware® VMotion™ technology, even if there is a hardware failure, virtual machines experience zero downtime. “We’ve had hardware failure that didn’t necessarily bring a host machine down,” says Zelinka. “We used VMotion to move the virtual machines to another host so we could do maintenance without bringing the applications down. If those had been physical machines, the applications would have gone down for up to a day, because we couldn’t have used VMotion to move them to another host.”

- **Ease of implementing operating systems.** CDW now uses templates of its operating systems when setting up new virtual machines. In addition to being quicker and easier to set up, deploying an operating system on a virtual machine gives the IT department greater peace of mind. “We are less apprehensive of deploying different operating systems because we have a protected way to do it,” Zelinka explains.
Already Fast Deployment Rate Made Lightning Quick
VMware software offers the company substantial time and cost savings. “It could take us four hours to one day to unbox, assemble, rack, configure networks and do OS patching on a new physical server—all depending on parts availability,” Zelinka says. "Now, with VMware virtual infrastructure, we already have a template and hosts with a large capacity, so we can deploy servers in just 30 minutes.” Given the time and money savings, it’s no wonder that almost all the servers CDW now deploys are virtual machines.

Not only has VMware software increased CDW’s efficiency when deploying servers for new projects, it has completely eliminated any uncertainty in server deployment. Zelinka explains, “With VMware software, we can deploy a server in a fraction of the time with complete predictability. We couldn’t do that before.”

Standardizing on Virtual Infrastructure Platform
CDW has already made VMware virtual infrastructure its default Intel platform and plans to continue expanding its use of VMware software to reap its full benefits; Zelinka says that he plans to use it for high availability environments and disaster recovery in the future.

The company has also upgraded all of its VMware Workstation licenses to VMware VMTN™ licenses. VMware Workstation enables users to run multiple operating systems and applications on one machine, but VMTN licenses allow them to use GSX Server and ESX Server—and their more sophisticated features—for test and development. “We all have machines at our desks capable of running ESX Server, and a lot of people already use Workstation,” Zelinka says. “With VMTN licenses, some people are running GSX Server or ESX Server instead. To us it’s a no-brainer.”
Administaff Uses VMware ESX Server to Reduce Costs, Server Sprawl

Intel Server Sprawl Was Crowding New Project Plans
Administaff offers off-site, full-service human resources services for small and medium-sized businesses across the United States. The company provides services such as benefits management, government compliance, employment administration, employer liability management, recruiting and selection, performance management, training and development and owner support. With corporate offices located in Houston, Texas, Administaff serves approximately 4,900 client companies and 76,000 employees nationwide.

Kevin Dickens supervises the Platforms Planning, Testing and Integration department at Administaff. Dickens applies an Administaff philosophy of "Dream it, Develop it, Deliver it." “We find new technologies for the company, test them against our current business model to see if they fit, and if they're successful, we manage deployment," he explains.

When the number of Intel-architecture servers housed in the corporate offices started to outgrow the available space, Dickens and team were tasked with creating a plan to consolidate resources. The first obvious target was a new project to upgrade the company’s portal Web site. “We support a large non-production environment for deploying new technology and updating code," says Dickens. “For every production environment, we need four pre-production machines: a lab server, a development server, a test server, and a staging server. We thought there would be immediate benefit if we could consolidate the non-production environment for our planned Portal rollout.”

ESX Server Brings Immediate Relief at Lower Cost
Dickens ran a cost comparison of physical machines vs. virtual machines and determined there would be an immediate savings of $70,000 on hardware and maintenance costs by purchasing only four physical servers instead of sixteen. After their success using ESX Server on this project, the team has gone on to deploy VMware software in several other capacities, including various Web server environments and a production rollout of Citrix METAFrame XPe hosting Administaff’s core application "Administaff Information Management System (AIMS).”

Administaff has realized a number benefits by using VMware ESX Server, including:

- **Increased server utilization**: "The typical Intel server is too powerful for single applications, it's too underutilized," says Dickens. "With VMware, you can put several applications on a server, each one running in its own virtual machine so they're isolated from each other, and use a lot more of the server’s capacity."
- **Reduced development and deployment time for servers**: Server builds can be done at an administrator's desk, rather than requiring a trip to the server rack, and the process is greatly simplified. "All the administrator needs to do is copy the master image from the disk, and then configure. We've reduced our build time for new servers from approximately four hours down to thirty minutes."

"VMware is a fantastic product, and I look forward to continuing to work with the software as it is enhanced and expanded. At every planning meeting now, someone asks, ‘Why not do it on VMware?’"

Kevin Dickens, Supervisor, Platforms Planning, Testing, and Integration, Administaff

**RESULTS**

- Saved $70,000 on hardware and maintenance on first project
- Improved server utilization
- Reduced deployment time for new servers from four hours to thirty minutes
- Improved time-to-market for client worksite employee websites
- 4:1 consolidation ratio
• **Ongoing cost savings.** As new projects begin, and as older hardware goes off maintenance contract, Administaff now looks first to see if virtual machines can take the place of physical servers. Using virtual machines to replace physical servers continues to reduce server costs.

**Administaff Achieves IT Flexibility, Efficiency with VMware Software**

The company’s creative approach to leveraging its Intel servers is a prime example of the kind of thinking that has earned it a spot on the *Information Week* 500 list of leading information technology innovators each of the last five years. After successfully deploying the first four HP Proliant DL360 G3 servers with ESX Server licenses, Dickens and the team began to look for other projects that could benefit from the use of virtualization technology.

“We’ve standardized on the HP Proliant DL360 and DL380 G3 servers, which allows us to deploy faster and manage the infrastructure more easily,” says Dickens. “The 2 CPU DL360/380 is a great server for us. It gives us the ability to run five to eight virtual machines in a very slim profile, providing a manageable virtualized environment in a small package.”

Once the Citrix development environment had been created, the team virtualized other non-production environments such as .net Web Services using Windows Server 2003.

With that experience in hand and the MetaFrame pre-production phase completed, it was time to look at using ESX Server for the production rollout of MetaFrame. The first production server, with five virtual machines, was tested for a couple of weeks to ensure that performance and availability would meet user needs. The rollout was completed with the deployment of four more systems running five virtual machines each, to provide AIMS and Microsoft Office 2000 suite software to some 500 users.

Administaff also plans to set up another three systems running ESX Server in its disaster recovery site to provide business continuity and disaster recovery for the enterprise applications.

“We’re also using VMware Workstation,” says Dickens. “We have a group that’s responsible for testing our client worksite employee Web site. We have to guarantee it will work with every client OS from Windows 95 to Windows XP, and with several different Netscape and Internet Explorer browser versions.” The group tests the performance of some 40 different combinations of operating systems and browsers, using virtual machine images downloaded from a server.

“For new application and physical server deployments, we always look first at whether we can put it on a virtual machine,” says Dickens. “VMware is a fantastic product and I look forward to continuing to work with the software as it is enhanced and expanded. At every planning meeting now, someone asks, ‘Why not do it on VMware?’”
Leading Professional Services Firm* Uses VMware Virtual Infrastructure to Maximize System Uptime

VMware Solution Speeds Research and Development Cycles and Server Deployment, Lowering Costs and Impacting the Bottom Line

One of The Country's Largest Consulting Firms Battles Server Sprawl

For a leading professional services firm that provide financial and management consulting services for many of the world's largest companies, maximum application uptime and speed of deployment are crucial. "Practitioners out in the field helping clients need a reliable platform," says Lindell Cagle, a research analyst in the company's infrastructure group.

