

# :: Realizing Increased Cost Control

## And Disaster Prevention with Virtualization

by Gabriel McAtee of Project Leadership Associates

As data-center space and energy costs rise, more and more companies are looking at blade servers, server consolidation and virtualization to help control and manage costs. Additionally, disaster preparedness and disaster-recovery planning are key issues in many companies, and the associated technologies can help to address the information systems portion of those overall cost-saving efforts. Let's examine these concepts, discuss some specific solutions and look at how some of these technologies can affect the information systems environment.

Server consolidation refers to an attempt to reduce the number of physical servers in an environment primarily through one of several methods: by collocating multiple applications on a given server, by collocating multiple copies of the same application on a given server, or by virtualizing multiple servers and collocating them on a single physical server or a cluster of physical servers.

A special method of consolidation is keeping the same number of servers but using smaller servers (*i.e.*, implementing a blade server solution). Blade servers are vendor-specific and generally composed of a chassis containing somewhere between 8 and 16 individual servers called blades. Each chassis has its own power supplies, input/output modules, keyboard/mouse/video, remote access and other tools. Also, most blade servers support one or two hard drives per blade.

Virtualization refers to the use of some virtualization package to provide one or more physical servers with the ability to host virtual computers, each of which is wholly independent of other virtual computers on the same or other physical servers. There are currently several virtualization vendors in the market, but the two biggest players are VMware and Microsoft.

### Virtual Benefits

The business drivers behind the push to consolidate and/or virtualize fall into three main areas: direct costs (hardware purchases and software licensing), operational costs (power, cooling and provisioning) and disaster recovery/prevention/high availability. Consolidating or virtualizing reduces the total number of physical servers in a given environment, which in turn reduces operational costs and, in some cases, licensing costs. Additionally, given the appropriate infrastructure, virtualization can provide a higher degree of disaster recovery/prevention and high availability. Provisioning refers to the cost associated with the process of building and implementing a new server in a consolidated environment. As applications are consolidated on to a reduced number of servers, the need to build new servers is reduced. Also, in a virtualized environment, new virtual servers can be built from preconfigured template virtual machines, which takes very little time and effort.

### Virtual Flavors

On the virtualization front, VMware has two main product lines which are typically used in the data center: VMware Server (formerly VMware GSX Server) and VMware ESX Server. VMware Server is a free product

which is most commonly used in a laboratory or staging environment. Support is not included with the product but can be purchased separately. This is a powerful, fast and free solution that is an excellent starting point for many companies interested in virtualization. It is limited to the number of virtual machines that can be placed on a single host; no automated facilities exist to migrate virtual machines between VMware servers, nor are any clustered solutions provided.

Virtual Infrastructure 3 ("VI3") is a powerful enterprise solution that includes a virtualization engine (ESX Server) and a number of add-on services that are bundled together in three combinations. VI3 allows virtual machines (guests) to be moved manually or automatically between ESX Servers (hosts) to provide for automatic resource balancing and to provide failover capacity in the case of the failure of a host. This allows for higher use of resources available on the company's physical hardware. At the same time, it also provides a higher degree of physical redundancy than is available with a single-server solution. An important additional point for many companies is that VMware products have a much higher degree of support for non-Microsoft operating systems than Microsoft's Virtual Server.

Microsoft's latest virtualization product is Virtual Server 2005 R2. This is similar to VMware's VMware Server product. Both are free and have many comparable features. Virtual Server 2005 R2 has a higher degree of flexibility in allocating CPU resources to a given virtual machine, which can make it a more powerful tool for some applications than VMware Server. Microsoft has recently released a beta of System Center Virtual Machine Manager, a centralized tool for the provisioning and management of Microsoft Virtual Server virtual machines. While the Virtual Server product line does not have any high-availability or resource-balancing tools, it does support clustering of virtual machines both within a host or across multiple hosts using Microsoft clustering technology and an iSCSI SAN on the back end.

For all of these solutions, certain infrastructure needs to be present to gain the most benefit from the servers and software. We will take as a given that power, air conditioning and rack space are available. Key to the successful implementation of any of these products on an enterprise level is the presence of gigabit network switching and centralized storage, generally a SAN. All of these products support local disks for basic services, but to get the more advanced tools such as high availability through VMware's HA service or a Microsoft cluster, or distributed resource management, a clustered file system in the form of a SAN is required.

### Virtual Economics

The economics of virtualization and consolidation are most effectively demonstrated through case study and return-on-investment (ROI) scenarios. For comparison, assume that a sizeable law firm (about 1,500 employees) has about 80 servers in its centralized data center. In this scenario, the company is growing in size about 10 percent a year, and the number of servers is growing at a rate of three to five servers a

year. The firm's policy is to replace servers every four years. Therefore in 2007, the firm plans to replace 20 servers and add three to five. For this analysis, assume a total of 24 servers. Since the firm participates in Microsoft Volume Licensing, Microsoft licensing will not be directly considered in this calculation. Also, to make all comparisons equal, we will assume the firm has a single virtualization product, VMware VI3, an in-place SAN and computers purchased from a single vendor. All pricing numbers will be based on list pricing with no discounting.

**For all of these solutions, certain infrastructure needs to be present to gain the most benefit from the servers and software.**

The three cases the firm wants to look at are: direct one-for-one replacement to 1U SAN-attached servers; consolidation to blade servers, assuming that some applications will be able to be consolidated to a single physical server for an overall reduction in number of servers of about 33 percent to 16; and virtualization of as many servers as possible. For this case, we will assume that 21 of the 24 servers being implemented this year can be virtualized. Further, we are going to estimate that we will be able to virtualize 10 physical servers to one ESX server for a normal production load, and that in a failover scenario (*i.e.*, one of the ESX Servers failing) we could run 12 to 15 virtual machines on a single host for a limited time.

