Server Consolidation and Virtualization

Summary Report

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Microsoft

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Executive Overview

This proposal describes the benefits of consolidating and virtualizing your existing servers. It offers detailed server consolidation recommendations based on key performance metrics and detailed hardware specifications of each server that the Microsoft Assessment and Planning (MAP) tool inventoried across the network.

In addition to this proposal, the MAP tool generated two Microsoft® Excel® workbooks as separate detailed reports that provide server assessment results. These are:

- **PerfMetricsResults-*Date-Time***. This workbook provides results of the Performance Metrics assessment.
- **ServerVirtRecommendation-*Date-Time***. This workbook provides specific recommendations for server virtualization.

The consolidation recommendations that the MAP tool provides are for planning purposes and for an initial assessment of your consolidation opportunity. System Center Operations Manager 2007 Enterprise Edition is recommended for performing an in depth analysis of server placement.

Based on the results of this assessment, you will need 22 or more virtual server host computers.

Where Is Your Organization Today?

Using the Server Consolidation and Virtualization Wizard, you specified the hardware configuration (model) for your virtual server(s), imported a list of computer names to include in the assessment, and specified the virtualization technology you want to use. Based on these inputs, the assessment was performed for 94 servers. The assessment identified 88 candidate(s) for server virtualization, using Windows Server 2008 R2 Hyper-V™ technology, on the specified hardware configuration.

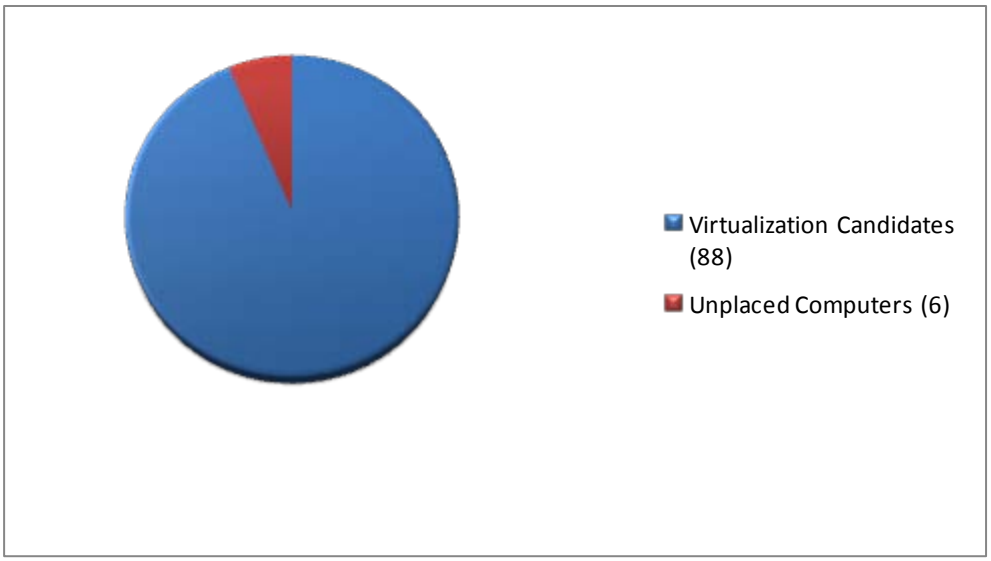

Figure 1. Placed and Unplaced Machines

There are 6 computers that could not be included (placed) in the consolidation recommendation. Of that group, 3 computers are unplaced because of insufficient data (performance or inventory data could not be collected). Refer to the Server Virtualization workbook for the specific reasons why a computer wasn't placed in the consolidation recommendation.

