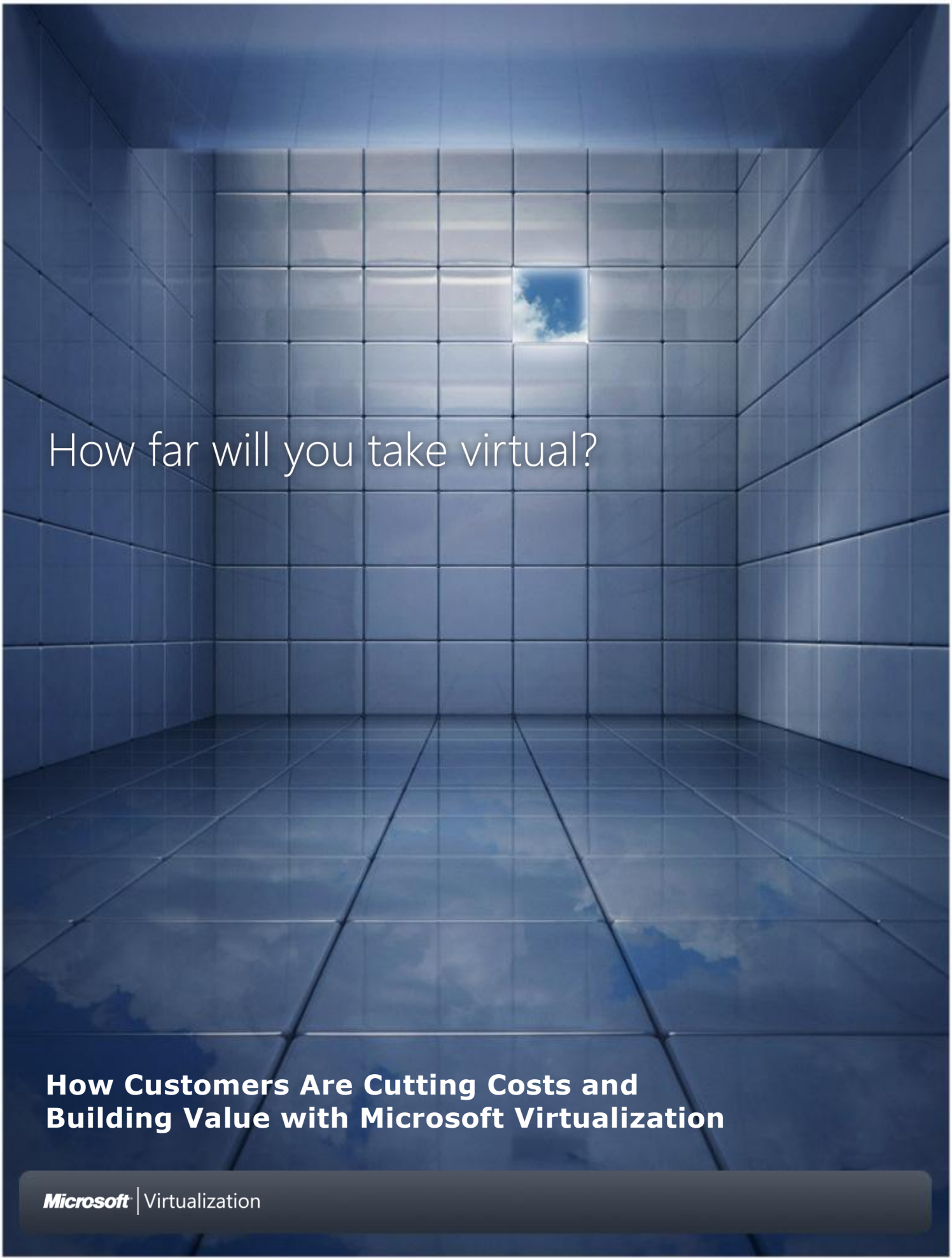

How Customers Are Cutting Costs and Building Value with Microsoft Virtualization

Microsoft | Virtualization

Introduction

The majority of organizations are incorporating virtualization into their IT infrastructures because of the potential to drive IT costs down. By consolidating servers organizations can lower costs for hardware and labor-related server management. Fewer servers also translate into reduced cost for data center space, and less for power and cooling. Many organizations also save money by using virtualization to ensure application compatibility, which eliminates the need for resource-intensive testing and installation processes.

Virtualization also helps make IT much more efficient. Servers, operating systems and applications can be provisioned in a fraction of the time previously required, so that end users can get the resources they need when they need them. High availability solutions help ensure that resources are always available and consistently reliable, which can result in drastic improvements in business continuity and, therefore, productivity.

