people ready

Virtualization of Microsoft® SharePoint® Products and Technologies

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For the latest information about Microsoft Office, see http://www.microsoft.com/office and for SharePoint, see http://www.microsoft.com/sharepoint.

Abstract

Multiple organizations have discovered that SharePoint Products and Technologies provide for significant productivity enhancements, allowing knowledge workers to be more efficient in creating and organizing content. In response, many information technology (IT) departments are being tasked with building and managing scalable SharePoint farms to provide for the infrastructure to support the collaboration and Microsoft Enterprise Content Management support that the technology provides. The SharePoint architect is subsequently tasked with creating a deployment model that is reliable and scalable, but without introducing unnecessary costs or over architecting an environment.

The development of virtualization technologies provided with Microsoft Windows Server® 2008 Hyper-V™ has provided SharePoint architects with a flexible toolset that can be used to reduce hardware and energy costs, increase the performance of a SharePoint farm, and provide for design flexibility that would not have been possible with traditional physical deployment approaches. In addition, the introduction of capable tools such as Microsoft System Center Virtual Machine Manager (VMM) 2008, part of the System Center Server Management Suite, provides SharePoint administrators with the ability to manage multiple virtual hosts, quickly provision SharePoint servers and farms, migrate physical servers to virtual ones, and other key virtualization management enhancements.

This paper is written for SharePoint architects who are considering the use of virtualization technologies and management as part of their SharePoint farm design. Topics include Microsoft Windows SharePoint Services (WSS) 3.0, Microsoft Office SharePoint Server (MOSS) 2007, Windows Server 2008 Hyper-V Virtualization, and VMM 2008. Specific focus is placed on determining which components of a SharePoint farm could be virtualized and examining sample real-world SharePoint virtualization models.

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Microsoft

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Why Virtualize?

Traditional application architecture models focused on defining how many servers would be required to deploy a specific technology. Depending on availability and redundancy requirements, number of users, and other factors, occasionally, multiple servers would be required, even if they were not heavily utilized. This is often the case for SharePoint Products and Technologies as well, as many deployment models provided for multiple redundant Web front-ends, dedicated index and/or application servers, 'warm' stand-by servers, and additional farms for test and development environments. This could quickly lead to a proliferation of SharePoint servers in an organization, many of which would go unutilized or underutilized for long periods of time.

Virtualization provides for the ability to consolidate multiple virtual guests within a single physical server, sharing the physical resources across the virtual machines. For SharePoint administrators, virtualization also allows for the flexibility to quickly provision new farm members to handle specific functions or to provide for redundancy of a specific server role—a key design advantage over physical server models.

Benefits of Virtualization in a SharePoint Environment

Reduced hardware costs Virtualization allows organizations to reduce overall physical SharePoint server count. Virtual machine isolation and resource management enable more workloads to coexist on fewer servers, which results in more efficient use of hardware resources and reduces demand overall. This can help save money on hardware, particularly in many organizations where the need for multiple SharePoint farms for production, failover, testing, and development exists.

Increased server utilization An optimized infrastructure is becoming imperative as servers sprawl and data centers reach their capacity for power and space. The problem is aggravated for companies whose servers run at very low utilization. Server utilization rates for many customers fall into the 10 to 15 percent range. This is often the case for SharePoint servers in particular, as many farms and servers

> ## Virtualization Efficiencies
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> By some estimates, up to 70 percent of processor and memory deployed on physical hardware goes unutilized. Virtualization allows for a much larger percentage of available resources to be more effectively utilized.

are provisioned not for performance, but for availability, testing, and redundancy reasons.

Reduced facility costs and lessened environmental impact By reducing server count, virtualization solutions also provide the associated benefits of lowering fixed costs including reduced power consumption, reduced cooling costs, and reduced space requirements. In turn, this reduces the overall environmental impact the server farm creates.

Improved service levels from IT organizations Virtualization solutions enable organizations to rapidly deploy new servers and operating environments. Many of the problems associated with the traditional marriage of one server to one operating system are eliminated with

virtualization, which allows IT staff to quickly deploy multiple operating systems and applications to fewer servers. It also allows them to delegate server provisioning to designated non-IT users for specific tasks. IT staff can then focus on higher-value, strategic activities rather than procuring, racking, and stacking hardware.

Extend useful life of legacy systems Virtualization technology can be used to consolidate multiple physical servers onto a single server. Virtualization can also be used to re-host legacy SharePoint physical farms, especially as older generation hardware becomes more difficult and costly to maintain.

Management of Virtual Environments

Streamlined manageability and security Virtualization enables IT organizations to enhance their administrative productivity and rapidly deploy new servers to address changing business needs. Easy integration into existing server management tools, such as those in the System Center suite of products, facilitates integrated management of Windows-based virtual machines. The ability to consolidate workloads in a hardware agnostic environment and an integrated physical and virtual IT management framework enables administrators to lower operational costs and create more agile infrastructures.

Improved manageability features include reducing downtime entailed in operating system and application patching in that virtual machines can be tested, updated offline, and then copied when ready. Improved security features include the ability to isolate and sandbox a suspect environment using virtualization technologies.

