



VMware Virtual Infrastructure Saves Covenant Health from Massive Data Center Overhaul and Brings Multiple Benefits

VMware Software Reduces Operational Expenses by \$155,000 and Prevents Costly Data Center Upgrade

RESULTS

- Achieved 25:1 server consolidation ratio
- Reduced operational costs by \$70,000 within one year, \$155,000 total in 18 months after the ROI was met
- Avoided costly data center overhaul
- Standardized 75 percent of new systems on virtual machines
- Increased CPU utilization from 5 percent to 60 percent
- Accelerated new server deployment from 4-6 weeks to one day
- Increased disaster recovery capability of applications
- Reduced per-processor licensing costs
- Facilitated test and development with "undoable" mode
- Eliminated downtime during hardware maintenance and upgrades

Growing Pains

Covenant Health is East Tennessee's leading healthcare provider; its hospitals, clinics, and services are known for excellence, quality and value. Headquartered in Knoxville, the health system includes five acute care hospitals: Methodist Medical Center of Oak Ridge, Fort Sanders Regional Medical Center and Parkwest Medical Center in Knoxville, Fort Loudoun Medical Center, and Fort Sanders Sevier Medical Center.

With approximately 8,000 employees and more than 1,000 affiliated physicians delivering quality care to thousands of patients, Covenant Health's data and infrastructure needs were rapidly expanding. Peter Hogan, systems manager, explains, "The company was buying an increasingly large number of Windows servers. We had to add most to segregate applications, not to expand capacity or performance. Across our data center we were only using half of the total disk space and a fraction of the processing power."

The expanding data center hardware inventory brought increased space and environmental issues, plus escalating costs for cooling, maintenance and IT equipment upgrades. By 2003, Covenant Health realized it needed to consolidate its servers or face a major data center upgrade, which could cost \$1 million or more. "It seemed like every other day, we had a conversation about buying a bigger building or expanding our data center," says Bill Dean,

systems analyst for Covenant Health. "We were also spending a lot on hardware maintenance from year to year."

Working with its hardware vendor, IBM, Covenant evaluated VMware® ESX Server in Spring 2003. "We had been working with our hardware manufacturers to discover new options, and they offered us some different tools," says Hogan. "We had been interested in VMware technology since the release of Workstation. When IBM showed us VMware ESX Server, we realized it would provide a viable server consolidation platform."

Performance as Promised Plus More

After a thorough test phase, Covenant Health deployed VMware ESX Server in January 2004. While the test phase had proven the software's ability to consolidate servers on a stable platform, the deployment brought additional unexpected benefits.

"The first ESX Server we bought cost nearly the same as the maintenance for systems we could consolidate and the new deployments we were anticipating—costs we would have to incur one way or another," explains Dean. "We felt like it was a no-lose situation. We primarily wanted to consolidate some of our low-hanging fruit. We were expecting to have a server consolidation platform, but it gave us so much more, we can't even put a dollar amount to it."

"After we deployed VMware software, our finance office wanted to know why our maintenance budget had reduced. It happened because we had eliminated or lowered so many of our maintenance and operational costs. That doesn't include other savings; we haven't had to update our data center, which could have cost \$1 million or \$1.5 million, and we saved resources and space. We solved our problems and gained a lot more than we anticipated by adopting this technology."

*Bill Dean
Systems Analyst, Covenant Health*



VMWARE VIRTUAL INFRASTRUCTURE AT WORK

- VMware ESX Server, VMotion and VirtualCenter on four 8-CPU IBM x445s and one 4-CPU HP ProLiant DL 580 for test lab
- Guest operating systems include: Microsoft Windows® NT4, Windows 2000, Windows 2003 and Windows XP
- Applications running in virtual machines include: SQL, Exchange, file, print, domain controllers, Citrix, clinical applications, oncology application
- IBM ESS SAN with McDATA SAN director
- With multiple locations, Covenant Health has 95 percent of its systems in one building, and a 100 mega-bit OC48 connection to remote locations

Hogan adds, "I would have been extremely happy with the project breaking even because of what we gained in abilities, portability, disaster recovery, quick deployment, systems setup. But we gained additional benefits and cost savings as well."

Covenant reports a capital gain of \$70,000 in hardware and maintenance contracts in the first year. "After we deployed VMware software, our finance office wanted to know why our maintenance budget had reduced," Dean says. "It happened because we had eliminated or lowered so many of our maintenance and operational costs. That doesn't include other savings; we haven't had to update our data center, which could have cost \$1 million or \$1.5 million, and we saved resources and space. We solved our problems and gained a lot more than we anticipated by adopting this technology."

