



Server Virtualization

Ready to expand your commitment to virtualization? Here's what to look for in evaluating VMware, Microsoft and Citrix.

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Executive Summary

Server virtualization is one of the fastest-growing IT initiatives for midsize and large businesses. Within three years, more than 50 percent of all enterprise data center workloads will be virtualized, according to research firm Gartner Inc.¹

If your organization has moved slowly to a virtual server environment, or if you have merely tested the waters, you may be missing significant opportunities to reduce costs, consolidate space, cut energy consumption and improve your ability to manage and control critical IT resources. Even if your organization is deeply entrenched in its deployment of server virtualization, there is a strong likelihood that you will be expanding server virtualization initiatives to new applications and departments over the next few years.

The question for most IT organizations is not whether to deploy or expand server virtualization, but how to sort out the differences among the leading virtualization software platforms — from VMware, Microsoft and Citrix — so that you can pick the solution that best aligns with the specific needs and requirements of your business.

This report provides an overview of the server virtualization market and addresses the strengths of each of the leading players.

¹ Gartner Says 60 Percent of Virtualized Servers Will Be Less Secure Than the Physical Servers They Replace Through 2012, March 15, 2010

Overview

It is no surprise that server virtualization has emerged as a leading technology initiative for midsize and large enterprises over the past few years. IT organizations have not only been charged with the mission to “move at the speed of business,” but they have also been asked to accomplish more in an era of tighter budgets and far more limited resources. Under these pressures and constraints, virtualization has emerged as a solution to address a range of key challenges, such as server sprawl, increasing energy consumption, the need for more stringent disaster recovery as well as the need for IT to be more flexible, scalable and efficient. Server virtualization can enable IT to achieve server consolidation, boost application availability, increase system flexibility and simplify deployment of new technologies.

At its core, virtualization is the decoupling of operating systems, users and applications from the hardware resources that are used to perform basic computing tasks. With virtualization, a single physical server can provide the necessary physical resources (such as processors and memory) to run multiple isolated operating systems. Since each physical server is utilized more efficiently, fewer servers are required. This helps reduce energy consumption and costs, and enables simpler system upgrades and rollouts of new hardware and applications across the enterprise. IT now operates more efficiently, with greater centralized control, and business value is enhanced as the result of a more scalable, flexible and cost-efficient IT infrastructure.

While the underlying concepts of virtualization have been around since the mid-1960s, the roots of the current boom

10 Steps to Cost-Effective Server Virtualization

Virtualization holds the promise of improved ROI, reduced costs, reduced energy consumption and far greater utilization of valuable IT resources. To realize that promise, however, you need to make sure you understand where and why you are turning to virtualization and what benefits you expect to yield for your organization. CDW offers a 10-point checklist to help you make sure you are asking the right questions and planning properly for a successful virtualization deployment, no matter which vendor you choose.

1. **Assess Your Server Environment.** Use advanced tools to help identify which servers would make good virtualization candidates.
2. **Finalize Candidates for Virtualization.** Before deciding which servers to virtualize, you need to understand each software vendor’s support policies.
3. **Determine the Virtualization Platform.** Once you’ve identified the features, functionality and caveats of each hypervisor, you can make an informed decision about which one will best meet your specific business needs.
4. **Determine the Server Platform.** Determine if server reuse is an option for your business and make sure you analyze warranty expirations and renewal costs.
5. **Determine the Storage Hardware Platform.** Centralized storage is a key consideration, particularly for features such as live migration.
6. **Revisit Backup/Restore Architecture.** If you are tied to a long-term maintenance contract, you may want to finish it out before changing your backup architecture, but eventually you want an architecture optimized for a virtualized infrastructure.
7. **Understand Your Operating System Licensing.** If you plan on running many Windows Server instances, you should consider licensing each host processor with Windows Server 2008 Data Center Edition. This enables unlimited Windows Server instances with no additional charge as well as dynamic movement of instances from host to host.
8. **Plan the Project.** Assign a project manager to ensure a successful virtualization implementation. Build a project plan and make sure you have a conversion time line.
9. **Educate and Implement.** You need to educate your implementation team. The virtualization platform should be rolled out simultaneously with the server and storage hardware.
10. **Leverage Physical-to-Virtual (P2V) Conversion to the Greatest Possible Degree.** To realize the greatest cost savings and ROI, you want to eliminate as many physical servers as possible through virtualization. With fewer physical servers, you have less heat dissipation, and you may want to also reassess your data center cooling distribution.