Improved development, testing, staging, and production software development lifecycle It is easier to replicate/simulate a virtual production environment over a physical production environment. It is also less expensive to provide a virtual development through

P2V and V2V with VMM

The Physical to Virtual (P2V) and Virtual to Virtual (V2V) capabilities of System Center VMM allow for administrators to make exact copies of running servers. They do this by integrating with the Volume Shadow Copy Service (VSS) to allow the server to continue to run while the virtual copy is created.

staging environments than to provide physical environments for each of these environments. In addition, a virtualized SharePoint farm allows developers to use consistent and well-maintained developer images.

Dynamic Data Center Batch jobs using Microsoft Windows Powershell and scripting and scheduling technologies can easily start or stop workloads. It is simple to "pause" activities on a server, transfer server files, and then resume work on another server using the virtualization product features. This allows organizations to quickly scale up a SharePoint farm by dynamically assigning additional front-ends to the workload and removing them when they are no longer required.

Simplify disaster recovery planning Windows Server 2008 Hyper-V can be used as part of a disaster recovery plan that requires application portability and flexibility across hardware platforms. In addition, using a Virtualized Recovery farm for System Center Data Protection Manager (DPM) 2007 restores can improve the flexibility of working with that particular tool for disaster recovery.

Overview of SharePoint and Virtualization Components

SharePoint Products and Technologies

Microsoft Office SharePoint Products and Technologies are a set of tools that provide for robust collaboration, document management, Web content management, and enterprise search. SharePoint tools allow organizations to easily share knowledge and valuable content on an extensible, scalable enterprise platform. The latest release of SharePoint Products and Technologies includes WSS 3.0, freely available with a license of Windows Server, and MOSS 2007, a full function Enterprise Content Management and Collaboration tool. For more information about Microsoft's SharePoint Products and Technologies, see Microsoft's SharePoint home page at http://www.microsoft.com/sharepoint.

Both WSS 3.0 and MOSS 2007 are installed on one or many Windows servers, depending on the scope and scale of the deployment. Virtualization of these servers may often be ideal, depending on the specific scenario. This paper subsequently covers both products as it relates to virtualization of their roles.

Microsoft Virtualization Core Products

Windows Server 2008 Hyper-V

The latest release of Microsoft's server virtualization product is Windows Server 2008 Hyper-V, which is a hypervisor-based virtualization technology for 64-bit versions of Windows Server 2008. Windows Server 2008 Hyper-V is a new role in Windows Server 2008 that allows you to create and manage a virtualized server environment. Hyper-V provides an ideal environment for SharePoint servers as it runs as a bare metal hypervisor that works between the physical hardware and the operating systems in each virtual environment. This greatly improves performance and security of the virtual sessions over competing solutions and previous versions of Microsoft Virtualization software.

Note The release version of Windows Server 2008 contained a beta version of Hyper-V virtualization software. Before using Hyper-V in production, the Virtual Server host(s) needs to be updated to the release version of Hyper-V referenced in the Microsoft Knowledge Base article 950050 at http://support.microsoft.com/kb/950050.

Legacy Virtualization Products

While SharePoint Products and Solutions are supported for virtualization using the older Microsoft Virtual Server 2005 R2 product, for performance and 64-bit guest support reasons, it is recommended to use Hyper-V for virtualization, when possible. SharePoint Products and Technologies are not supported for production use when virtualized using Microsoft Virtual PC or other versions of Microsoft Virtualization products.

Third-Party Virtualization Products

Microsoft provides for limited support of their products when virtualized with third-party virtualization products. For more information about the policy, see the Knowledge Base article 897615 at http://support.microsoft.com/kb/897615.

Virtualization of SharePoint Components

Windows Server 2008 Hyper-V virtualization provides a great deal of design flexibility for SharePoint architects. Each server role operates in a different way, and each has different memory and disk requirements, so it is important to understand in which scenarios the most benefits can be obtained from virtualizing SharePoint servers and in which scenarios it may not be ideal.

Virtualization of SharePoint Roles

Building a scalable SharePoint farm required a good understanding of the individual server roles that make up a SharePoint farm, and which scenarios those roles would be installed on multiple servers. Each SharePoint role has a different impact on server performance, and some have higher disk I/O requirements than others, which can affect virtualization performance. It is subsequently important to review the different memory, processor, and disk requirements of each role and determine if virtualization is the right strategy for deployment of an individual server.

It is important to note that not all SharePoint servers may be perfect candidates for virtualization. While it is true that any SharePoint role is fully supported with Windows Server 2008 Hyper-V virtualization, some servers with very high memory requirements may not be able to take advantage of some key virtualization benefits, while other servers with high disk I/O activity may not perform at ideal levels when virtualized. This makes it even more critical to identify what type of deployment exists and how heavily utilized a SharePoint farm will be before making the decision to virtualize an individual role.