Finally, organizations use virtualization to make their businesses much more agile. With dynamic data centers and desktops, IT can respond very quickly to evolving business, market and user needs.

Microsoft® Windows Server® 2008 R2 with Hyper-V and Microsoft System Center are an enterprise-ready solution for comprehensive server virtualization, monitoring, and management. Microsoft's solution contains the key features required to maximize datacenter efficiency and server uptime with minimal cost, even in the free Hyper-V Server and inexpensive Virtual Machine Manager Workgroup Edition and System Center Essentials SKUs.

This paper compares using Microsoft's virtualization solution to using VMware's products. The focus of this comparison will be on the overall software acquisition cost for each solution, and on the functionality provided by each software solution.

There are several models that can be used when comparing the pricing of two software solutions. Because software requires hardware to run, the price of both hardware and software could be included in the comparison. This approach may be more comprehensive from the perspective of money spent, but it may also obscure important value differences between the two software solutions by introducing many comparison points that do not directly correspond to total solution value, like hardware maintenance contracts, datacenter costs, and IT labor costs. Cost comparison calculators by competing vendors often base their comparisons on per-VM or per-host costs. Because of this, these cost comparison calculators function more as cost estimators for infrastructure implementation than as software cost comparison calculators.

The per-VM or per host pricing models are often predicated on the assumption that customers will use memory over-commit to increase the number of VMs per host. While memory over-commit can be helpful in testing and development scenarios, it can seriously degrade performance when used in production scenarios.

Any cost-calculator that assumes customers will use memory over-commit will not translate well to production scenarios.

In addition, competing solutions which calculate costs based on a per-VM pricing model are actually sold based on a per-host or per-processor licensing model. This creates a disconnect between the methodology used to calculate cost, and the actual way in which the software is sold and consumed.

This cost comparison will focus only on software pricing. This approach provides the greatest clarity in viewing functionality and value differences between two software solutions. This cost comparison will examine three scenarios that are typical of a wide range of applications for server virtualization. These scenarios are described in the table below:

Scenario Description	Number of Host Servers
A small business that is experimenting with server virtualization	5
A small or medium business (SMB)	50
An enterprise business	200

The following sections of this paper examine the licensing cost required to implement each approach in the three scenarios described above, as well as the functionality and value offered by the VMware and Microsoft virtualization approaches. Use the Virtualization Cost Comparison Calculator to analyze the cost of these two solutions in your own environment: http://www.microsoft.com/virtualization/en/us/cost-compare-calculator.aspx

Microsoft and VMware Compared

Although Microsoft and VMware's virtualization solutions offer similar core functionality, the three comparison scenarios below will help illustrate the differences between these two products.

Small Business Scenario

In a scenario that uses five virtualization hosts, the following table describes the licensing that would be used:

Microsoft	Cost	VMware	Cost
Microsoft Hyper-V Server 2008 R2 or existing OS	$0	VMware vSphere Essentials Plus	$8,776.28
Microsoft VMM Workgroup Edition (WGE)	$757.00		
Total List Price	**$757.00**		**$8,776.28**

There is an important functionality difference between the two products in this scenario. Microsoft Hyper-V Server includes VM high availability/clustering and live migration support, while vSphere Essentials Plus does not include real-time migration. In addition, adding VM real-time migration to vSphere is not possible without purchasing a more expensive version of vSphere. Even in a scenario involving five virtualization hosts, the flexibility and efficiency benefits of live migration are vital. The Workgroup Edition of VMM 2008 R2 includes the full feature list of VMM in an edition designed to manage up to five virtualization hosts. This means that Microsoft's solution in this scenario not only costs less but includes the VM monitoring, management, and automation capabilities of System Center VMM.

Small Enterprise Scenario

In a scenario that uses 50 virtualization hosts, the following table describes the licensing that would be used:

Microsoft	**Cost**	**VMware**	**Cost**
Microsoft Hyper-V Server 2008 R2 or existing OS	$0	VMware vSphere Enterprise Plus	$512,064
Microsoft Server Management Suite Datacenter (with 2 years Software Assurance)	$75,200.00	VCenter Standard	$7,318.14
Microsoft Operations Manager (with 2 years Software Assurance)	$726.00		
Microsoft Configuration Manager (with 2 years Software Assurance)	$726.00		
Microsoft DPM (with 2 years Software Assurance)	$726.00		
Total List Price	**$77,378.00**		**$519,382.14**

In this scenario, the VMware solution about seven times the cost of the Microsoft solution. For purposes of this comparison, the Enterprise Plus version of vSphere was chosen because it is the most popular vSphere edition and provides the most comparable feature set to Microsoft's Server Management Suite Datacenter offering. Other less expensive vSphere editions could be substituted to bring total costs closer together but in doing so, customers would be giving up key functionality such as real-time VM migration (vMotion), resource management tools (DRS) and other important features.