But the company's IT team was struggling to find the space and resources to meet the demand for research and development, quality assurance (QA), testing and development labs. Cagle's group, tasked with providing technological direction for the company and setting hardware, applications and operating systems standards, evaluated the situation. "Server sprawl was a huge problem," Cagle says. "Labs were constantly growing, with everybody wanting more hardware. We had large power and cooling needs, and space restrictions. We had too many servers in a small area."

The team reviewed its options, including a more efficient imaging process and blade server technology. "Speed of implementation was an issue because we're constantly building and rebuilding operating systems," explains Cagle. "You can get around that with imaging, but it's not always a clean process. Blades were another option, but we found that didn't give us the speed of implementation we wanted, and they were expensive at the time. VMware software turned out to be the best answer to our problems."

VMware software enables the firm to set up multiple virtual machines on a single physical server – each of which runs its own operating system and applications. "We knew it would meet our server consolidation goals, and our general goal of lowering costs," says Cagle.

VMware Leaves an Impression

In January 2003, Cagle saw a VMware demonstration. "We liked the VMware software," says Cagle. "So we called the VMware representative back to look at running VMware software on our HP hardware."

Cagle and his team were impressed with the software when they implemented it in labs, and their enthusiasm helped spread it to other groups. "A lot of people didn't understand server virtualization and were kind of afraid of it," he says. "So we phased it in. Pretty much every group we've turned on to VMware software has just loved it. They found ways to use it that sped up the work they do. It has spread like wildfire around here."

"Being able to patch our core systems more quickly and easily means more uptime. With VMware virtual infrastructure in place, we can get our systems tested and patched before a virus or operating system flaw can be exploited. This means our systems stay up so we can reliably provide services."

Lindell Cagle
Research and Development Analyst
Professional Services Firm

*The company described in this case study requested anonymity.
Building a Virtual Infrastructure Pays Off

Over time, the firm has expanded its use of VMware software from one VMware® GSX Server license, to many ESX Server licenses. In December 2003 the company began using VMware VirtualCenter and VMotion™ technology to complete its virtual infrastructure with optimized server management. The company achieved a number of benefits from its virtual infrastructure deployment, including:

- **Efficient Server Consolidation.** For development labs, the company has been able to average 10 virtual machines on each 2-CPU server, and 20 virtual machines on each 4-CPU server. “This has prevented us from buying many smaller-CPU servers,” Cagle says.

- **Improved CPU Utilization.** Before virtualization, servers averaged three to six percent utilization. Now, servers are typically 40-50 percent utilized.

- **Decreased Server Deployment Time.** Provisioning virtual machines with ESX Server takes just a few hours, compared to provisioning physical servers, which could take weeks because of the time required to order and set up. Now, with VirtualCenter, the company has instant provisioning.

- **Cut Development Time by More Than 50 Percent.** VMware software has snapshot and revert features, which save developers time because they can stop and save their work before moving on. “For example, to test an operating patch or write procedures for a patch, before we had VMware software, we’d have to build the server or image a server to a certain standard,” Cagle says. “It could take two hours to build that server, and then we would test the patch. If there are problems and you have to do it again, it takes another two hours. With VMware software, given the speed of deploying virtual machines and the revert features, all of that can be done in less than an hour.”

- **Cut Costs.** VMware has alleviated the need to buy more hardware, cutting costs by about 40 percent. “In addition to the obvious savings in hardware, we save money in other ways,” Cagle says. “For example, management is easier, saving us time so we can be more productive.”

- **Minimized Downtime.** VMotion allows Cagle and his team to move virtual machines across different physical servers without downtime to maximize resource utilization. “Being able to move boxes – to take down a physical server and make a hardware change or software upgrade, and bring that server back up and move its environment back over in just a few minutes – is a great improvement. We love that.”

- **Centralized Management.** VirtualCenter provides the firm with a single point of management for its virtual computing resources. “This is a tremendous help,” says Cagle. “Remote management, being able to connect over the VPN, being able to schedule events, make a few changes and then check them – it’s time savings over and over.”

- **Saved Resources.** With fewer physical servers taking up space, the company has lowered expenses and saved power, cooling and cabling costs. “The more servers you add, the more UPSes and outlets you need,” Cagle says. “In our lab, which was pretty large, power was getting to be a major issue. With fewer servers, the power issue is less of a problem because there are fewer connections. Cabling 60 servers in four racks is a lot harder than cabling 10 servers in two racks. Cabling ease and reduced cooling requirements are just a few of the benefits of reducing the number of physical servers.”

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**VMware® Virtual Infrastructure at Work**

- VirtualCenter on HP ProLiant DL380s, with 2GB RAM
- ESX Server on HP ProLiant DL580, 4-CPU and 2-CPU, ProLiant DL 380s, 2-CPU, 4-16GB RAM
- GSX Server on HP ML 530, 2-CPU, 4GB RAM
- 10 ESX Server licenses with HP EVA 5000 SAN storage
- 10 VMotion nodes on SAN-attached servers
- Workstation on Toshiba Tecra laptops
- Host operating system on GSX: Microsoft Windows 2000
- Host operating system on Workstation: Microsoft® Windows® XP
- Guest operating systems include: Microsoft Windows, Red Hat Linux, and Novell Netware
- Guest operating systems on Workstation: XP, Linux and Netware
- Applications running in virtual machines include: virus parent servers, (Norton anti-virus, McAfee EPO), Microsoft SQL, DNS Wins, SMS, Bindview
The Bottom Line – Lower TCO and Better Customer Service

Speeding deployment and research and development cycles means that end users – practitioners in the field using the firm’s standard applications – benefit from VMware virtual infrastructure. “Being able to patch our core systems more quickly and easily means more uptime,” Cagle says. “With VMware virtual infrastructure in place, we can get our systems tested and patched before a virus or operating system flaw can be exploited. This means our systems stay up so we can reliably provide services.”

The reduction in total cost of ownership (TCO) also impacts the company. “Obviously, in our business, being able to reduce TCO helps the bottom line, which keeps the partners happy,” Cagle says. “VMware software helps us stay competitive in the marketplace.”
Move Toward Server Consolidation Promises New Value for Customers

In today’s frugal economic climate, a number of mid-size organizations are opting to outsource critical business applications to avoid high implementation costs and the productivity drain that often accompanies complex applications management. Assisting in this venture is Surebridge, a Massachusetts-based application outsourcer of On Demand solutions. Surebridge offers customers a complete portfolio of business applications such as customer relationship management, financial management, human resource management, productivity and supply chain management, each delivered end-to-end along with affordable services for strategy, implementation, outsourcing and optimization. With over 1,000 customers and a profitable track record, Surebridge has been leading the competition since 1997 – and plans to continue its success by building upon the economies of scale that server consolidation provides.