Virtualization of the SharePoint Web Role

The SharePoint Web role, responsible for the rendering of content, is the most ideal virtualization candidate in a SharePoint farm. Each front-end has comparatively lower memory requirements and there is generally a lower amount of disk activity that occurs on Web front-ends than on some of the other roles. Subsequently, many organizations are finding it highly useful to virtualize Web role servers in farms of many sizes and configurations.

> ## Virtualized Web Role Servers
>
> The Web role is the most commonly virtualized role in a SharePoint farm, by nature of its smaller memory and disk requirements, and by the ease in which a new Web front-end can be added into an existing farm.

Multiple Web front-end servers in a farm can be load-balanced, either with built-in Windows Network Load Balancing or by using a hardware-based load balancer. Because of this fact, multiple Web front-ends can easily be provisioned into a SharePoint environment and added into a load-

balanced pool. This provides for both high availability in the event of a failure of an individual server, but also provides for distribution of the load across the Web front-ends. Virtualization adds another layer to this as SharePoint architects are no longer limited to individual physical boxes, but can instead be distributed across multiple virtual guests. In the event that the load increases in a SharePoint farm, additional Web role servers can be quickly provisioned to distribute the load.

For example, where previous physical architecture would dictate two or more physical servers with a large amount of memory and processor capabilities, current flexibility with virtualization technologies allows for a larger number of virtual servers that use less memory and processor than their physical counterparts. Indeed, recent testing performed by Microsoft found that throughput on virtual Web roles with 8GB of RAM allocated to them performed only 7.2 percent less than a physical Web role server with 32GB of RAM allocated to it. In the same testing, page response time was only 4.4 percent slower on the Hyper-V Web front-end than the physical server. This type of testing illustrates how virtualizing the Web role has little impact on overall performance compared to physical Web role servers.

Virtualization of the SharePoint Query Role

The query role, responsible for searches performed by users, is another possible candidate for virtualization, as long as SharePoint architects consider a few key factors. First and foremost, each query server in a farm must have a propagated copy of the index stored on a local drive. Depending on the amount of data that is being indexed, both within and outside SharePoint, the index size can be quite large.

> ## Query Propagation
>
> If the query role resides on the same server as the index role, there cannot be any additional query servers in the farm, as SharePoint will not propagate the index. For virtualized environments, this can mean fewer disk requirements for the index corpus.

The index corpus can vary in size from 10 to 30 percent of the total size of the documents being indexed, so SharePoint architects will need to take this into account when designing a virtual server solution. For large indexes, it is generally recommended that each index server use a physical disk volume that is dedicated to the individual query server, rather than a virtual disk (VHD) file. Hyper-V fully supports this scenario, and it provides for faster disk performance than a VHD file.

SharePoint architects often combine the Web and the query role onto the same servers, and this model is also supported in a virtualization environment, as long as the propagated index considerations listed previously are taken into account. Because of the ease of provisioning new servers, and the ability to deploy multiple servers on a small number of physical hosts, many SharePoint architects find it advantageous to break the query role from the Web role and virtualize them as separate sessions. For example, a pair of Web/query servers in a physical farm could instead become four separate servers—two Web and two query. The key is that Hyper-V provides for this type of flexibility, and if the query role performance suffers in the future, the SharePoint architect can always break the role onto a separate server in the future, if needed.

Virtualization of the SharePoint Index Role

The index server role in a SharePoint farm is often the most memory-intensive role, making it a less ideal candidate for virtualization. This by no means rules it out as a candidate to be virtualized. It simply reduces the advantages that can be gained by virtualizing the server, as more of the host's resources will need to be dedicated to the task.

As with the query role, the index role requires enough drive space to store the index corpus. Depending on the size of documents being indexed, this could be a volume of significant size. If large enough and for performance reasons, it is often best to attach directly to a physical volume connected to the host server, rather than to a VHD virtual disk file.

If the environment is small, if it is a test or development environment, or if it does not crawl significant amounts of content, it is perfectly viable to use virtual disk files for the index role. For very large production SharePoint farms or for farms that are crawling a significant amount of content, the memory requirements and disk I/O activity may prompt SharePoint architects to install the index role on a physical server. SharePoint architects can start an environment with a physical server and then virtualize at a later time using Physical to Virtual (P2V) tools that are part of VMM. (See the section **System Center Virtual Machine Manager 2008**.)

> ## Crawling Recommendation
>
> It can be advantageous to have the index server be the dedicated crawl server for a farm, as it eliminates the extra hop required to crawl content in a traditional scenario when other Web servers are used. To do this, the Web role must be added to the server, and the farm must be configured to use a dedicated server.

Virtualization of Application Roles

The application roles of Excel® Services and InfoPath® Forms Services are sometimes installed on dedicated servers, depending on their usage. These roles are similar to the Web server role in that they also can be easily virtualized in many environments. As the resource requirements of the individual application increase, additional servers to assist with the application can simply be added to the farm. Indeed, the flexibility of the virtualization model makes it easier for SharePoint architects to simply break out the application roles onto their own dedicated servers without having to invest in additional hardware.