in server virtualization can be traced back to 2001, when VMware introduced the first virtualization software for the Intel x86 platform. Since that debut, the worldwide market for server virtualization has topped more than \$2.7 billion, according to Gartner,² and overall virtualized end-user spending reached more than \$15 billion in 2009, according to IDC.³ A study by CDW earlier this year indicated that more than 90 percent of companies with more than 100 employees have implemented server virtualization at some level.⁴ Tellingly, in the CDW survey, more than 95 percent of the businesses that have implemented virtualization believe they are saving significant money as a result and almost as many are measuring their success in terms of IT productivity, business agility and reductions in IT energy consumption.

Vendor Overview

Which vendor or vendors you choose for your virtualization projects will depend upon a number of factors. The research shows that 90 percent of medium and large businesses have implemented some level of virtualization. This means that many companies already have some degree of experience with one or more of the leading virtualization vendors. The research also shows that only 18 percent of server workloads are virtualized today, which means there are plenty of important decisions to be made about expanding the use of virtualization throughout the enterprise. While this article is focused primarily on the three leading virtualization vendors, it is important to note that a successful server virtualization deployment must also be based on crucial decisions about server hardware, network hardware and storage. If you don't have shared storage today, you won't be able to realize the most significant business benefits from your server virtualization deployment, including live migration of running applications from one virtual host to another, avoiding costly downtime.

As is often the case with significant IT investments, it is critical to start out with an assessment of your current environment and identify your goals with virtualization: Are you looking at virtualization as an enterprisewide initiative, or is it just for specific applications or departments? Are there certain departments or applications for which you would absolutely rule out virtualization? What is the expertise of your IT staff in rolling out, supporting and managing virtualized environments? What is the state of your IT budget? And how will you measure the success of your virtualization initiatives?

Answering each of these critical questions with an honest, straightforward assessment will go a long way toward helping you determine where to use virtualization, which virtualization

vendor to select and what to expect in determining how the next stages of virtualization will impact your organization in both the short and long term. It is important to be working with a team of experts when conducting this assessment and rolling out your plan. It is equally critical that the partner you choose is not tied in to one specific vendor. There are differences in features, functionality and pricing among the leading virtualization vendors, and it is necessary to have a team that has experience with all three virtualization vendors and can clearly identify all of the options for you.

One additional key point: The server virtualization market has developed into a hotly contested arena among the three leading players discussed in this report. As the pioneering vendor in this market, VMware has been the historical market leader with a market share anywhere from 70 to 80 percent, depending upon which organization is doing the tracking. Microsoft, however, has clearly decided that server virtualization is a strategic market in which it must gain market share: Whenever Microsoft includes software as part of its base operating system — as Microsoft has done by including Hyper-V within Windows Server 2008 R2 — then you know it is serious. Citrix, with its approach of building an open software platform, is not to be easily dismissed, as it has developed strategic partnerships with most of the leading hardware players as well as with Microsoft to compete with VMware's dominant position.

All of this is to say that in a market as highly competitive as server virtualization, leading vendors are constantly improving their products and providing new feature sets and approaches to licensing. For example, VMware's vSphere 4.1 has memory management features and control functions for managing storage and networks. Microsoft is quickly addressing perceived holes in its product line, introducing Live Migration in 2009 and Dynamic Memory with the latest release of the Microsoft Server 2008 R2 SP1 Beta. Citrix and Microsoft have teamed up with a series of announcements targeted to position the combination of Hyper-V with Citrix virtual desktop solutions as a clear alternative to VMware. In addition, Citrix supports Microsoft's server virtualization platform with products such as Citrix Essentials for Hyper-V, which offers advanced virtualization management capabilities for Windows Server 2008 Hyper-V.

Therefore, as we look at the virtualization vendors and each of their strengths, it is important to keep in mind that this market is increasingly dynamic, which is all the more reason to be working with a well-informed partner that has access to the latest information about changes in features, functionality and

²Gartner Says Worldwide Virtualization Software Revenue to Increase 43 Percent in 2009, Feb. 12, 2009

³Virtualization Market Accelerates Out of the Recession as Users Adopt "Virtualization First" Mentality, According to IDC, April 28, 2010

⁴CDW Study Finds Server Virtualization Market Maturing, With Pent-up Potential for Further Growth, January 2010

pricing from all three of the leading virtualization vendors. There are a number of ways to evaluate each option, and there are many websites that feature head-to-head comparisons, including sites produced by the vendors themselves. For an independent look, we are using some of the criteria established by an independent research firm, the Burton Group, which worked with Global 1000 organizations to determine which features and functions were most important to them.⁵ Among the key features are:

- High Availability
- Licensing and Support
- Live Migration
- Memory Management
- Networking
- Power Management
- Storage
- Security
- Virtualized Environment Management

As we go through the approaches of the vendors, be aware that some of the features we discuss are not available on each version of each product, so it makes sense to determine which of these features is most important and work with an expert partner to conduct a deeper evaluation.