After consolidation you can expect to require 27 physical servers (22 virtual server host machines and have 5 additional physical servers). The following figure shows the resulting environment, after consolidating your servers:

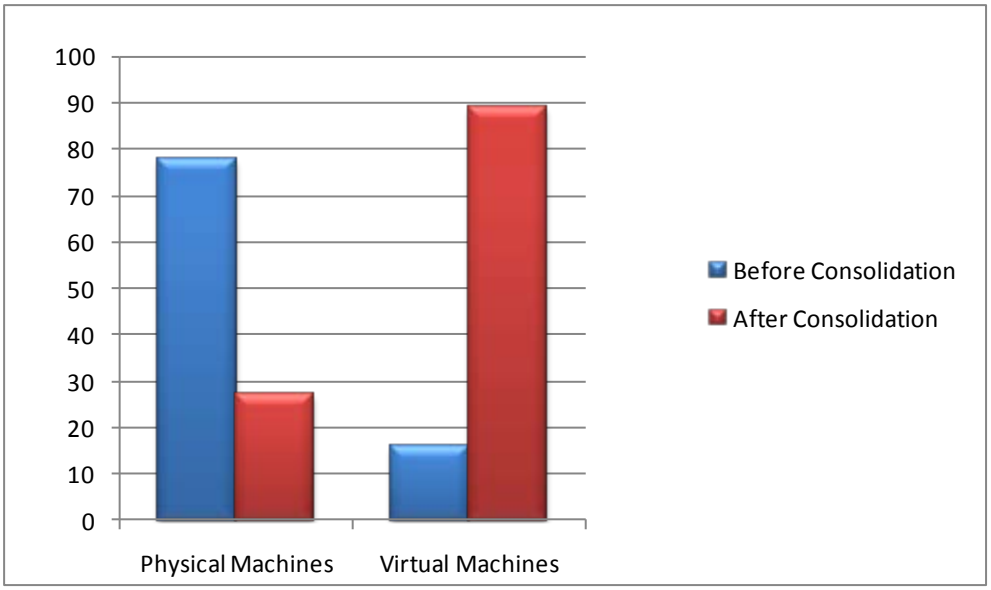

Figure 2. Virtual servers before and after consolidation

Benefits of Server Virtualization

Virtualization enables four core scenarios: server consolidation, business continuity, test and development, and dynamic data center. Combined with the System Center management suite, you can now have a complete and integrated server management solution that works with virtual machines (VMs) and physical servers.

Server Consolidation

Organizations that look at production servers in their data centers find that overall hardware utilization levels are often between 5 percent and 15 percent of the capacity of a physical server. By using Windows Server® virtualization technologies to consolidate servers, businesses can increase overall hardware utilization and reduce the cost of operating a data center through reduced rack space, electricity usage, and cooling costs.

Business Continuity Management

IT administrators are always trying to find ways to reduce or eliminate downtime from their environments. This includes time lost to routine functions, such as maintenance and backup, as well as unplanned outages. Windows Server 2008 virtualization technologies help you deal with maintenance operations by enabling live backups and quick migration of VMs to other virtual server hosts in your environment. With Hyper-V and enhanced failover clustering, you can seamlessly maintain service availability. In addition, System Center management technologies provide amazing features to help you migrate from physical computers to virtual machines, deploy your virtual servers, manage your virtualized environment, and avoid service interruptions.

Software Test and Development

Test and development are frequently the first business functions to take advantage of virtualization technology. Using virtual machines, your development staff can create and test a wide variety of scenarios in a safe, self-contained environment that accurately approximates the operation of physical servers and clients. Microsoft virtualization technologies maximize utilization of test hardware, reducing costs and improving life cycle management and test coverage. With extensive guest operating system

support and checkpoint features, these technologies provide a great platform for test and development environments.

Dynamic Data Center

The rich set of features of Windows Server virtualization combined with the new management capabilities extended by Virtual Machine Manager enables organizations to create a more agile infrastructure. By taking advantage of features like automated virtual machine reconfiguration, flexible resource control, and quick migration, you can dynamically manage your servers and quickly respond to problems and changing service demands.