Virtualization of the SharePoint Database Role

The least common role that is virtualized in production scenarios is the SharePoint database role, mainly because this role

> ## SQL Alias Flexibility
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> When provisioning a new SharePoint farm, it is highly recommended to use an alias to connect to the Microsoft SQL Server®, as this provides for greater flexibility to move the SharePoint databases to a new server. For example, if starting with a smaller, virtual SQL database server and then scaling out to a larger physical cluster in the future, the migration process can be simplified by using an alias during the installation.

has the highest amount of disk I/O activity and can often have very high memory and processor requirements. This rule of thumb generally only applies to production SQL databases, however, and it is very common to see the SQL Server virtualized in test farms, quality assurance (QA) farms, demilitarized zone (DMZ) farms, or smaller SharePoint environments. The litmus test for whether to virtualize SQL Servers is whether a high level of usage is expected from the server itself. Gathering performance metrics using a tool such as System Center Operations Manager 2007 can be a useful way to determine the disk I/O requirements of an existing farm if determining whether or not to virtualize that environment.

Common deployment scenarios for the SQL role in a SharePoint farm may have multiple farms, both physical and virtual, use a single database server or database cluster, further increasing the amount of resources consumed by the role. For example, in Figure 1, the sample SharePoint environment illustrated maintains a two-server SQL cluster that is used by several virtual farms and one production farm.
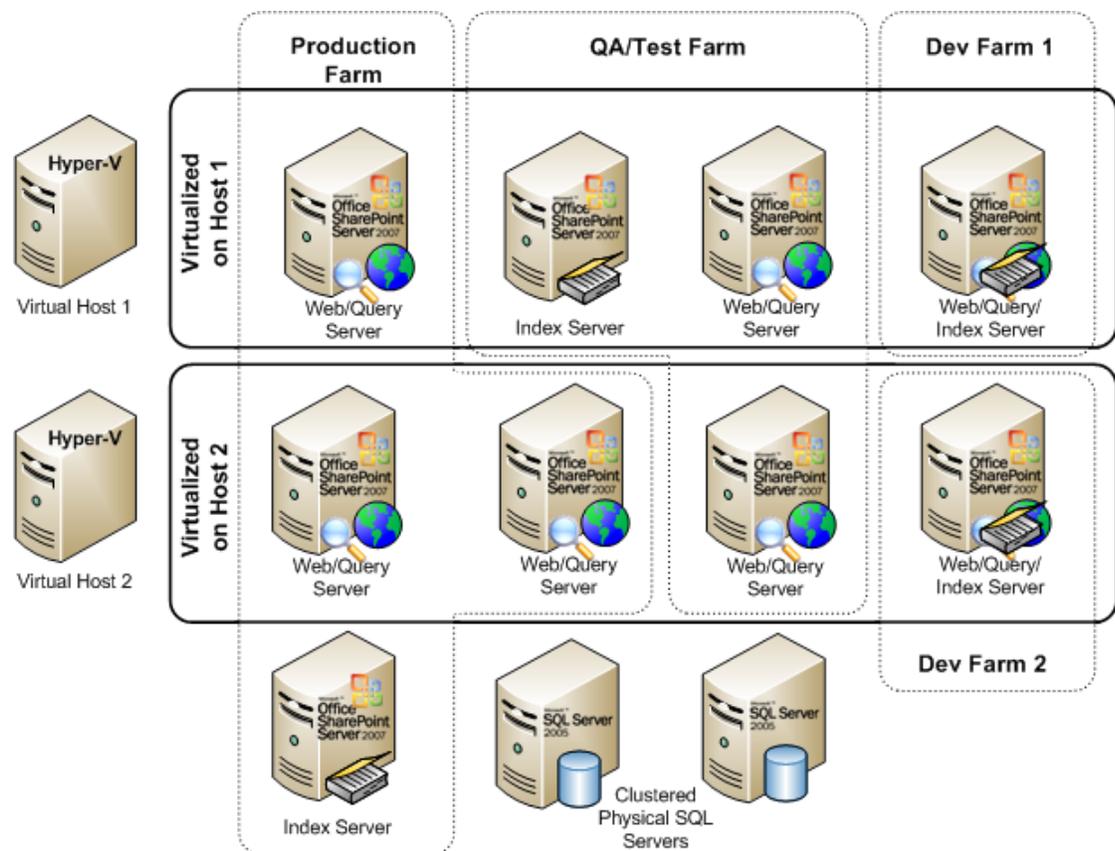
Figure 1: Sample Multi-Farm Physical and Virtual SharePoint Architecture

In Figure 1, the organization chose to virtualize three front-ends as part of their production farm, but to maintain a dedicated physical index server. They then chose to virtualize the rest of the farms, including QA and two Development farms, and to host all of the databases from each of the farms on a physical set of SQL Servers.

Virtualization of the SQL database role, whether using SQL Server 2005 or SQL Server 2008, is fully supported for a SharePoint farm. With this in mind, a SharePoint architect can examine whether it makes sense to virtualize a SQL environment for SharePoint or whether it is more

logical to choose the more traditional physical server model for the SQL farm that a production SharePoint environment will use.