VMware

VMware enjoys many of the advantages of having pioneered the market and owning a dominant market share. For years, it was virtually the only game in town and thus benefits from the support of the broadest range of third-party software programs and systems for functions such as disaster recovery, lifecycle management and capacity planning. VMware also has the benefit of being generally regarded as the technology leader and pacesetter. In having the largest installed base, it has an inherent advantage of already being in place when companies are looking to expand their use of virtualization: VMware, in its 2010 corporate brochure, says its solutions are used by more than 97 percent of Fortune 1000 companies and 94 percent of Global 500 companies.

Key Products

Most of the industry refers to VMware's hypervisor as ESX or ESXi, although it is now officially called the vSphere Hypervisor. It is offered in a free version, which is not optimal for production operations but allows potential customers to test the

functionality. VMware Server is another free product that is basically a hosted virtualization platform that can be on any existing server hardware and partitions a physical server into multiple virtual machines. It is available primarily for customers assessing virtualization for the first time or for testing or evaluating software. VMware's main virtualization product is VMware vSphere, which is available in a variety of editions, depending upon your needs, and there are kits for small businesses as well as packages for midsize and large enterprises. Plus, vSphere 4.1 includes advanced features for memory management, high availability and active directory integration.

Key Features

High Availability: VMware offers a number of features and tools for high availability, including automatic detection of server failures; automatic detection of operating system failures; smart failover of virtual machines to servers with the best available resources; scalable high availability across multiple physical servers; and proactive monitoring with resource and health checks. vSphere 4.1 includes memory compression plus a feature called Storage and Network I/O control. With these features, administrators can set QoS priorities for guest machines for their network or storage I/O.

vMotion: vMotion enables IT to move running virtual machines from one physical machine to another without any impact to users. According to VMware, vMotion is used in production by 70 percent of VMware customers and enables administrators to perform live migrations with zero downtime, undetectable to the user; continuously and automatically optimize virtual machines within resource pools; perform hardware maintenance without scheduling downtime; and proactively move virtual machines away from failing or underperforming servers. vMotion enables up to eight vMotion operations in parallel.

vCenter Server: The vCenter Server centralized management platform enables functions such as rapid provisioning, performance monitoring, operational automation, secure access control and resource optimization. With vSphere 4.1, there is functionality for deployment of third-party patches, preflight checklists and advanced handling of recalled patches. vCenter enables IT to manage more than 1,000 hosts and 10,000 virtual machines from a single console.

Microsoft

Customers that are new to virtualization and coming from Windows environments tend to view Hyper-V as a natural virtualization platform. Microsoft benefits from its ability to deliver familiar administrative tools and setup options. As a

⁵ Server Virtualization Hypervisors, Burton Group, April 2009

company coming in against an established market leader, Microsoft has taken an aggressive pricing approach by simply making Hyper-V R2 an available option within the setup of Windows Server 2008 R2. Since Windows Server virtual rights licensing is the same across any vendor's hypervisor, this results in Hyper-V being a generally less expensive solution to implement than VMware, at least for the up-front initial investment. However, the Microsoft solution includes more than just the integrated features in Windows Server. Management tools, which are branded under Microsoft System Center, provide management at all four layers of the IT infrastructure, from the physical hardware all the way to the application and services inside the virtual environments, in any easy-to-license suite. This provides a cost-effective way to build a virtual environment without losing control and insight. There is definitely an advantage for some customers in purchasing solutions from a single vendor. For example, as part of Windows Server 2008 R2, Hyper-V R2 offers the same driver support for attached devices.