Covenant Health has continued adding to its virtual infrastructure, using VMware VirtualCenter and VMotion™ technology for optimal server management. "Everything we can put on it, we do put on it," Dean says. "We're running every back office application from Microsoft® on our virtual infrastructure; SQL, Exchange, file and print servers, and domain controllers. We have some McKesson software, Citrix servers running clinical applications and other medical applications on it. We're in the process of putting one of our oncology applications onto virtual machines."

Hogan adds, "The point is that it's not different from an IT perspective than a physical server. It can be used for anything as long as there isn't a unique hardware configuration requirement. We also haven't put some highly utilized servers onto virtual machines because it doesn't make a big consolidation impact to virtualize a system that is already well-utilized."

John Russell, systems analyst for Covenant, adds that virtualization enables functionality that is not possible with physical servers. "It frees us from our dependence on hardware," Russell says. "We don't have to wait for server resources, and we can easily add resources to a virtual machine, such as RAM, disk space and processor power."

Better Shape Than Ever

Although the solution was originally deployed to consolidate servers in its data center, Covenant Health has realized a variety of benefits including:

- **Server consolidation.** Covenant Health has achieved a consolidation ratio of 25:1. "We have the ability to put up to 40 virtual machines on a server, but we keep our servers about 60 percent utilized so we can load balance. This provides room to move virtual machines from one server to another," explains Dean.
- **Reduced costs.** With VMware software, Dean explains, Covenant reduces operational costs by not needing to renew maintenance contracts, and it reduces capital costs by not needing to buy new hardware. The result: a savings of \$155,000 in the first 18 months. "We also save from not needing to renovate the data center or move to another location," says Dean. "That alone is great, but to be able to cut the budget by \$155,000 on top of that is impressive."
- **Increased CPU utilization.** Before, Covenant Health had more than 100 servers that averaged five percent utilization. Now, servers with VMware ESX Server are utilized 60 percent.



- **Reduced server deployment time.** Covenant staff members no longer have to wait four to six weeks to order and set up new hardware to meet project needs; new servers are ready within days.
- **Better disaster recovery at a reduced cost.** With physical hardware, Covenant Health's disaster recovery protocol for a failed server used to take 12-14 hours. With VMware software, it takes one hour. Also, Covenant is able to connect all virtual machines to its storage area network (SAN), whereas before, it was too costly for the equipment to connect each physical server. "We've saved a lot in connectivity costs," Dean says. "With physical boxes, we don't usually put them on the SAN unless it's dual attached, which are \$1,000 each. We no longer have to purchase dual fiber cards because our servers are on virtual machines."
- **Systems redundancy.** Dean adds that redundancy ensures that systems can be recovered. "We have redundant network connections, failovers, network switches, each virtual machine has dual power supplies on their own power circuits," he says. "So if we lose a power circuit, we're fine. Our virtual machines are also distributed in different places in our data center so if there's an environmental issue, if the ceiling falls in on one place, we can recover."
- **Increased application availability.** Covenant Health estimates a 95 percent increase in application uptime. Deploying a virtual infrastructure has also drastically reduced hardware failures, further increasing uptime. "When you have 350 hardware boxes in a data center, you'll be having hardware problems weekly," says Russell. Dean adds: "If you have 50 servers with five hard drives each, you have 250 hard drives. If you have 50 virtual machines on two servers with two hard drives each, you only have four. Statistically, you have a much lower chance of a hardware failure."
- **Reduced hardware dependency.** With its virtual infrastructure, Covenant Health no longer needs to worry about stockpiling hardware to meet its needs, saving the organization from problems and lengthy response times. For example, Dean explains, "If there is a failure and you're on a four-hour response time from your hardware vendor, you may have to wait until the next day to get your replacement part. We've had to stockpile models of hard drives just for that reason, or else wait until the next day. You don't have that problem with virtual machines."
- **Reduced licensing fees.** Being able to fit multiple virtual machines on fewer physical servers has reduced many miscellaneous costs. For example, many licenses, including software and hardware backup, are charged on a per-processor basis. "For example, a backup license for a server is about \$500," says Dean. "With 28 systems on an 8-CPU server, we save on 20 server licenses, a \$10,000 savings in licensing fees."
- **Better test and development environment.** Covenant Health used to have a lab room full of servers. With VMware software, the team was able to put the entire test lab onto one HP DL 580 server. Application analysts now have more flexibility because they're using virtual machines for test and development. They can work in undoable mode in a virtual machine to test applications without having to worry about how to backtrack if something goes wrong: They can simply undo their work and go back to a previous state. "It saves time and gives them the flexibility to fully test the applications."



IT Fitness

With a virtual infrastructure, Covenant Health has maximized efficiency and flexibility in the data center while lowering costs. "We are able to complete projects faster, and they are completed under budget," says Dean. "We can put as much as we want in our data center because we know our virtualization platform will support our growth."

Hogan adds: "The solution has broadened our capabilities while reducing costs and administrative tasks, going above and beyond our original goal of server consolidation."

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