Much of the company’s success, says Surebridge Research and Development Manager Jay Keating, can be attributed to its dedication to efficiency. “Surebridge helps its customers lower IT costs and improve employee productivity,” he says, “so it’s only natural that we take the same approach with our own IT organization.” By streamlining its infrastructure—minimizing hardware expenditures and maximizing utilization—Surebridge keeps purchasing, maintenance, and support costs down, and passes the savings along to its customers.

“VMware software is one of the key levers in our overall consolidation strategy, and we are very pleased with its performance. VMware ESX Server certainly is a production-level infrastructure component.”

Jay Keating
Research and Development Manager, Surebridge

RESULTS

• Achieved a 5:1 server consolidation ratio, significantly improving overall IT efficiency
• Increased server speed and performance by as much as 150 percent
• Reduced server provisioning costs and deployment time frames by 50 percent
• Supported a virtual machine configuration for 20 percent of what a comparable physical infrastructure would cost

SUREBRIDGE, INC.

Consolidating Intel®-based servers through virtualization has now become a critical component of the streamlining process, according to Keating. “Virtual machines enable multiple applications and operating systems to run in independent partitions on the same physical server,” explains Keating. “This approach allows us to reduce the number of physical servers without sacrificing performance, and calls for a much lower up-front investment than other consolidation options.”

When Keating and the IT staff at Surebridge learned about VMware® ESX Server software, the reaction was purely positive. “VMware had what we needed to jump in and try server consolidation right away,” says Keating. Keating and his team worked with evaluation copies of ESX Server for several months in mid-2003 while building their comfort level with the technology. “By August,” he says, “we had purchased the software and started our pilot phase. Tests proceeded so smoothly that our full implementation process began the following month.” By October 2003, Surebridge had deployed ESX Server on three HP ProLiant DL380 G3 servers, each running five virtual machines, with plans for further expansion into 2004.

Surebridge Builds Better Customer Service with VMware ESX Server

For a leading application outsourcer, virtual machines translate into customer value through reduced IT costs and greater operational efficiency
VMware Software Achieves a 5:1 Server Consolidation Ratio for Surebridge

“In selecting a server virtualization approach, we are able to efficiently meet one of our primary objectives as a company: providing valuable, low-cost services to customers,” says Keating. “VMware ESX Server helps us reduce our hardware requirements while still allowing applications for vital tasks such as name-serving, mail-relay, web servers, Citrix servers and domain controllers, to run in their native environments—no compromises for compatibility or resource-sharing.”

Consolidating servers using VMware ESX Server has enabled Surebridge to achieve the following goals:

• **Dramatically reduced IT costs.** “With VMware ESX Server, we have consolidated servers at a 5:1 ratio,” says Keating. “One physical server can now run five virtual machines.” This reduction in hardware requirements translates into substantial financial benefit for Surebridge. The company can reduce capital expenditures while redeeming greater functional benefit from the servers that are purchased. “In one environment we are running 15 total virtual machines on three physical servers,” says Keating. “Had we purchased 15 bare-metal servers that offer similar application performance, we would have had to spend twice as much money.” In addition, the infrastructure costs associated with supporting the new virtual machine configuration are about 20 percent of the cost of supporting a comparable physical setup with 15 physical servers. “We are saving on space in the data center as well as on power, cooling, heating, and maintenance,” says Keating.

• **Streamlined integration with existing IT deployment strategies.** One of the best advantages to working with VMware ESX Server, from Keating’s perspective, is that the software integrates smoothly with the company’s existing IT implementation strategies. “The ESX Server deployment was incredibly efficient for Surebridge,” he says. “Our current tools worked very well for deploying virtual machines – so we had no added cost in rolling out the virtual machines as opposed to bare-metal servers. And the fact that the VMware virtual machines are running as virtual disk files allowed us to have a much faster time to deployment – less than one hour as opposed to two hours for each fully configured virtual machine. That is time our employees can now spend performing core business tasks. Our company just got a lot more efficient.”

• **Enhanced customer service.** The boost in efficiency has extended beyond the Surebridge enterprise – particularly where customers are concerned. “Our objective always has been to achieve a faster time to market, and to deliver responsive solutions that customers need at an attractive price,” explains Keating. “Our cost savings with VMware ESX Server play a huge role in meeting that objective. Virtualized servers allow us to deliver services at a fraction of the cost because we can pass along to each customer our savings on hardware costs, rack space, heating, cooling, and electricity.” Faster deployment also is crucial in improving customer service. “Our customers definitely appreciate the fact that we can deliver products more rapidly than before, and at a more economical price,” says Keating. “And when our employees have more time to spend on our core business, we can develop stronger services with greater customer value.”

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**SUREBRIDGE, INC.**

**CUSTOMER SUCCESS STORY**

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**VMWARE ESX SERVER AT WORK**

- VMware ESX Server deployed on HP ProLiant servers
- Three dual-processor HP ProLiant DL380 T3 servers, 4GB RAM, with direct-attached storage; each server has two movable 72GB storage disks and six network interface cards
- Host operating system: VMware ESX Server
- Guest operating system: Microsoft® Windows® 2000 Server
- Applications: Name servers, Simple Mail Transport Protocol (SMTP) servers, domain controllers, low-user count terminal servers
ESX Server Helps Create High-Performance Infrastructure to Deliver Critical Customer Applications

For a company focused on delivering critical business applications to customers on an out-sourced basis, the ability to provide services on a high-performance infrastructure is vital to success. VMware ESX Server is now helping Surebridge improve the value and functionality of that infrastructure in order to grow its overall core business.

"With VMware ESX Server, we can now activate virtual machines and run mixed application workloads on a single server without risking compatibility issues," says Keating. "This is a huge step forward in allowing us to reduce the time required to expand our offerings to customers and to grow our customer base."

Surebridge has big plans for its VMware implementation in the next year. In addition to transitioning virtual machines from direct-attached storage to a storage area network (SAN), the company plans to explore new scenarios for virtual machine usage, from test and development to server recovery to delivering server resources on demand.

In the meantime, Surebridge is impressed with the progress it has already made. VMware software is one of the key levers in our overall consolidation strategy," Keating says, "and we are very pleased with its performance. VMware ESX Server certainly is a production-level infrastructure component."
With Virtual Infrastructure, Willis Group Makes Real Savings of Over £200,000

VMware® ESX Server, VMotion™, VirtualCenter and Virtual SMP™ Enable Server Consolidation and Streamlined Management

Willis Group solves warranty issue using VMware ESX Server
Willis Group is one of the world’s largest professional services firms specialising in risk management. With over 300 offices in more than 100 countries, its global team of 14,500 associates provides a wide range of strategic and operational risk management services.

The Information Services (IS) division at Willis Group is responsible for providing robust production systems to support its global user base, as well as training end users and developing new applications. It maintains 400 servers in the main UK data centre, the same in the US, and another 200 servers around the rest of the world.

One of the key issues facing Willis was that a number of its servers were approaching the end of their warranties and to replace them would have required a huge hardware investment. Other significant challenges facing the IS division included:

- Space restrictions on server farm expansion due to many machines operating at below optimum capacity
- Desire to expand training, development and maintenance environments but limited available budgets
- Too much time required for server administration
- Spiralling power, cooling and network infrastructure costs

Andy MacLachlan, senior technical specialist at Willis Group, along with the project team, was tasked to find a solution to address the immediate warranty issue that would also allow Willis to implement a future-proof infrastructure and reduce administration time.