Even using vSphere's premier edition, there continues to be a significant price and feature differential between the Microsoft and VMware offerings. For about one seventh the cost of the VMware software, the Microsoft solution offers more extensive management capabilities, including in-guest monitoring, application monitoring even for applications that run on physical servers, VM and application backup capabilities, and VM high availability and live migration.

Enterprise Scenario

In a scenario typical of a large enterprise organization with 200 virtualization hosts, it is clear that the ratio of cost savings is sustained as the following table describes:

Microsoft	**Cost**	**VMware**	**Cost**
Microsoft Hyper-V Server 2008 R2 or existing OS	$0	Existing OS	$0
Microsoft Server Management Suite Datacenter (with 2 years Software Assurance)	$300,800.00	VMware vSphere Enterprise Plus	$2,048,256.00
Microsoft Operations Manager (with 2 years Software Assurance)	$726.00	vCenter Standard	$7,318.14
Microsoft Configuration Manager (with 2 years Software Assurance)	$726.00		
Microsoft DPM (with 2 years Software Assurance)	$726.00		
Total List Price	**$302,978.00**		**$2,055,574.14**

To obtain customized cost comparison information on your specific scenario, please use the Virtualization Cost Comparison Calculator: http://www.microsoft.com/virtualization/en/us/cost-compare-calculator.aspx

Additional Cost-Related Considerations

These three scenarios examine software licensing costs only. Organizations that already have an investment in tools, personnel, and processes that are based on Microsoft products can save even more by using Hyper-V and System Center. The Microsoft solution enables organizations to integrate virtualization into existing tools, personnel, and processes. This saves management, software, and training costs.

How far will you take virtual?

Server uptime and datacenter efficiency are significant components of Total Cost of Ownership (TCO). Microsoft Hyper-V in combination with System Center does more to maximize datacenter uptime and efficiency that the VMware solution.

Microsoft VMM includes a product connector for Operations Manager, which adds the virtualization-specific information from VMM into the already rich monitoring database of Operations Manager. Using Operations Manager, administrators can monitor the entire IT infrastructure, both the physical and virtual, and get a visual diagram view of the complete virtual infrastructure. This provides visibility into all layers of the IT infrastructure, including logical groupings of virtualization hosts, virtual hosts, the virtual machines running on those hosts, and the Windows installation and all the applications running in each virtual machine. This comprehensive view illustrates the linked relationship between infrastructure components, which speeds and eases problem resolution. Operations Manager exposes real-time status of the systems, including the status of their applications and services, at each layer of the infrastructure. Operations Manager is able to provide this information regardless of whether applications are running on physical or virtual machines.

Only Microsoft provides both host and in-guest management of all virtual machines. The combination of Hyper-V and System Center delivers critical insights into the virtual infrastructure at the application and service levels, and tools to leverage that knowledge. One of the VMM features that enables this is Performance Resource Optimization (PRO). PRO allows optimization at both host and application levels. This is critical because managing virtual machines from an application perspective is needed to maximize efficiency and availability.

In its more expensive vSphere licenses, VMware has a Distributed Resource Scheduler (DRS) feature for performing post-placement optimization. Unlike System Center PRO, DRS can only monitor CPU and memory utilization and cannot react automatically to application issues. VMware customers who do not have System Center would need to purchase and implement additional third-party applications for in-guest management, such as backup and software distribution. Many of these third-party applications are charged on a per-virtual machine basis. By contrast, the System Center suite is licensed at the host level. This means that, as organizations scale more virtual machines per server, the capital cost benefits with Microsoft increase while the benefits associated with VMware decrease.

With Microsoft, a virtualized infrastructure consists of the three computing layers already present in an IT infrastructure: hardware, operating system and applications. Windows Server includes the Hyper-V role and thereby avoids adding a fourth infrastructure layer exclusively for virtualization. Organizations that use VMware to add a virtualization layer will increase the complexity of their IT infrastructure. Increased complexity will tend to increase support costs, especially if an integrated management solution is not in place.

The upgrade process from VMware ESX 3.5 to vSphere involves a significant change to customer environments. For example, new virtual machines must be created to take advantage of many vSphere features.