Key Products

Microsoft's hypervisor, Hyper-V, is part of the Windows Server 2008 R2 operating system and is available for free if you license the operating system. A stand-alone version, Hyper-V Server 2008 R2, is also available for free. For the first time in a Microsoft virtualization solution, Hyper-V R2 includes live migration and shared VM storage. The Enterprise and Datacenter editions of Windows Server 2008 R2 provide advanced features and functionalities for Hyper-V virtualization beyond the Standard edition. These include increased memory support, application failover, host clustering and dynamic data center. There are also different virtualization licensing benefits associated with the Enterprise and Datacenter editions, which is an area where an expert partner can provide guidance as to the overall costs and ROI of your Microsoft virtualization deployment.

Key Features

High Availability: High availability for Hyper-V is achieved through the use of the Windows Server 2008 R2 Failover Cluster feature. Virtual machines managed by the Failover Cluster can be configured for high availability. If there is a failure in the physical Hyper-V host or the VM guest, the other nodes of the Windows Failover Cluster detect that the cluster member is no longer responding and bring the VM online on a surviving cluster node. Multipath (MPIO) is supported for iSCSI and FC storage connections as well as re-routable storage access through cluster communications in the event of total loss of storage connectivity by a cluster node.

Live Migration: Live migration allows IT to transparently move running virtual machines from one node of the failover cluster to another node in the same cluster without a dropped network connection or any perceived downtime. It can handle multiple simultaneous VM migrations depending on the size of the Hyper-V cluster. The Intelligent Placement feature allows the cluster to automatically determine the best node for an administrator to move a running VM to. Live migration enables the administrator to perform hardware maintenance without scheduling downtime.

System Center Virtual Machine Manager: Virtual Machine Manager is Microsoft's product for centralized virtualization management of a Microsoft virtualization environment as well as a VMware environment managed by Virtual Center. It enables rapid provisioning, operational automation and dynamic resource optimization across multiple platforms while integrating to Active Directory Domain Services for secure access control. Performance and Resource Optimization (PRO) supports the dynamic management of virtual resources across Hyper-V cluster nodes. Virtual Machine Manager also enables P2V migrations to Hyper-V and is capable of V2V migrations of VMware Virtual Machines through its ability to manage VMware vSphere resources. In addition, IT organizations and service providers can enable private cloud functionality via a powerful self-service portal.

System Center Operations Manager: Through the Systems Center Operations Manager (SCOM), Microsoft enables full monitoring of the virtualization environment as well as the physical hosts, storage environments, the Virtual Machine Operating Systems and applications inside of the virtual machines. This is all available through a single console that seamlessly integrates with the Virtual Machine Manager Service.

Citrix

Citrix benefits by having a solution that comes from the open-source world. Its Xen hypervisor has an active community of software developers, ensuring many options, particularly those that organizations can build into their own virtualization solutions. Like Microsoft, Citrix positions itself as a far-less-costly alternative to VMware. XenServer 5.6 provides customers with the most robust and competitive free virtualization suite, compared with free products offered by VMware and Microsoft. Another advantage for Citrix is its strong position in the desktop virtualization market: Some customers will prefer using the same vendor for both server and client virtualization.

Key Products

Citrix XenServer is a free virtualization platform based on the open-source Xen hypervisor. It includes a multiserver management console, according to Citrix, with core management features such as multiserver management, virtual machine templates, snapshots, shared storage support, resource pools and live migration. In addition, Citrix offers advanced management capabilities in Citrix Essentials for the XenServer product line. Customers can obtain XenServer for free, although they do need a license, and with the free version, they get access to features such as live migration, centralized management, VM template functionality and infrastructure update management as well as physical-server-to-virtual-machine conversions. Additional features are available for a fee in the Advanced, Enterprise and Platinum editions of XenServer.

Key Features

High Availability: XenServer automatically restarts virtual machines if a failure occurs at the virtual machine, hypervisor or server level. The auto-restart capability allows administrators to protect all virtualized applications. Workload balancing is a feature of XenServer that captures data such as CPU, memory, disk I/O and network I/O on the hosts and virtual machines to guide the initial and ongoing host location for virtual machines. There are two optimization modes for workload balancing in XenServer: One is for optimizing performance, the other for optimizing density.

XenMotion: With XenMotion, Citrix's product for live migration, virtual machines can be moved from server to server without service interruptions. With dynamic provisioning, XenServer enables the streaming of workloads from the network to both physical and virtual servers. Another new feature is Host Power Management, which consolidates virtual machines onto fewer hosts in off hours and reactivates them when needed.