VMware ESX Server enables 20 to one server consolidation
The team decided that the only way to avoid replacing every legacy server like-for-like would be to initiate a virtualisation strategy. After assessing a number of products based on performance and track record, they chose the only product that fully met all of Willis Group’s requirements: VMware ESX Server.

The project team initially rolled out ESX Server to replace 40 legacy servers with just two. A further project included the expansion of the company’s training environment, which needed 12 extra machines. Using ESX Server, Willis Group reduced the number of physical machines required from 12 to four. Lastly, they virtualised the test lab environment, avoiding the need to purchase 30 extra machines that would have cost £105,000.

“Not only did we manage to solve our initial issue of replacing out-of-date machines but also made cost savings of at least £70,000 by consolidating 40 legacy systems to two high performance servers. In addition, the savings made by virtualising our training environment and test lab means we have saved over £200,000 just on hardware by using VMware.”

Andy MacLachlan
Senior Technical Specialist, Willis Group
Benefits of Willis Group’s virtual infrastructure strategy include:

- **Hardware cost savings.** Willis Group has saved over £200,000 by limiting the number of new physical machines in its training, maintenance and test environments.

- **Streamlined management & high availability.** VMotion and VirtualCenter streamline the support and administration of Willis Group’s data centre as well as offering higher availability for users worldwide.

- **State-of-the-art training environment.** The expansion of Willis Group’s training environment means that more users can be trained faster, at a lower cost.

- **Rapid deployment of new applications.** Applications can be tested and delivered to end users far more quickly than previously, giving associates a valuable competitive advantage.

**Realising the benefits of a virtual infrastructure**

The team have based the company’s consolidated virtual infrastructure on HP DL580, 4-way, 2GHz servers running ESX Server with VMotion and VirtualCenter. VMotion enables the IS division to move running virtual machines between physical machines without any server downtime or impact to the end user.

“The management capabilities of VMotion and VirtualCenter mean that the time spent moving machines is reduced by several hours. They are very easy to use which allows less skilled staff to carry out operations previously performed by a few specialist staff. This enables us to be more cost-effective and flexible and our US colleagues can carry out critical server maintenance remotely to provide a round the clock service,” explained MacLachlan.

The IS department can test new applications dramatically faster and more easily now that developers can take test systems back to a previous state in just five minutes. Before they would have spent an entire day rebuilding a system after each test.

Virtual SMP enables Willis Group to maximise the performance and availability of applications running in a virtual environment. With Virtual SMP a single virtual machine can span multiple physical processors to share the workload of resource-intensive applications.

Following the success of the UK project, Willis Group plans to consolidate its US data centre in Nashville. This is anticipated to reap hardware cost savings of £70,000 over six months.
VMware Helps Google Develop Innovative Search Web Site

Google focuses exclusively on delivering the best search experience on the World Wide Web. Through innovative advances in search technology, Google helps its users find the information they’re looking for with unprecedented levels of ease, accuracy, and relevancy.

Google’s team needs to develop and test its Web site across a wide range of platforms and browsers. This testing ensures that their clean interface will work equally well for a Netscape user running on Linux and for a Microsoft Internet Explorer user.

“I use VMware to test Google on a variety of platform and browser combinations without having to reboot my computer or leave my desk,” says Sergey Brin, Co-Founder and President of Google.

Google developers installed VMware, then configured virtual disks with various operating system and browser combinations. For example, they could quickly bring up a virtual machine with Windows 95 and Microsoft Internet Explorer 4, then a virtual machine with Linux and Netscape Communicator to preview design changes.

Before using VMware to test a variety of configurations on a single machine, Google Web developers had to use a bank of test PCs, each dedicated to running a specific operating system and browser combination. Installing VMware on their desktops meant they didn’t have to get up to test design changes.

In addition to providing a bank of virtual machines on each desktop, VMware allowed Google to eliminate the need to choose between Linux and Windows for their applications.

Using VMware to get the most flexibility and power from a desktop PC helps keep Google at the cutting edge of the Internet.

Sergey Brin notes: “Working at a hot Internet startup today, access to both Linux and Windows is a must. There are hundreds of great applications and tools for both. VMware lets me use both Windows and Linux on one computer at the same time.”

Instead of hassling with two PCs for each desktop or configuring dual-booting operating systems, Google uses VMware to get access to the applications they need. Google saves time and money and can focus on what it does best.

Sergey Brin stresses that the ease of use and reliability of VMware are keys to its success at Google. “The VMware window on my Linux desktop looks and functions exactly like a Windows 98 machine. VMware is based upon very impressive technology, but the most impressive thing about it is that it really works.”
VMware Virtual Infrastructure Saves Monster from Horrors of Server Sprawl

Monster Takes a Bite out of Hardware Costs and Increases System Reliability With VMware Software

Data Center Was Getting Scary

Monster.com is the 14th most visited site on the Internet, with over one million job postings and 28 million unique visitors each month (according to comScore Media Metrix). Supporting sites in 23 countries in the world, 200,000 member companies and over one million unique job postings, the Monster Network requires vast computing resources.

Since its beginning in 1994, Monster has been on a fast track for growth, establishing itself as the leading global online careers website. In 1999, Monster’s revenues were $125 million, up twenty-fold from 1996. By June 2002, Monster’s data center was packed. “We were at capacity with 230 racks of gear,” says Brian McCarthy, director of operations analysis for Monster. “It was too hot and consumed too much power. We also had computers being shipped to us from other sites, including 8-CPU and larger servers.”

“When you do a job search, you access one of fifty 4-CPU Xeon servers,” McCarthy explains. “Each part of Monster is separated by function. We needed separate QA environments for each different product running at the same time. That entailed about 30 servers for each QA environment. So I had about 12 racks of QA gear. The maximum CPU utilization was three percent. It made it a prime candidate for virtualization.”

After researching their options, McCarthy and his team found that the VMware® GSX Server would meet Monster’s needs, enabling them to do a direct IP migration of each physical server onto a virtual machine, and keep multiple virtual machines on each physical server. “We saw that it had the capability of multiple VLANs for each server so we could easily migrate our servers. So we bought GSX Server, tested it and migrated our QA environments to GSX Server on Windows platforms.” The goals for the project included:

- Consolidation of 70-80 servers onto virtual machines;
- Rapid deployment to QA and development;
- Capitalizing on existing knowledge of Windows and Ethernet;
- Offering direct IP migration due to application licensing;
- Providing system redundancy and recovery options.

“Our company is dedicated to providing people with the resources, products and services to enable them to achieve their career goals. With a virtual infrastructure in place, we have the computing resources to fully test, develop and provide tools that will be valuable to our customers.”