Understanding Virtualization Scenarios

There are many common scenarios where SharePoint infrastructure can be effectively virtualized on Hyper-V hosts. In addition to production scenarios, where the SharePoint architect is looking to take advantage of the consolidation and performance improvements that Hyper-V offers, there are several additional scenarios that virtualization provides key benefits.

Virtualization of SharePoint Farms for QA and Test Environments

One of the most common and widely used virtualization models for SharePoint is one where smaller test and development farms are virtualized. Since the resource requirements for these types of farms are typically quite low, quick and easy virtualization and provisioning of new farms is facilitated through the use of Hyper-V technologies. In these environments, typically all of the server roles, including the SQL database role can be virtualized, as disk I/O and memory requirements are quite low.

> ### Multiple SharePoint Farms
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> Many SharePoint environments are installed not just on a single farm, but on multiple farms. Farms for QA, Test, and Dev are one reason, but other reasons may include security isolation, content in different locations across a Wide Area Network, or for Disaster Recovery. Virtualization of many of these environments can greatly decrease the overhead required with running multiple farms.

In certain cases, some organizations build test environments that exactly match the specifications of the production environment. For these environments, it may be the case that not all of the components are virtualized, depending on whether they are in production. In many cases, however, an approximate virtual sample infrastructure is created to roughly equate to what is currently in production.

Virtualization of SharePoint Farms for System Center Data Protection Manager 2007 Recovery Farms

DPM 2007 is an enterprise-level backup and restore platform for SharePoint environments, providing for snapshot-based recovery of SharePoint farms and individual item-level recovery capabilities. When using DPM 2007, the supported approach to recovering individual items from SharePoint backups is to build a 'Recovery Farm' that is used for restoration of the content database from which the item will be extracted.

The most straightforward approach to construction of a Recovery Farm with DPM 2007 is by virtualizing the farm components. In most cases, this means installing all roles on a single virtual server that has the available local disk capacity to store the largest content database that exists in production. This farm is then only used for recovery of SharePoint content using the DPM console, and can be paused or turned off when not in use.

Virtualization of SharePoint Farms for Disaster Recovery Testing

A task that is often overlooked in many SharePoint environments is the task of testing disaster recovery failover of the SharePoint farm. Many organizations have plans in place, but the actual procedures have never been tested with production data. Using virtualized equipment, SharePoint administrators have the flexibility to test their disaster recovery scenarios in a realistic environment with real data.

A copy of existing SharePoint production and failover farms can be created using the P2V tools and V2V tools included in VMM. (See the section **System Center Virtual Machine Manager 2008**.) These tools allow for running servers to be copied to isolated virtual networks where the disaster recovery process itself can be fully verified. This same process is also used when creating refreshes and copies of existing SharePoint farms for test environments.

Additional Virtualization Considerations for SharePoint Farms

Hardware Requirements for Virtualization Infrastructure

The general rule of thumb for virtualization is that the more memory and processor power that can be allocated to a host, the better. Having more memory and processing power will increase the number of virtual sessions that are allowed, and will allow for expansion of the environment as necessary. In addition, adding additional memory or processor capabilities will have a similar effect.

Server Licensing for Virtualization

Microsoft provides for a flexible licensing model for Windows Server when running in a virtualized environment. Each version of Windows allows for the following virtual licensing allowances:

- **Windows Server Standard Edition** One license of Windows Server Standard Edition covers one instance of the server software in the physical operating system environment (POSE) and one instance of the server software in a virtual operating system environment (VOSE).
- **Windows Server Enterprise Edition** One license of Windows Server Enterprise Edition covers the host server plus an additional four server licenses (either Standard or Enterprise) that run on the Enterprise Edition host.
- **Windows Server Datacenter Edition** One license of Windows Server Datacenter Edition covers the host server plus an unlimited number of virtual server session licenses that run on the host.

This licensing model covers both Windows Server 2003 and Windows Server 2008 hosts and guests, and applies to either 32-bit or 64-bit editions.

NUMA Memory Considerations

Non-uniform memory access (NUMA) nodes are memory boundaries on the physical hosts that virtual sessions can be split across if those sessions are allocated a large amount of RAM. In general, the more NUMA nodes a virtual guest is spread across, the fewer gains in performance will be realized. In some testing, a virtual SharePoint Web server role with an

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allocation of 32GB of RAM actually performed worse than a virtual server with an allocation of 8GB of RAM. It is critical to review the Hyper-V logs (Windows Server 2008 Custom Views\Server Roles\Hyper-V) to determine if the RAM for the session is being spread across multiple NUMA nodes and, if so, to drop the amount of RAM allocated to the server until this event is no longer displayed.

> ## Planning Memory Allocation
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> The performance impact of having a virtual session cross NUMA boundaries is significant, so it is highly important to plan for proper allocation of memory to the virtual session without crossing NUMA boundaries.

A good rule of thumb for planning allocation of memory on virtual sessions without breaking the memory across NUMA sessions is to divide the total amount of RAM in the server by the number of logical processors (physical processors divided by number of cores) in the host server. For example, on a Hyper-V host with 64GB of RAM and two quad-core processors, the optimal amount of RAM allocated to a single session would be 64 divided by 8, or 8GB of RAM. The same server with 32GB of RAM would ideally have no more than 4GB of RAM allocated to a single session to see the most benefits in performance.