**1-to-1 Server Replacement**

24 servers with two dual-core 3.0GHz processors, redundant power, two local 73GB disks and dual-port HBA. Approximate price for each is \$9,000.00, subtotalling \$216,000.00.

Average cost associated with building the 24 servers, patching them, adding them to AD, and migrating applications and data to them (assume 12 hours at \$100/hr total cost) Approximate cost for each is \$1,200.00, subtotalling \$28,800.00.

Total Direct Costs: **\$244,800.00**

Note: These servers will take up 24U of space in the data center, will require 48 power connections and 72 network connections if remote access cards are to be used.

**Blade Servers with Consolidation**

2 blade chassis (no blades) with dual Cisco switch modules. Approximate price for each is \$6,000.00, subtotalling \$12,000.00.

16 server blades, 2 dual core 3.0GHz processors, dual local disks, 4GB of RAM and HBA. Approximate price for each is \$7,000.00, subtotalling \$112,000.00

Average cost associated with building the servers, patching them, adding them to AD, and migrating applications and data to them

(assume 12 hours at \$100/hr total cost. Approximate cost for each is \$1,200.00, subtotalling \$19,200.00.

Total Direct Costs: **\$143,200.00**

Notes: These servers will take up 44U of space in the data center, will require 3 power connections and 4-12 network connections depending on configuration and if the remote access cards are to be used.

**Virtualization**

3 servers with two dual-core 3.0GHz processors, redundant power, two local 73GB disks, dual-port HBA and 4GB RAM. Approximate price for each is \$9,000.00, subtotalling \$27,000.00.

1 server with two dual-core 3.0GHz processors, redundant power, 6x300GB drives, dual-port HBA and 4GB RAM. Approximate price is \$12,500.00.

3 servers with two quad-core 2.66GHz processors, redundant power, two local 73GB disks, dual-port HBA and 16GB RAM. Approximate price for each is \$12,500.00, subtotalling \$37,500.00.

3 VMware VI3 enterprise. Approximate price for each is \$5,750.00, subtotalling \$17,250.00.

3 VMware Vi3 enterprise support (SNS). Approximate price for each is \$1,435.00, subtotalling \$4,305.00.

1 VMware Virtual Center 2.0. Approximate price is \$5,000.00.

1 VMware Virtual Center 2.0 support (SNS). Approximate price is \$1,250.00.

Average cost associated with building the servers, patching them, adding them to AD, and migrating applications and data to them (assume 12 hours at \$100/hr total cost). Approximate cost for each is \$1,200.00, subtotalling \$3,600.00.

Average cost associated with building a four-server VI3 production environment, 40 hours @\$100/hr. Approximate cost is \$4,000.00.

Total Direct Costs: **\$112,405.00**

Note: These servers will take up 8U of space in the data center, will require 16 power connections and 27 network connections if the remote access cards are to be used.

Projecting the numbers above across three years we see the following:

**1-to-1 Replacement**

Year one costs: . . . . . \$244,800.00  
 Year two costs (assume 26 servers at similar ratios): . . . \$255,000.00  
 Year three costs (assume 29 servers at similar ratios): . . . \$295,800.00

### Blade Servers with Consolidation

Year one costs: . . . . . \$143,200.00  
Year two costs (assume 26 servers at similar ratios): . . . \$159,600.00  
Year three costs (assume 29 servers at similar ratios): . . \$184,200.00

### Virtualization

Year one costs: . . . . . \$112,405.00  
Year two costs (assume 26 servers at similar ratios): . . . \$102,260.00  
Year three costs (assume 29 servers at similar ratios): . . \$105,415.00

Obviously, great savings are possible through either consolidation or virtualization.

The cost benefits of the reduced power, cooling and rack space required for a consolidated or virtualized solution are not as easy to quantify and can be significant. In many modern data centers, space and cooling are even more of an issue than direct-purchase cost savings.

### A Winning Practical Application

Many companies are very serious about implementing some kind of formal disaster preparedness or disaster recovery plan. VI3 opens some very interesting and powerful opportunities to DP/DR planners. Whether considering a localized disaster (*i.e.*, fire or flood in a data center) or

something more widespread such as the effects of a hurricane or earthquake, most companies' DP/DR plans include some form of offsite recovery, whether automated or manual. In either case, virtualizing the DP/DR environment allows for the significant reduction of costs associated with building the DP/DR site. For companies that have to rent space from a hosting provider for a DR site, this becomes even more attractive, as many ISPs/colocation facilities charge by the number of units taken up in the rack.

In cases where space is at a premium, a combination of blade servers, a small workgroup-level SAN and VI3 is unbeatable in terms of providing a highly redundant, compact and rapidly expandable infrastructure. While the site is strictly being used for DR, guests can be loaded quite heavily onto the hosts (20 to 1 or so). In the case of a major disaster, when that virtualized environment must be used for production purposes, it is extremely simple to add additional VMware ESX Servers to the VI3 environment and to allow the distributed resource services to load balance the guests across the new hosts.

Given the enormous benefits of virtualization, the next questions to be asked are, "What servers can I virtualize?" and "How can I easily migrate my physical servers to a virtual environment?" And those are topics for another article.



*This article was first published in ILTA's June, 2007 white paper titled "Virtualization — Less Really Is More" and is reprinted here with permission. For more information about ILTA, visit their website at [www.iltanet.org](http://www.iltanet.org).*