Brian McCarthy
Director of Operations Analysis, Monster
**VMware Virtual Infrastructure at Work**

- GSX Server on 2-CPU Dell PowerEdge 1650 and 2650, 4GB RAM
- Intrasa iSCSI SAN storage used in development
- Host Operating System: Microsoft Windows 2003 Server
- ESX Server, VirtualCenter and VMotion on 2- and 4-CPU HP DL 585s
- EMC CLARiiON CX600 SAN
- Applications in virtual machines include: Web servers, Citrix servers, domain controllers, chat servers, e-mail gateway servers, deployment/compilation servers, administrative servers

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**Successful, Fast Implementation Leads to Monstrous Benefits**

The project was deployed in two months by a team of three people. “It was relatively easy to set up,” says McCarthy. The team evaluated a physical server hosting 15 virtual machines for about a year. One senior administrator was able to document and script all setup procedures and create sample machine configurations. “It is amazing how stable the GSX platform is. We had nearly no maintenance, and hardly had to reboot except to reboot the operating system,” he says, adding that it took approximately 90 man-hours to set up the project.

After the success of the trial phase, Monster migrated its QA environment onto virtual machines. “Now our entire QA environment – what used to be 52 servers – is on four servers,” McCarthy says. “There are fewer hardware issues to deal with, including operating system maintenance and patching, plus BIOS updates.”

McCarthy also says GSX Server’s iSCSI support was important for Monster’s consolidation strategy. It enabled them to easily and safely migrate applications, saving important client information. Monster uses Intrasa iSCSI SAN storage to snapshot volumes and backup current virtual machines, transmitting data through its LAN. “On VMware software with iSCSI, we get instant failover in case of host hardware failure,” McCarthy says. “With iSCSI, we get the benefits of having a SAN without the high cost.”

Since its successful initial deployment of GSX Server, Monster has continued to expand its virtual infrastructure, including the addition of more GSX Servers, ESX Server, VirtualCenter and VMotion™. “Going forward, our plan is to take more demanding applications that require more resources and higher availability and put them on ESX Server,” says McCarthy. “GSX is the right thing to use for our QA environment, but we plan to utilize ESX Server, VirtualCenter and VMotion to build out our virtual infrastructure.”

Monster has realized a number of benefits from having a virtual infrastructure, including:

- **Cost Savings.** In its initial deployment, Monster was able to save $275,000 in hardware costs.
- **Server Consolidation.** Monster was able to retire 75 underutilized servers in the initial deployment. Now, Monster averages a 10:1 server consolidation ratio, increasing its data center capacity.
- **Faster Server Provisioning.** Deploying virtual machines is far easier than deploying physical servers. “Now, we are able to deploy new servers in hours instead of days,” McCarthy says. “It’s even faster and easier with VirtualCenter and ESX Server. We can deploy servers from a centralized point, and it’s instant.”
- **Faster Updates.** Because there is less hardware, McCarthy says it is easier to keep systems updated. “With VMware software, server firmware and BIOS updates are less time consuming.”
- **More Scalable, Easily-Managed Production Environment.** Monster is now deploying multiple ESX Servers connected to an EMC CLARiiON CX600 SAN, building a reliable, scalable production environment. ESX Server enables us to provide a stable, reliable and flexible infrastructure.
- **High Availability With VMotion.** Using VMotion, Monster is able to migrate virtual machines across different physical servers without any downtime. “It’s incredible to take live Citrix servers with users attached from one physical host to another without disruption.”
Monster Enjoys Invisibility
McCarthy says that although VMware software has brought noticeable results of decreased costs, better manageability and space savings, users cannot tell that they are using applications running on virtual machines instead of physical servers. "When a developer needs a machine for a new project, I can set it up for them in an hour, and they don't even know it's a virtual machine," says McCarthy. "They just know they have a computer with a name and it doesn't have any problems."

Visitors to Monster also work on virtual machines without realizing it. "If you go on Monster to a forum where you can chat with other members, it is happening on GSX Server, clustered between our Maynard and Indianapolis applications," McCarthy says. "It works great. We also have virtual machines supporting Exchange, Blackberries, Treo, Web Integration, QA and the creative process."

Supporting Monster’s Growth
Using VMware software, Monster has the computing resources in place to support the company's success and growth. "Our company is dedicated to providing people with the resources, products and services to enable them to achieve their career goals," McCarthy says. "With a virtual infrastructure in place, we have the computing resources to fully test, develop and provide tools that will be valuable to our customers."

About Monster
Monster is the leading global online careers property. A division of Monster Worldwide, (NASDAQ: MNST) Monster works for everyone by connecting quality job seekers at all levels with leading employers across all industries. Founded in 1994 and headquartered in Maynard, Mass., Monster has 25 local language and content sites in 23 countries worldwide. More information is available at www.monster.com or by calling 1-800-MONSTER. To learn more about Monster's industry-leading employer products and services, please visit http://recruiter.monster.com.
PTC Uses VMware Workstation to Deploy Demos and Solutions Quickly

A World-Leading Provider of Product Lifecycle Management Solutions Uses VMware Workstation to Effectively Demonstrate Its Products and Provide Superior Customer Service

Creating Tailored, Technological Solutions for Customers

For nearly 20 years, PTC has been at the forefront of product development technologies, providing engineering and manufacturing product lifecycle management (PLM) tools for more than 35,000 customers. Famous for its first computer-aided design (CAD) product, Pro/ENGINEER, PTC has continued its innovation with a suite of PLM products that foster interoperability, hardware independence, simplified product management and collaboration.

Helping engineers and manufacturers do their jobs at the highest level of excellence means delivering highly tailored, technological solutions. With its dedication to customers, PTC creates customized demonstrations for clients to illustrate the power of its software. But the company wanted to be sure it was building demos in the most efficient way. “We wanted to have sales people and sales engineers spend less time setting up demos, and more time with customers,” says Peter Borden, director of worldwide technical sales operations for PTC. “We also wanted to enable customers to more quickly understand and evaluate our products and avoid delaying the sales cycle due to our own preparation or configuration changeover set-up time.”

The company evaluated VMware® Workstation in January 2003 as an enabling technology to create pre-packaged demonstrations for its sales force. VMware Workstation lets users create demonstrations isolated within virtual machines instead of directly on a computer’s hardware. Borden found that with Workstation, sales engineers could run demos for customers who used various types of Intel-architecture hardware, and they could pre-configure demonstrations to meet customers’ needs.

“We saw that with VMware Workstation, we could reuse the work that we’ve done, whether it’s a simple installation that may take a few hours, or a complex benchmark that would take a couple of days to configure,” Borden says. “We knew it would allow us to do more than we’ve ever been able to do before.”

Boosting Sales With Customized Demos

PTC salespeople and sales engineers use Workstation to pre-configure product installations and demonstrate customer solutions. The company uses Workstation most often to demonstrate its Windchill™ product line, a comprehensive suite of collaboration and control solutions to support today’s distributed product development processes. Because the PTC Product Development System needs to share information with other enterprise systems, PTC integrates Windchill with enterprise systems to help manufacturers streamline processes, fuel innovation and ultimately, to deliver superior products.

“The bottom line is, VMware software gives us the ability to spend more time with our customers. If we’re setting up our systems, we’re spending time with our computers and not with our clients. With VMware software, we can tailor solutions and systems quickly and focus our time and energy on our customers.”