Processor Allocation Guidelines

As a general rule of thumb, the best performance can be realized from a Hyper-V host if the number of virtual processors allocated to running guests does not exceed the number of logical processors (physical processors multiplied by the number of cores) on the host. For example, a four processor quad-core server will be able to allocate up to 16 virtual processors across its running sessions without any significant performance impact. Note that this only applies to sessions that are physically running simultaneously.

There are multiple factors that can affect server performance, and virtual processor allocation is only one of them. Consequently, it is important to manage and monitor Hyper-V host performance with tools such as System Center Operations Manager 2007 and VMM 2008 to determine available capacity and use these architectural guidelines as general best practice guidance.

Network Load Balancing Across Virtual Hosts

SharePoint Web front-end server uses network load balancing to provide for high availability of SharePoint content. To be able to provide for the fullest level of physical server fault-tolerance, virtual Web role servers should be split across multiple Hyper-V hosts. This way, if a single host were to fail, the other host would keep the other Web server role running.

Clustering Virtual Guests

Windows Server 2008 Hyper-V is fully cluster-aware, and supports scenarios where cluster nodes are installed on one more or more Hyper-V servers.

SharePoint Virtualization Management

Windows Server 2008 Hyper-V is an excellent tool for virtualization of servers, and many organizations are deploying multiple Hyper-V hosts for virtualization of SharePoint and other servers. With the proliferation of hosts and guests comes increased management and administration that is required to keep the environment functioning properly. In addition, many organizations are looking for comprehensive tools to allow for migration of physical and virtual servers to Hyper-V. To address these needs, Microsoft has developed a comprehensive virtual machine management tool called VMM, part of the System Center suite of management tools.

System Center Server Management Suites

The System Center suite of management tools includes several other components that allow for management of SharePoint and other virtualized and non-virtualized servers. These products allow for comprehensive control of multiple servers, both virtualized and non-virtualized. The most obvious candidate for virtualization management in the System Center line is the VMM 2008 product (see the section **System Center Virtual Machine Manager 2008**), but there are other products within the System Center suite of tools that allow for in-depth control and management of virtualized SharePoint servers.

System Center Data Protection Manager 2007

System Center Data Protection Manager (DPM) 2007 is a comprehensive backup and restore platform specifically designed for SharePoint environments. It provides for snapshot-based backup of SharePoint farm content by using the VSS installed on the Windows Server Operating System. DPM provides for quick and frequent backups of the entire SharePoint farm, item-level recovery capabilities, fast backup and recovery from disk capabilities, and granular retention policies for SharePoint administrators.

> ## System Center Suite Licensing
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> Server Management Suite Enterprise (SMSE) is a cost-effective method of acquiring the Enterprise management licenses for the four System Center products—DPM, OpsMgr, ConfigMgr, and VMM—and the rights to use VMM 2008 server software. The SMSE is licensed on a per physical server basis with unlimited operating system environments (OSEs). VMM 2008 is also available in a stand-alone version.

System Center Operations Manager 2007

System Center Operations Manager (OpsMgr) 2007 is an advanced management tool that allows for proactive monitoring of a server environment. For SharePoint farms, OpsMgr monitoring has significant capabilities, as custom built SharePoint–specific knowledge has been built into freely downloadable management packs, which are installed directly into the tool and provide SharePoint–specific knowledge to be added into the platform. For example, the application-specific knowledge built into the SharePoint Management Packs for OpsMgr allows SharePoint administrators to be alerted when events that affect a SharePoint farm are triggered. Integration of OpsMgr 2007 into a SharePoint environment greatly improves the ability of SharePoint administrators to monitor and maintain SharePoint servers.

System Center Configuration Manager 2007

System Center Configuration Manager (ConfigMgr) 2007 is a comprehensive tool that allows SharePoint administrators to track hardware and software assets, monitor the configuration of servers, patch SharePoint systems, and deploy operating systems more efficiently. The Desired Configuration Management component of ConfigMgr can be especially useful for SharePoint farms with multiple Web front-ends, as it provides a mechanism to track changes made to servers, allowing administrators to ensure that each system is configured identically.

System Center Virtual Machine Manager 2008

System Center Virtual Machine Manager (VMM) 2008 provides a straightforward and cost-effective solution for unified management of physical and virtual machines, consolidation of underutilized physical servers, and rapid provisioning of new virtual machines. It provides for critical virtual management functionality in environments that are considering virtualizing SharePoint farms, particularly when dealing with multiple servers and farms.

> ## Management of Hyper-V and VMware Hosts
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> VMM is an end-to-end management solution that can manage both Hyper-V guests and VMware Virtual Infrastructure 3 (VI3). It integrates with VMware's VirtualCenter server to directly manage the VMware hosts. This allows for VMM to perform tasks specific to VMware, such as moving sessions from ESX hosts using VMotion technologies.