XenCenter: XenCenter is Citrix's product for centralized virtualization management. The XenCenter management console distributes management data across servers in a resource pool to ensure there is no single point of management failure. If a management server fails, any other server in the pool can take over the management role. Performance monitoring, reporting and alerting dashboards enable administrators to see both real-time and historical views of virtual machines and physical host performance.

Licensing and Support

Server virtualization, as noted, is one of the most competitive markets in all of IT, and there has been a lot of shifting by the vendors in their pricing and licensing strategies. This is where having an expert partner can be extremely helpful, not just in understanding which edition of which software makes sense for you, but also in understanding how the licensing fees will impact your initial investment as well as your total cost of ownership. It's also important to understand the details of your operating system licenses and license fees for applications that will be virtualized, because hidden costs could affect your initial analysis as well as your projected return on investment.

CDW's Approach to Server Virtualization

CDW helps organizations reduce the cost and complexity of their computing infrastructure so financial resources are freed up for more strategic initiatives. One of the ways in which CDW accomplishes this is by constantly leveraging virtualization and optimization technology and techniques. CDW's experienced team has conducted more than 1,000 assessments and has had more than 500 onsite implementation engagements. CDW offers comprehensive support services and works with clients through the entire client virtualization process, from assessment and planning through implementation and beyond. CDW's approach includes:

- An initial discovery session to understand your goals, requirements and budget
- An assessment review of your existing environment and definition of project requirements
- Detailed vendor evaluations, recommendations, future environment design and proof of concept
- Assessments, analysis and reviews of licensing agreements, in which CDW licensing experts help customers properly license systems and applications software in the virtualized environments
- Procurement, configuration and deployment of the final solution

CDW works to provide you with the best information and assistance available as you go through the process of selecting the right virtualization solution. At CDW, we don't believe in one-size-fits-all. We'll help you tailor an end-to-end solution that meets the specific needs of your business.

Studies: With Virtualization Spending on the Rise, IT Managers Are Evaluating Alternative Platforms

IT managers that have either deployed or are evaluating virtualization solutions are open to looking at alternative platforms, according to a 2009 TechTarget survey of 666 IT professionals. Among the respondents, 56.3 percent said they were planning to evaluate an alternative platform. Among these decision-makers, VMware and Microsoft were the dominant platforms under consideration: About a quarter of the respondents said they were looking at the latest version of VMware and 17.4 percent said they were considering Microsoft Hyper-V.

Among those looking at alternatives to VMware, 55.7 percent cited costs as their primary reason for evaluating another platform. Another 31 percent said it would be to extend their feature set, and 27.6 percent said it would be to avoid vendor lock-in. Respondents seeking alternatives to Hyper-V cited similar concerns: 49 percent cited costs, 26.5 percent mentioned vendor lock-in and 32.7 percent said they would like to extend the feature set.⁶

If you are thinking about having more than one hypervisor, you will be in a distinct minority. More than 55 percent of respondents said they would standardize on a single hypervisor if possible, while only 1.9 percent said they would insist on multiple platforms for sourcing reasons. Among server virtualization challenges, IT professionals cited I/O bottlenecks, backing up virtual machines and managing storage as their top concerns. These findings were pretty consistent between VMware and Microsoft users.

Another survey by TechTarget shows that nearly 60 percent of data centers will expand their virtualization deployments in 2010. The survey, the 2010 Data Center Purchasing Survey Report, indicates that 42 percent of IT professionals said enhancing virtualization capabilities will be the primary impetus for new server purchases this year.⁷

⁶Virtualization Decisions 2009 Purchasing Intentions Survey, September 2009

⁷The 2010 Data Center Purchasing Survey Report, July 2010

About CDW

CDW is a leading provider of technology solutions for business, government, healthcare and education. Ranked No. 41 on *Forbes'* list of America's Largest Private Companies, CDW features dedicated account managers who help customers choose the right technology products and services to meet their needs. The company's technology specialists offer expertise in designing customized solutions, while its technology engineers and solution architects can assist customers with the implementation and long-term management of those solutions. Areas of focus include notebooks, desktops, printers, servers and storage, unified communications, security, wireless, power and cooling, networking, software licensing and mobility solutions.

CDW was founded in 1984 and as of March 31, 2010, employed approximately 6,150 coworkers. In the 12 months trailing March 31, 2010, the company generated sales of \$7.6 billion. Intently focused on responding to customers' technology needs with a sense of urgency, CDW helps customers achieve their goals by providing the right technology products and services they need — when they need them.