



## Community College of Baltimore County Budget Goes Further With VMware Virtual Infrastructure

### VMware ESX Server Software and IBM BladeCenter Streamlines College's Computing Infrastructure With Faster Deployments and Improved Hardware Manageability

#### RESULTS

- A long-term increase in IT cost efficiency, with savings on hardware purchase and maintenance
- Accelerated server deployment due to near-instant provisioning of virtual machines (VMs)
- Hardware independence of virtual machines makes it easy to deploy blades as interchangeable compute appliances
- Significant server consolidation and improvement in hardware manageability from running VMs on blade servers
- Dramatically improved server utilization rates
- Highly secure application testing thanks to the isolation afforded by virtual machines
- Compressed test and development cycles with the ability to quickly push test platforms into production

#### 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 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 server blades 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."

#### VMware ESX Server Brings a New Class of Value

CCBC is currently running ESX Server on an IBM BladeCenter with 14 HS20 server blades and is expanding their deployment to a second BladeCenter with seven HS80 blades. The HS20s are connected to a storage area network (SAN) with IBM TotalStorage "Shark" Enterprise Storage Server and an IBM TotalStorage DS4100 SAN array. Thus far, the ESX Server implementation has provided benefits beyond the IT group's initial expectations. Advantages include:

**"The cost savings, flexibility and redundancy from the combination of VMware virtualization and IBM BladeCenter made running virtual machines on server blades the clear choice for us. 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 VIRTUAL INFRASTRUCTURE AT WORK

- VMware ESX Server deployed on dual IBM BladeCenters
- Three dual processor IBM HS20 blade servers, 2 GB RAM;
- Each BladeCenter connected through a Brocade Fibre Channel switch module to IBM Enterprise Storage Server (ESS Shark) and DS4100 SANs with 2.4 TB capacity
- Guest operating systems: SUSE Linux, Microsoft Windows, Mandrake Linux, Novell NetWare
- Applications running in virtual machines include: domain name service, WebCT, Common UNIX Printing System (CUPS), GloPass, Windows Domain Controllers, Web servers, Nagios, Nortel Networks Optivity, SquirrelMail for students

- **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 7Us of rack space. Each VM shares the storage and networking interfaces in the BladeCenter chassis to reduce hardware requirements. 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.
- **Redundancy and flexibility.** VMware virtualization lets CCBC manage its server blades as truly stateless and interchangeable appliances. Each server blade is configured to boot ESX Server from the SAN and the VMs are completely hardware independent, so no hardware configuration is required when deploying or migrating VMs. Each VM fully benefits from the redundant SAN ports and network interfaces in the BladeCenter backplane to spread out I/O traffic and leverage high availability across every server in the chassis. CCBC can also mix server blades running ESX Server with blades running conventional physical servers in the same BladeCenter chassis.
- **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.



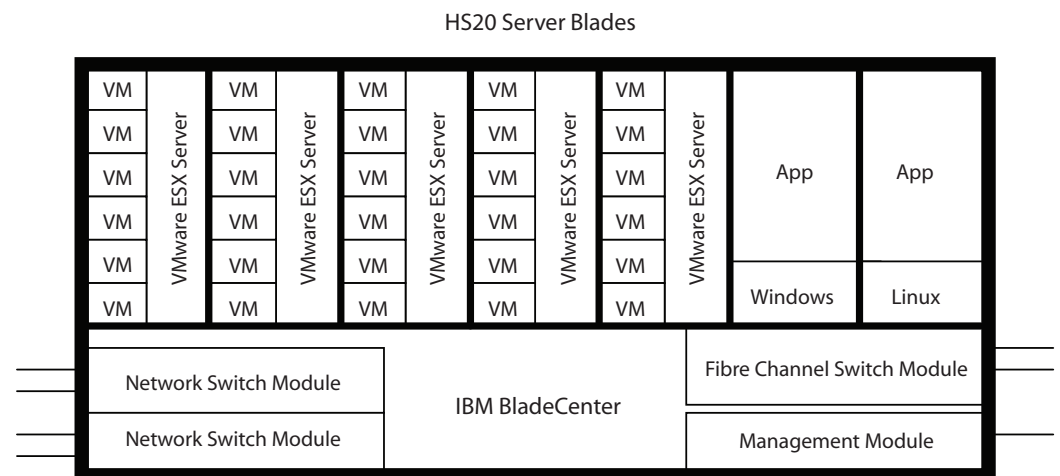
### The Future Looks Bright With VMware Solutions

In addition to consolidating all of its old HP/Compaq servers through virtualization using VMware ESX Server, CCBC anticipates using VMware VirtualCenter for centralized virtual machine management and provisioning. CCBC will also use VMware VMotion™ technology for zero-downtime migrations of running virtual machines in conjunction with the IBM SAN and a Layer 4-7 switch from Nortel Networks™, which will be part of the IBM BladeCenter. VMotion will 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 stateless spare server blade that boots the ESX Server software from the SAN.

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.”

Figure 1 IBM BladeCenter with VMware ESX Server at CCBC



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