VMware ESX and vCenter Functionality

vSphere is a suite of VMware products that includes the ESX hypervisor and the vCenter management tool. vCenter provides the ability to manage VMware hypervisors and VMs.

vCenter is focused on managing hypervisors and VMs rather than applications. vCenter actually has no visibility into many application-level events, and instead relies on the optional AppSpeed module to monitor only the network traffic traveling to and from VM-hosted applications. vCenter also has no visibility at all into applications that are running on physical servers rather than VMs.

vCenter has no ability to manage physical machines either. The physical machines which run hypervisor software are a critical aspect of any virtualized infrastructure. Using a separate management and monitoring tool to manage physical machines introduces additional complexity and fragmentation to the use of management software. This increases the effort required for end-to-end management in any environment that utilizes VMware.

VMware vSphere, and many of the extra modules required for maximum functionality, are licensed on a per-processor pricing model. There are several vSphere licenses available, and the cost of these licenses is tied to the functionality provided by each license. For example, VMware customers who want to use real-time migration to move running VMs from one host to another will not have that functionality if they purchase the VMware vSphere Standard license. Instead, they must purchase a more expensive Advanced, Enterprise, or Enterprise Plus license. This means that the total solution price for VMWare vSphere scales based on both the functionality desired and the number of processors used. Although it depends heavily on the practices of each organization, using a hypervisor that is priced per-processor may encourage short-term cost savings through excessively high consolidation ratios that come at the expense of reduction in performance and flexibility.

The table below describes the core capabilities of each VMware vSphere license, along with retail cost at the time of publication:

License	Capabilities	Retail Price
VMware vSphere Standard	Hypervisor Basic High Availability VM Management	$795 per processor * this license limited to 256GB of physical server memory
VMware vSphere Advanced	Hypervisor	$2,245 per processor

License	Capabilities	Retail Price
	VM Live Migration VM High Availability VM Backup Hot Add and Removal of VM Resources VM Management	* this license limited to 256GB of physical server memory
VMware vSphere Enterprise	Hypervisor Resource Pooling VM Live Migration Storage Live Migration VM High Availability Hot Add and Removal of VM Resources VM Management	$2,875 per processor * this license limited to 256GB of physical server memory
VMware vSphere Enterprise Plus	Hypervisor Resource Pooling Distributed Networking VM Live Migration Storage Live Migration VM High Availability Hot Add and Removal of VM Resources 8-way SMP VM Management	$3,495 per processor

Based on this table, you can see that vSphere provides its maximum functionality only in its higher-end licenses. In addition, capabilities that are now considered essential to virtualization, like real-time migration and VM high availability, are not present in the Standard vSphere license.

Microsoft Hyper-V and System Center Functionality

Microsoft provides a virtualization solution that includes two hypervisors, and a comprehensive monitoring and management system. The free Hyper-V Server and the Hyper-V role in Windows Server 2008 R2 both offer reliable, scalable, cost-effective hypervisors that extend the capabilities of the enterprise IT environment to

include virtualization. Microsoft System Center is a suite of monitoring and management tools that provides comprehensive management and helps maximize datacenter efficiency, flexibility, and uptime.

Live migration, which allows real-time migration of VMs from one host to another, and VM high availability, is included with both Microsoft hypervisors. Both the free Hyper-V Server and the Hyper-V role in Windows Server 2008 R2 Enterprise or Datacenter editions support the real-time migration of running VMs from one host to another with no downtime for users. Both hypervisors use 64-bit code and support host memory configurations up to 1TB. The free Hyper-V server is not a functionality-reduced version of Hyper-V. Instead, it is a fully-featured version of Hyper-V that is managed remotely instead of using a local GUI for management.

Built-in virtualization

Windows Server 2008 R2 includes a hypervisor built directly into the operating system through the Hyper-V role. By avoiding a separate computing layer for the hypervisor, the number of layers and vendors involved in an IT infrastructure is minimized. For most enterprises, this avoids the unjustified cost and complexity of introducing a dedicated virtualization layer and vendor to the infrastructure.

Windows Hyper-V leverages existing knowledge and tools that are already familiar to most IT teams. In addition, Hyper-V Server and Windows Server 2008 R2 Hyper-V integrate seamlessly with Microsoft System Center.

Microsoft System Center

The Microsoft System Center suite includes System Center Virtual Machine Manager (VMM), System Center Operations Manager (Operations Manager), System Center Configuration Manager (SCCM) and System Center Data Protection Manager (DPM). This integrated suite of products can be licensed together as a single purchase using the Server Management Suite Enterprise or Datacenter licenses.