Microsoft Virtualization Technologies

Microsoft provides a number of products to enable test and development in virtual environments, virtualization of production servers, and management of your servers and virtualized environment.

Server Virtualization

Server virtualization allows you to run most major x86 and x64 operating systems in a virtualized environment, utilizing the host operating system's device drivers to ensure robust and stable device support and compatibility. Microsoft server virtualization offerings include Microsoft Virtual Server 2005 R2 and Windows Server 2008 Hyper-V technology.

Virtual Server 2005 R2

Virtual Server 2005 R2, the most cost-effective server virtualization technology, is available as a free download. Virtual Server 2005 is ideal for server consolidation in both the data center and branch office scenarios for consolidating redundant workloads and re-hosting older applications. It is also a powerful and effective tool for software test and development environments, infrastructure testing, and service migration test and development. Additionally, Virtual Server 2005 R2 is a great part of your disaster recovery plan and increases the portability and flexibility of your IT environment across hardware platforms.

Windows Server® 2008 Hyper-V Technology

Windows Server 2008 Hyper-V technology provides the ability to virtualize both 32-bit and 64-bit server platforms. It supports a broad array of Microsoft and non-Microsoft operating systems, and its utilization of the virtual server host hardware is greatly enhanced, when compared to Virtual Server 2005 R2. Hyper-V technology provides the following features:

- SMP support for up to four processors.
- Support for large memory allocation per virtual machine.
- Pass-through disk access and broad support for SAN and internal disk access.
- Virtual switch capabilities and support for the Windows Network Load Balancing (NLB) server.
- Improved access and utilization of hardware resources on the virtual server host.
- Quick migration from physical to virtual.
- Ability to snapshot a running virtual machine for improved backup and recoverability.
- Extensible platform for software vendors and developers to build custom tools, utilities, and enhancements to the virtualization platform.

The features of Hyper-V provide a platform that is highly scalable, easily managed, and very reliable.

Windows Server 2008 Features

The core Windows Server 2008 platform provides many features to vastly enhance the security, reliability, and performance of your virtualized environment. This section describes some of the new or updated features in Windows Server.

Failover Clustering

Failover clustering is vastly enhanced with Windows Server 2008 and is a core feature in your virtualized environment. The clustering technology is now easier to configure, self validating, more reliable (quorum resource is no longer a single point of failure), and better integrated with your storage solution. The storage features include adding disks to the cluster while the resources are online, better performance and stability, larger disk partitions, and the ability to perform storage maintenance with less disruption to the cluster.

Server Core

Server Core is a new installation option with Windows Server 2008. It provides a minimal environment for running specific server roles. This minimal environment reduces system resource requirements and maintenance. When Hyper-V is deployed on a Windows Server 2008 Server Core installation, only the services and files required for virtualization are installed on the virtual server host. This frees up more resources for your virtual machines, and provides a more secure and manageable platform compared to a full installation.

Windows PowerShell

Windows PowerShell™ is a new command-line shell and scripting language that you can use to streamline and automate server administration tasks. Windows PowerShell provides 130 standard command-line tools and is easy to adopt, learn, and use.

Windows Deployment Services

Windows Deployment Services is a way to rapidly and remotely deploy Windows Server on new virtual machines.

Management Technologies

The System Center family of management technologies provides the best tools for managing your IT environment and virtualized infrastructure.

This section provides more information about specific System Center products that you can use to manage your virtual environment.

System Center Virtual Machine Manager 2008

Virtual Machine Manager 2008 provides a straightforward and cost-effective solution for the unified management of physical computers and virtual machines, consolidation of underutilized physical servers, and rapid provisioning of new virtual machines. It provides the following features:

- Easy identification of consolidation candidates.
- Fast and reliable physical-to-virtual and virtual-to-virtual machine conversion.
- Intelligent placement of virtual machines per virtual machine host.
- Cross-Platform support for VMware ESX Infrastructure virtualization technology.
- Centralized administration of your virtual infrastructure.
- Rapid provisioning of virtual machines.
- Library of stored virtual machines and resource configurations.
- Auto-detection of SAN infrastructures and storage infrastructure provisioning tools.
- Physical and virtual machine monitoring from a single console.
- Fully scriptable using Windows PowerShell.
- Active Directory® Domain Services integration.