VMM 2008 is the ideal management tool for SharePoint administrators tasked with the upkeep of virtualized SharePoint farms, as it provides valuable tools that allow for rapid provisioning of new SharePoint front-end servers, conversion of physical servers to Hyper-V guests, and other highly useful management capabilities.

Fast and Reliable Physical-to-Virtual-Machine Conversion

Converting a physical SharePoint server to a virtual machine can be slow and error-prone. VMM improves the Physical-to-Virtual (P2V) experience by integrating the conversion process and by using the VSS for Windows Server 2003 or Windows Server 2008 to create the virtual machine faster and without having to interrupt the source physical server or shut it down.

Fast and Reliable Virtual-to-Virtual-Machine Conversion

To help ease the migration from VMware virtual guests to Hyper-V, VMM converts VMware Virtual Machine Disk Format/Virtual Machine Extensions (VMDK/VMX) virtual machines to the Microsoft Virtual Hard Disk (VHD) format. If the guest operating system runs Windows, VMM will perform fixes during the conversion process, to ensure a working converted virtual machine.

Easy Identification of Consolidation Candidates

VMM allows for migration of an existing SharePoint physical environment to a virtual environment by allowing architects to identify which servers are the ideal candidates for virtualization. VMM allows for this level of control by identifying the appropriate physical workloads for consolidation onto virtual machines. VMM leverages historical performance

data in an OpsMgr 2007 database to identify and list underutilized physical servers that are good candidates for consolidation.

Intelligent Placement

Selecting the appropriate virtual machine host for a given workload is the key to maximizing the utilization of physical assets, whether the goal is to balance loads among existing hosts or to maximize resource usage on each host. In VMM, this process is called "Intelligent Placement".

When a virtual machine is deployed, VMM has the capability to analyze performance data and resource requirements that are gathered from a deployed OpsMgr 2007 environment. This allows an IT administrator to fine tune placement algorithms to obtain the best deployment recommendations. First, historical performance data is used to understand actual resource requirements of the workload. Next, minimum CPU, disk, RAM, and network capacity requirements in the virtual machine's configuration are checked. After determining the virtual machine's requirements, performance data is gathered

> ### Performance and Resource Optimization
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> VMM uses a concept called Performance and Resource Optimization (PRO) to monitor the performance of individual hosts and sessions using OpsMgr 2007. Using this data, PRO can then take proactive measures to improve performance. For example, thresholds could be set in VMM to move a virtual session from one Hyper-V host to another using Quick Migration if the original host performance is overloaded.

for candidate virtual machine hosts. Finally, pre-selected business rules are factored in to optimize placement recommendations either for resource maximization or for load-balancing, and to weight the importance of different resource types for the workload.

Centralized Resource Optimization

Using VMM, SharePoint administrators can tune resource settings for individual virtual machines or migrate virtual machines from one host to another using the VMM Administrator Console. Resource settings can be changed on virtual machines without interrupting workloads, and virtual machines can be migrated from one host to another to optimize physical resources.

Rapid Provisioning of New Machines

VMM enables quick provisioning of new SharePoint servers, a feature that is particularly useful for SharePoint farms, as it allows for quick creation of new farms for QA, testing, or disaster recovery purposes. Using a wizard-based user interface, IT administrators can rapidly deploy virtual machines from approved customized SharePoint server templates. VMM also allows management and migration of existing virtual machines between virtual machine hosts, giving IT administrators an integrated and holistic view of their virtual and physical infrastructure.

Leveraging Library Features

The virtualized data center relies on the ability to find and maintain image files for virtual machines (known as "virtual hard drives"). Unlike a physical server, these virtual hard drives can be unintentionally lost or duplicated. VMM provides a library to manage all the building blocks of the virtual data center. The library organizes not only stored virtual machines but also the various virtual machine "building blocks", such as VHDs, CD/DVD media/ISO images, Windows PowerShell scripts, hardware configurations, and templates.

The VMM library provides centralized management of distributed resources for creating virtual machines. This enables the efficient distribution of offline virtual machines, templates, ISO images, scripts, and other library resources to the edges of the organization, enabling rapid creation and deployment of virtual machines in branch offices.

Rapid Deployment of Virtual Machine Templates

The VMM library adds an important tool to the SharePoint administrator's toolkit—virtual machine templates. A virtual machine template enables an administrator to create approved standard virtual machine configurations for subsequent virtual machine deployments. Templates contain both the guest operating system configuration and the hardware configuration, to ensure consistency in the data center. SharePoint administrators can use pre-created SharePoint templates to provision new servers and then use automated scripts to add those servers into an existing farm. Templates bring all the standardization and ease of management of "SysPrep'ed" images to virtual machines.

> ## SharePoint Server Templates
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> Creating server templates for SharePoint using VMM is relatively straightforward. The operating system can be installed and configured, and the SharePoint binaries can be pre-installed on the image as well. This allows a SharePoint server to be rapidly provisioned and immediately brought to the point where it can be installed into an existing farm using the SharePoint Products and Technologies Configuration Wizard.