Peter Borden
Director, Worldwide Technical Sales Operations, PTC
VMWARE WORKSTATION AT WORK

- 500 Workstation licenses for sales, sales engineers and customers
- Hardware: desktop computers, laptops, various brands and models, running 1 - 2 CPUs, with 1 – 4GB RAM
- Guest operating systems: Microsoft® Windows® 2000 Pro, Windows XP Pro
- Host operating systems: Windows 2000 Pro, Windows XP Pro
- Applications running in virtual machines include: Windchill Foundation, Windchill ProjectLink, Windchill PDMLink and Pro/ENGINEER

With VMware Workstation, PTC is able to work with suppliers, partners and customers efficiently to design the best solutions and proofs of concept – ultimately increasing sales productivity – due to the following benefits:

- **Faster Custom Installations.** Instead of sales engineers starting an integrated demo from scratch, they can select from pre-configured operating systems, databases and application servers matching the customer’s environment. “We can re-use the work that we’ve done, from a simple installation, which may take a couple of hours, to a rather complex configuration that would have taken a couple of days to set up,” Borden says. “We already have that configuration locked down and can send it to someone’s machine, saving us hours or days of installation.”

- **Snapshot Feature Saves Time.** With VMware software, sales engineers can take snapshots – saved point-in-time copies of the virtual machine state. If the integration fails or if there is a need to step back to a previous configuration state, they can revert to a recent snapshot, instead of having to start over. Also, during longer sales cycles, it is easy to reset a presentation if they need to demonstrate the solution again, even months later.

- **Hardware Independence.** PTC can create demos on clean VMware virtual machines, eliminating the need to duplicate a customer’s hardware environment. “We can effectively demonstrate our solutions without being dependent on specific hardware,” says Borden. “VMware Workstation allows a much more stable configuration on people’s personal machines so they don’t have to figure out how to backup and reset their personal computers to do regular business.”

- **More Time for Customer Service.** Because it is easier to set up demos, sales people and sales engineers can spend more time with customers. “With Workstation, we have everything installed already; sales people and engineers don’t need to worry about setting up their machines for each presentation,” says Borden. “We also have more demos available, so sales people can switch between demos, and customers can get a better idea about how our products work, in less time.”

**Expanding Capabilities**

Using VMware Workstation has revolutionized sales demonstrations for PTC. Because PTC integrates with other software, setting up demos was a complicated process before using VMware Workstation. Now, spending less time configuring solutions and setting up demos has a strong impact on the company.

“For example, on a Windows laptop with a commercial database, we often had to configure Pro/ENGINEER, Windchill ProjectLink™, Windchill PDMLink™ and other components,” Borden says. “It was a challenging environment in which to keep your laptop running, especially given its continuously changing installations, demos and configurations, and its support of a broad product line. You would have to frequently re-image the laptop to get a clean start on a new presales configuration. Now, with VMware Workstation, applications engineers and sales people can have virtual machines with different configurations, and the impact on their existing system is negligible.”
The optimized efficiency with VMware Workstation has helped PTC increase its business while conserving resources and saving money. “Our sales force has been able to expand the range of what they do, instead of spending time configuring hardware, learning to install software or setting up demos,” Borden says. “Due to the benefits of VMware software, we are now able to do more work in less time and stay further ahead of our competition.”

“The bottom line is, VMware software gives us the ability to spend more time with our customers,” Borden adds. “If we’re setting up our systems, we’re spending time with our computers and not with our clients. With VMware software, we can tailor solutions and systems quickly and focus our time and energy on our customers.”
Cellcom Uses VMware Technology with Blade Servers to Create Virtual IT Infrastructure

Leading cellular company in Israel embraces virtualization technology to meet goals for business growth and provide superior customer service

Cellcom chose VMware technology to create a scalable IT infrastructure while lowering costs. "It is the best of breed product that meets our long-term goal of reducing the burden of managing hundreds of hardware platforms and servers. We knew it would solve our problems, giving us a more scalable infrastructure, and helping us get the most out of our hardware resources."

VMware Loweres Costs and Speeds Response Time

Cellcom chose VMware® ESX Server, VirtualCenter and VMotion™ technology to meet its needs. With ESX Server, Barak and his team can create multiple virtual machines on each physical server. They are able to run multiple applications and operating systems, each isolated within its own virtual machine, so that each physical server is more fully utilized. The company has two ESX Server licenses for quality assurance (QA) and development environments used in development of engineering and sales demos. Another four ESX server licenses run on HP BL20 p G2 server blades with storage area network (SAN) connectivity to an HP Enterprise Virtual Array machine. The virtual machines that run on the blade servers are VMotion enabled, giving the IT team the ability to migrate a running virtual machine to a different physical server connected to the same SAN without service interruption. All of the virtual machines are centrally managed by a single instance of the VMware VirtualCenter management software.

Using ESX Server in conjunction with VirtualCenter and VMotion, Cellcom has a robust data center management solution. It allows the company to centrally manage its pool of virtual machines residing on different physical servers, and move the virtual machines to different physical servers based on resource allocation needs. "VMware gives us the opportunity to quickly deploy new operating systems almost regardless of hardware availability, enhancing our ability to respond rapidly to the demands of our growing business," Barak says.

Using the VMware solution, Cellcom has realized benefits that include:

- Optimization of Blade Servers: Barak sought a server consolidation solution that would involve two cutting edge technologies: virtualization and blade servers. Barak explains that the two together result in an efficient use of resources, fast provisioning and unprecedented hardware availability.

- Time Savings and More Efficient Server Management: With the VMware solution, Cellcom can provision servers in minutes instead of hours, helping the company respond more quickly to customer needs and reduce time to market. Cellcom also saves time with the sophisticated centralized management features of Virtual Center. "Managing hundreds of hardware platforms was time consuming," says Barak. "With virtual infrastructure, it becomes much simpler to manage my server environment."

- Improved Server Utilization and Server Consolidation: Cellcom was able to consolidate servers by a ratio of more than 13:1 and increase server utilization from 5-15 percent to 35-50 percent.

Results

- 13:1 server consolidation
- Server deployment time reduced from about two hours to twelve minutes
- Provided mainframe levels of reliability and data security at lower cost
- Optimized blade server utilization, increasing from 5-15% to 35-50%
- Reduced hardware costs
- Streamlined system administration
- Saved physical space for servers
- Lowered management and operating costs
• **Reduced Costs.** Barak says he anticipates costs savings because of the need for fewer servers and resources, such as heating and space for multiple servers. Cellcom also saves the time of managing multiple hardware platforms.

• **Zero Downtime Maintenance.** “The VMotion technology lets us migrate a server from one hardware platform to another without any service interruption, allowing us to schedule maintenance of the hardware without notifying users or taking down the systems residing on the server. This is particularly useful for small changes and improvements, such as modifications to an ESX server’s software parameters,” explains Barak.

With a fast growing business, it is important to have a scalable, reliable IT infrastructure. “With VMware, we are confident that we can support the company and enable employees to do their jobs better. For example, with zero downtime maintenance, engineers can keep working. Faster provisioning also means we can more easily allocate resources for projects. We can also quickly respond to changing customer needs.”

Barak said the powerful capabilities of virtualization technology will help Cellcom maintain its leading position in the market. “VMware provides a cost effective solution that enhances our abilities by giving us more flexibility. We can more quickly and easily respond to changes, helping us stay ahead of our competition and best serve our customers.”