Virtualization tends to increase complexity in the IT environment, and greater complexity demands better and more comprehensive management tools. The System Center suite has visibility into all layers of the IT infrastructure from the physical and operating system through the hypervisor and application layers. This extensive visibility into all aspects of the virtualized environment illustrates causal relationships between infrastructure components and facilitates greater efficiency, flexibility, and uptime in the datacenter.

Microsoft VMM provides visibility into the hypervisor layer of the IT infrastructure so that other System Center components are fully virtualization-aware. In addition, VMM provides comprehensive VM management and deployment tools, as well as VM automation capabilities.

Microsoft VMM provides a centralized management platform for enterprise virtualization of both Microsoft virtualization products as well as VMware virtualization products. Many organizations are running both virtualization platforms, but before VMM 2008 they needed to manage each different product using separate and distinct management tools. VMM supports features like VMware’s VMotion technology to transfer VMs

between different ESX Servers with no downtime. VMM provides comprehensive virtualization management in a single tool. VMM also works with Operations Manager so that administrators can comprehensively manage both physical and virtual infrastructure.

Microsoft Operations Manager provides a sophisticated solution for unified health monitoring of both physical and virtual machines. Operations Manager provides an easy-to-use management environment that can oversee thousands of servers and applications, delivering a comprehensive view of the health of the datacenter. Operations Manager also comes with over 60 management packs, which extend management capabilities to the operating systems, applications, and other technology components that make up the datacenter. With these management packs, IT departments have access to best-practice knowledge about specific Microsoft products and can more easily discover, monitor, troubleshoot, report on, and resolve problems for a specific technology component.

Microsoft SCCM provides a comprehensive solution for change and configuration management. SCCM includes hardware and software inventory capabilities that help IT organizations identify hardware and software assets, gain insight into who is using those assets, and understand where the where they are located.

Microsoft DPM provides continuous data protection on physical and virtual machines for backup and business continuity. DPM helps companies plan a server upgrade with confidence by enabling IT departments to reliably back up existing data. DPM was specifically built to protect and recover Microsoft SQL Server, Exchange Server, Office SharePoint Server, Hyper-V, Active Directory directory services, and Windows file services. With a foundation built on Volume Shadow Copy Service, DPM provides ongoing protection of an organization's core server workload by backing up to disk or tape storage.

Microsoft Licensing

Microsoft licenses Windows Server 2008 R2 with Hyper-V on a per-server basis. Microsoft also licenses System Center products either individually or as a suite, also on a per-server basis. Except for Windows Server 2008 R2 Standard, all versions of Hyper-V and System Center suites contain the full complement of features available for each product.

License	Capabilities	Retail Price
Hyper-V Server	Hypervisor Live Migration VM High Availability Storage Live Migration Hot Add and Removal of VM Resources	$0 (available as a free download)
Windows Server 2008 R2 Datacenter with Hyper-V	Hypervisor Live Migration	$2,999 per processor

License	Capabilities	Retail Price
	VM High Availability Storage Live Migration Hot Add and Removal of VM Resources Cluster Shared Volumes	
VMM Workgroup Edition	VM Creation, Configuration, Management, and Self-Service Deployment Hypervisor Monitoring for Hyper-V and VMware	$757
Server Management Suite Datacenter	VM Creation, Configuration, Management, and Self-Service Deployment In-Guest Monitoring Physical Server and SAN Monitoring Operating System Monitoring for Clients and Servers Hypervisor Monitoring for Hyper-V and VMware Application Monitoring Image and Configuration Management for Physical and Virtual Machines VM Backup Application Backup	$744 per server with no per-server VM limit

Conclusion

As can be seen from the three comparison scenarios, both Microsoft and VMware provide hypervisor and management software. However, there are substantial functionality and price differences between these two solutions. In general, VMware approaches virtualization as a niche infrastructure addition while Microsoft approaches virtualization as an integrated infrastructure commodity. In addition, Microsoft System Center provides greater functionality than competing products like VMware vCenter.

How far will you take virtual?

By approaching virtualization as an integrated part of IT infrastructure, Microsoft's virtualization offerings are more easily managed. By approaching virtualization as a niche product that is added to an existing infrastructure, VMware makes it more difficult effectively integrate and manage virtualization.

While both Microsoft and VMware's pricing structure causes overall solution price to scale with the number of servers used, VMware's pricing structure simply charges more for less overall functionality. In most cases, the VMware solution costs between three to five times as much as the comparable Microsoft solution. With the greater functionality of System Center, including the only solution for in-guest management and automated VM optimization using in-guest knowledge, the Microsoft solution provides more value in scenarios from five servers all the way through to large enterprise deployments of 200 servers or more. This makes Microsoft the better value for organizations of any size.