Automate Test Lab Operations on Virtual Infrastructure

Virtual infrastructure is commonly used in test and development environments, where there is constant provisioning and tear down of virtual machines for testing purposes. While this task is far easier with virtual machines than with physical hardware, it typically still requires some IT involvement. With VMM, administrators can delegate this provisioning role to authorized users through VMM's Self Service Portal, while maintaining precise control over the creation and management of virtual machines and hosts. Authorized personnel are assigned to a set of physical host servers—known as a "host group"—on which they can provision virtual machines according to administrator restrictions. The authorized users work from templates provided by the administrator and can only manage the virtual machines that they, or their group, own. This can be highly useful for SharePoint environments that require a group of power users, such as developers, the ability to provision their own farms quickly and consistently, without the need for SharePoint administrator intervention.

Familiar Interface, Common Foundation

The VMM Administrator Console is built on the familiar Operations Manager 2007 user interface, already widely in use and recognizable within many organizations. The VMM library is also based on standard Windows file shares, which increases its ease of adoption. In addition, comprehensive health monitoring of hosts, virtual machines, library servers, and VMM components is provided through the Virtualization Management Pack in Operations Manager 2007.

Below the surface, System Center also is integrated with familiar tools and technologies. For example, System Center uses a SQL Server database to store performance and configuration data, and reporting in VMM leverages the familiar SQL Reporting Services provided through Operations Manager.

Fully Scriptable Using Windows PowerShell

VMM is built on Windows PowerShell, a widely used administrator-focused command shell and scripting language. Easy to adopt, learn and use, Windows PowerShell's architecture enables the quick construction of ad-hoc integration solutions. Its scripting features allow administrators to integrate System Center with established tools and procedures in the data center.

Using VMM for Fast Provisioning and Disaster Recovery of SharePoint Servers

There are many scenarios when quick provisioning of SharePoint servers is ideal, as it gives SharePoint architects and administrators flexibility to rapidly create farms for disaster recovery, testing, or development work. Management of virtual SharePoint servers using VMM allows for this type of rapid provisioning of pre-configured servers, which has significant operational advantages over traditional server build models.

With the creation of a SharePoint server template in VMM, new servers can be quickly added to existing farms or new farms can be created on the fly. This covers scenarios such as the following:

- **Adding Capacity to an Existing Farm** VMM can quickly provision additional Web front ends to an environment to handle increased load, such as in scenarios when a seasonal business ramps up traffic during certain months of the year. When the additional SharePoint Web servers are no longer needed, they can be quickly removed from the farm.
- **Creating a Disaster Recovery Farm** VMM can be used to quickly create a disaster recovery farm for a SharePoint environment. This can be performed during a disaster or to prepare a warm standby farm for restore of SharePoint production data.
- **Provisioning QA or Test Farms** Multiple QA or test farms can be quickly provisioned, and data in those environments can be more easily refreshed using VMM.
- **Testing Failover** VMM can be used to convert V2V or P2V production farms to a test environment, where disaster recovery and failover procedures can be tested against production data without affecting production servers.

Conclusion

Virtualization and virtualization management are powerful tools for SharePoint farm architects, as they allow for greater flexibility in deployment and server role placement. The ability to quickly provision virtualized SharePoint servers and farms provides new capabilities and improves disaster recovery methods.

Windows Server 2008 Hyper-V is an ideal environment for SharePoint server virtualization, as its Hypervisor architecture provides the guest sessions direct access to the hardware of the host server, greatly improving performance. In addition, support for 64-bit guests allows for greater performance and architectural flexibility.
While specific SharePoint roles such as the SQL Database role may not be the ideal candidate for virtualization in all scenarios, SharePoint Products and Technologies are fully supported in a Hyper-V virtualization environment. Additionally, significant improvements in resource utilization, disaster recovery, and multiple farm deployment capabilities are made possible with virtualization.

With the proliferation of virtual server hosts and guests, management of the deployed infrastructure becomes a top priority. Microsoft's System Center Management Suite, including VMM 2008 provides a highly capable set of tools to manage virtual environments, allowing for P2V and V2V conversion, rapid provisioning from server templates, and Performance and Resource Optimization capabilities. All of these capabilities within the System Center Suite are rapidly positioning it as an ideal tool to provide SharePoint architects and administrators with critical management functionality in a virtualized SharePoint infrastructure.

Additional Information

Product Marketing
http://www.microsoft.com/sharepoint
Community Portal
http://mysharepointcommunity.com
Hyper-V Planning Guide
http://technet.microsoft.com/en-us/library/bb897505.aspx
Microsoft Virtualization
http://www.microsoft.com/virtualization/default.mspx
Windows Server 2008 Editions
http://www.microsoft.com/windowsserver2008/en/us/editions-overview.aspx
Hyper-V
http://technet2.microsoft.com/windowsserver2008/en/servermanager/virtualization.mspx
System Center Server Management Suite
http://www.microsoft.com/systemcenter/en/us/management-suites.aspx
System Center Virtual Machine Manager
http://www.microsoft.com/systemcenter/virtualmachinemanager/en/us/default.aspx