**VMWARE ESX SERVER, VMOTION AND VIRTUAL CENTER AT WORK**

- Two VMware ESX Servers on HP DL 380 G3s
- Four VMware ESX Servers on HP BL20p G2 blade servers with SAN connectivity
- Servers are managed by a single VirtualCenter server
- Applications run in virtual machines: MSSQL, Oracle, MSCS, Citrix MetaFrame and others

“The VMotion technology lets us migrate a server from one hardware platform to another without any service interruption, allowing us to schedule maintenance of the hardware without notifying users or taking down the systems residing on the server.”

David Barak
System NT Expert
Cellcom
QUALCOMM Lowers TCO Using VMware ESX Server and VirtualCenter

VMware Virtual Infrastructure Helps QUALCOMM Save Six Figures On Hardware—while Providing Optimal Server Management to Support the Company’s Rapid Expansion

Large-Scale Consolidation Project Weeds Out Underutilized Servers
QUALCOMM Incorporated, a leader in the digital wireless communications field, is best known for pioneering and commercially developing Code Division Multiple Access (CDMA) digital wireless technology. Over 174 million consumers worldwide rely on CDMA today for clear, reliable voice communications and leading-edge data services.

In the first half of 2003, the QUALCOMM IT department embarked on a consolidation project to lower costs in the company’s data centers worldwide. IT Manager Paul Poppleton investigated alternative approaches for consolidating the company’s Intel®-based servers.

VMware ESX Server™ Chosen as the Best Consolidation Approach
The QUALCOMM IT team considered several approaches to lower costs as well as reduce power and space requirements. “Blade servers were interesting,” says Poppleton, “but we needed a greater reduction in power and space requirements than blade servers would provide. Server consolidation had much greater potential to lower our total costs.” Poppleton assessed the feasibility of server consolidation using VMware software, which virtualizes servers so that multiple applications, each encapsulated in an independent virtual machine, can run on the same physical server.

After Initial Testing, It Was Full Speed Ahead
QUALCOMM started with just one VMware® server to evaluate the product and get comfortable with its operation. “For example, we have a number of internal administrative tools and we wanted to be sure that they worked with VMware virtual machines just like they worked with standalone servers. We migrated a couple of production servers, but everything was going so well that we decided to open up the use of that machine a little.

“We get many requests for new test servers and often, these servers must be provisioned quickly. This is an ongoing need here and VMware is a perfect way to satisfy those users. Pretty soon, we had entirely filled that first machine. We had zero problems and felt comfortable with VMware administration. Our IT team and other test users were so impressed with this initial test that we felt comfortable going full speed ahead with the consolidation of production servers.”

Poppleton describes his approach: “Initially, we considered every server ‘guilty until proven innocent’—meaning that every server was a prospect for consolidation. Then we realized that there was a huge potential—upwards of 1,000 servers—so we needed to set some criteria to limit the number initially and develop a methodical rollout plan that we could implement over time. We decided to start with the 30 oldest and least critical servers and then march through the others, from least critical to most critical. These included Web servers, database servers, and other application servers.”

“Once we introduced VMware ESX Server, it caught on faster than I could have imagined. Even more amazing than the product’s efficiency was the way it reduced our costs. VMware software probably saved us several hundred thousand dollars within a year on hardware purchases alone. As QUALCOMM grows, we anticipate even greater savings.”

Paul Poppleton
IT Manager, QUALCOMM
VMware® ESX Server Enables QUALCOMM to Consolidate Physical Servers 30:1, Beats Everyone’s Expectations

The QUALCOMM IT team added two more eight-way servers and migrated more production applications onto VMware virtual machines. The consolidation ratio was impressive. “Initially, we hoped to consolidate eight physical servers on one VMware ESX Server,” says Poppleton. “Instead of an 8:1 ratio, we’ve achieved 30:1—a huge win for us. This was largely because we started with the most underutilized servers hosting applications with modest demands for memory and CPU resources. So the real workhorse applications will probably yield something like an 8:1 ratio, which is still absolutely fantastic. But we eliminated 30 small servers, so we were also seeing our administrative burden reduced.”

Consolidation Leads to Reduced Costs

The most obvious benefit of server consolidation is a reduced total cost of ownership. First, capital equipment costs are reduced because hardware utilization goes up dramatically. QUALCOMM had many servers with utilization as low as five percent of CPU resources before consolidation. On the VMware ESX Server–based machines, CPU utilization rate is now close to 100 percent. In addition, many other costs are reduced: data center space, administration labor, cost for the network drop, cost for power, and so on. Says Poppleton, “We probably saved several hundred thousand dollars within a year just on hardware purchases alone, as a result of using VMware software.”

According to Poppleton, deploying a new 1U physical server can cost a company approximately $6,000 for the equipment and labor to install it. The consolidated approach costs $2,000 per server, a $4,000 savings. “The bottom line is that we’re saving a lot of money, on the order of several thousand dollars per server,” says Poppleton.

Adding VirtualCenter and VMotion™ – the Ultimate in Server Management

In January 2004, Poppleton and his team evaluated VMware VirtualCenter to control its data center computing resources from a centralized point. “When we saw VirtualCenter in action, we could see that it was a powerful tool that would bring us even greater capabilities,” says Poppleton. So in February 2004, they implemented VirtualCenter along with VMotion—which allows Paul and his team to move live virtual resources from one physical machine to another with no service interruption.

With VirtualCenter and VMotion, Poppleton can effectively manage QUALCOMM’s virtual machine resources. For example, Poppleton and his team can view the usage and availability of virtual machines across the enterprise, and make any necessary adjustments to optimize resource use and performance.

“While we were happy with ESX Server, VirtualCenter allowed us to do more,” he says. “It gives us complete control of our virtual computing resources so we have the flexibility to quickly react to business demands. VMotion has also given us the agility to perform hardware upgrades with no downtime to the systems running in virtual machines.”

IT Can Now Respond Faster to Business Needs

Poppleton’s team can fulfill most requests for new servers quickly because new hardware does not have to be procured. As a result, IT can be much more responsive to QUALCOMM’s business needs. “It used to take a minimum of two weeks to get hardware approved and ordered,” says Poppleton. “Now we can instantly provision new servers. That enables QUALCOMM employees to be more productive and do a better job for our customers.”
QUALCOMM Anticipates High Availability and Disaster Recovery for Business-Critical Applications

As the IT team looks to consolidate business-critical applications, VMware’s high availability features provide important benefits. In clustered server configurations with redundant components, the failover features of VMware ESX Server enable QUALCOMM to improve the availability of business-critical applications. ESX Server supports network interface card (NIC) teaming and redundant storage area network (SAN) configurations. Redundant NICs preserve network connections even if a NIC fails and ESX Server SAN support enables continuous operations if a host bus adapter (HBA), switch, or controller fails. Also, with VMotion, QUALCOMM will be able to migrate virtual machines between datacenters with no downtime.

“Our virtual IT infrastructure will help us provide greater availability than ever before for our most critical applications,” says Poppleton. “We plan to move forward with additional projects enabled by VMware software.”

VMware Professional Services Helps Shorten Time-to-Value

As QUALCOMM started its VMware deployment, Poppleton engaged with two VMware consulting services to make sure that QUALCOMM was following VMware best practices. VMware consultants in the ESX Server Jumpstart program assisted with ESX Server installation, configuration, and training. The P2V (physical-to-virtual) Migrations service provided tools that enabled QUALCOMM’s team to move an intact image of one physical server to a virtual machine image on another physical server, mounting the image and making any necessary operating system changes so the image runs flawlessly on the new hardware.

Future Plans Call for Continued Consolidation

Virtual machines are now supporting applications used by thousands of QUALCOMM employees. Says Poppleton, “A wonderful surprise is that some stand-alone servers that were problematic have actually become more reliable since we’ve migrated them to ESX Server, indicating that there were hardware problems with the old machines. We are now moving as quickly as possible to consolidate as many servers onto ESX Server as is practical.”

Asked to give advice to other potential VMware software users, Poppleton says, “Once we saw how effective and easy to administer VMware ESX Server is, the economics drove us to accelerate our consolidation efforts. So the best advice I can give is, plan for quick growth!”
Vidéotron Telecom Migrates 171 Servers from Chicago to Montreal in Seven Weeks with VMware Software

Vidéotron Meets Tough Deadline Using VMware Virtual Infrastructure and Engaging VMware Technical Account Manager (TAM) Program

Seven-Week Migration Plan Seems Impossible

Vidéotron Telecom Ltd. (VTL), a subsidiary of Quebecor Media Inc., is a state-of-the-art business communications provider delivering robust, high-quality services to large and medium-sized businesses, Internet Service Providers (ISPs), Application Service Providers (ASPs), broadcasters and government institutions. VTL offers customers a complete portfolio of network solutions as well as data, hosting Internet, local and long distance telephony and studio-quality audio-video services.

VTL supports more than 25,000 users and 600 servers for internal and external clients, offering turn-key IT solutions including managed services for its customers. When one client wanted to migrate 128 production servers plus another 43 development and test servers from Chicago to VTL’s headquarters in Montreal in two months, the VTL technical staff knew it would be a challenge.

“Ideally, we would have more time to prepare ourselves to do what was required for the migration of a datacenter from one city to another,” says Alain Dagenais, director of operations for VTL. “Our present datacenter didn’t have the capacity to receive these 128 production servers plus another 43 development and test servers in such short time. It would have been difficult to get a new datacenter in place and expensive to get the raised floor space, electricity and other requirements necessary to build a new data center.”

Study Reveals Cost Effectiveness of VMware Virtual Infrastructure

Before beginning the project, VTL conducted a study showing the total cost of ownership (TCO) for the next three years of operations. The company looked at many cost factors, including square footage of data center space, licensing fees, manpower, management and operations. “We looked at different formulas to calculate costs,” says Vafi. “We found that using VMware software would give us a 70 percent reduction in costs over the next three years. The cost of bringing servers to Montreal by itself would have cost more than putting a virtual infrastructure in place.”

“As a service company, we want to provide the best solution to our clients, fully meeting their needs. Because we are able to use virtual infrastructure technology, we were able to give our clients the benefits of this technology – a fast migration from physical to virtual environment, reduced costs, higher performance and high availability.”

Alain Dagenais
Director of Operations, Vidéotron
Enlisting a VMware TAM Helps Make the Impossible Possible

Facing a large project with a short deadline, VTL chose to engage a VMware Technical Account Manager (TAM) to help ensure the overall success of the project and apply best practices per the VMware Virtual Infrastructure Methodology. The VMware TAM program provides customers with a technical VMware insider who serves as their organization’s conduit into all groups within VMware, including product management, support and the executive team. The VMware TAM was assigned to VTL to validate the project plan, identify risks and apply best practices throughout the deployment life cycle.

The VTL team says the VMware TAM was a key ingredient to their success in meeting their client’s needs. “The TAM helped keep us on track through the deployment,” says Vafi. “I would recommend the TAM program to anyone. To gain confidence and validate processes, as well as get top-notch support, it is best to engage a TAM.”

Cost Savings and Increased Flexibility With Virtual Infrastructure

By implementing virtual infrastructure, VTL was able to provide its client with a cost-effective solution in record time. VTL and its client have also realized the following benefits:

- **Reduced Costs by 70 Percent.** Evaluating factors including floor space, software licensing fees, hardware costs and utility fees, Vafi estimates a 70 percent cost savings by implementing virtual infrastructure.

- **Achieved Server Consolidation Rate of 4.5:1.** VTL was able to consolidate its client’s 128 production servers onto 28 blade servers. Also, the combination of ESX Server on blades saved a tremendous amount of datacenter space, power, and management resources.

- **Improved CPU Utilization by 78 Percent.** Instead of having many underutilized servers, VTL was able to have fewer, highly utilized servers.

- **Server Deployment Time Reduced by More Than 87 Percent.** Whereas it used to take about 8 hours to deploy a server, with virtual machines it takes about 20 minutes, including setting all permissions.

- **Improved Application Availability by 50 Percent.** Vafi says performance and availability has increased with the virtual infrastructure. “It allows us to support the client’s applications,” says Vafi. “Also, the performance is better than before for many applications.”

- **Increased Flexibility.** The Win Admin Team says working with virtual machines instead of physical servers provides more flexibility. “We have live cloning of servers, snapshots and change control,” says Vafi. “I can take a physical server and bring it into a virtual environment. I can take snapshots of my running environment, and if anything goes wrong, I can revert to that snapshot. After using VMware software I wouldn’t want to go back to purely physical server management.”

- **Increased Control.** With VMware VirtualCenter, VTL system administrators can manage servers from a central console. “VirtualCenter gives us flexibility for everyday administration,” Vafi says. “It has removed the drudgery from management duties.”

- **Eliminated Hardware Dependence.** The virtual infrastructure frees VTL from dependence on hardware, resulting in cost savings. “I love that I can move servers from one place to another without being dependent on the hardware,” says Vafi. “It doesn’t matter whether the servers are brand new or not, as long as they have enough resources and are operating well. That we do not need to consider hardware for each new virtual machine, or worry about having compatible hardware, is a huge cost savings.”
Optimal Customer Service with Virtual Infrastructure

The VTL Win Admin Team says VMware software and the assistance of the VMware TAM enabled VTL to meet its client's needs with a successful, cost-effective solution. "As a service company, we want to provide the best solution to our clients, fully meeting their needs," Dagenais says. "Because we are able to use virtual infrastructure technology, we were able to give our clients the benefits of this technology – a fast migration from physical to virtual environment, reduced costs, higher performance and high availability."

Vafi says that in addition to these benefits to VTL clients, virtual infrastructure brings increased flexibility and ease of management for him and his staff. "Because it is easier for us to manage the servers in a virtual environment, we can quickly react in order to best serve our clients," he says.

One Year Later

Since the delivery of project, one full year has passed, and VTL is happy with the results. Vafi says, "The environments are more robust and that the up-time has been improved."

VTL is also using VMware software as an important part of its Disaster Recovery plans. "We are proud to be able to bring up all critical servers within a couple of hours in case of a major event."