System Center Data Protection Manager

The updated version of System Center Data Protection Manager provides extended disk-based backup and recovery capabilities to such Microsoft applications as Microsoft SQL Server®, Microsoft Exchange Server, and Windows SharePoint® Services.

System Center Operations Manager

System Center Operations Manager 2007 provides end-to-end service management that is easy to customize and extend. It includes the management of critical services; application, client, and server monitoring; and a wide variety of management packs and service templates to extend monitoring capabilities.

Assessment Results Summary

The assessment results summary contains the following information:

- Virtual server host model
- Current server utilization
- Consolidation recommendations

Virtual Server Host Model

When you ran the Server Virtualization and Consolidation Wizard, you provided the hardware configuration (model) for the virtual server hosts. This model is used for each of the virtual server hosts required for placement of all virtualization. If the specified model server does not have sufficient hardware resources for some workloads, servers with those workloads will be unplaced. If you have a large number of unplaced servers due to insufficient resources on the virtual server host, run the wizard again and increase the hardware resources specified for the virtualization host model.

Table 1. Host and Guest Settings

Property	Value
Virtualization Technology	Windows Server 2008 R2 Hyper-V
Maximum number of virtual machines per host:	Not set
Additional physical memory reserved for each guest (MB)	256
Additional physical disk reserved for each guest (%)	50

Table 2. CPU of the target host machine

Central Processing Unit Characteristics	Configuration
CPU Make:	Intel Xeon
CPU Speed (GHz):	3.600
CPU Count:	2
Cores per CPU:	1
Hyperthreads Per Core:	1
L2 Cache Size (KB)	1024
L3 Cache Size (KB)	0

Table 3. Physical disk for the target host machine

Storage Characteristics	Configuration
Disk Type	SATA, 10000 RPM, 1.5 Gb/s
Storage Capacity (GB):	250
RAID Level:	5
Number of Disks:	4
Cache (GB):	0
Max Disk IOPS	747
Total Available Storage (GB):	750

Table 4. Network adapters and memory for the target host machine

Network Adapter and Memory Characteristics	Configuration
Network Adapter Speed:	Gigabit Ethernet (1 Gbps)
Number of Adapters:	2
Amount of memory (GB):	8.000

Current Server Utilization

Computer names in Table 5 with all utilization numbers equal to 0 percent or "No Data" are computers on which there isn't any performance data. You will need to run the Performance Metrics Wizard on these computers to update this proposal and place the relevant servers. If computers are unplaced due to inadequate resources on the virtual server host, you should run the Server Virtualization and Consolidation Wizard again, change the hardware configuration, and regenerate this proposal.

The following table summarizes your current servers and their observed utilization:

Table 5: Current Server Utilization

Placement Type	Number of Servers	Average CPU (%)	Average Memory (GB)	IOPS	Average Network Throughput (MB/s)
Total number of servers:	94	3.05	1.34	25.15	0.09
Unplaced: Missing Inventory Data	0	No Data	No Data	No Data	No Data
Unplaced: Missing Performance Data	3	No Data	No Data	No Data	No Data
Unplaced: Unknown Error	0	No Data	No Data	No Data	No Data
Unplaced: Utilization exceeds host thresholds after virtualization	3	11.08	2.76	32.92	0.07
Virtualization Candidate	88	2.78	1.29	24.89	0.09

The accompanying Server Virtualization report (ServerVirtRecommendation-*date-time*) provides detailed utilization and placement information for each server.

Consolidation Recommendations

The recommendations of this assessment are that you use server virtualization to consolidate your existing servers and Virtual Machine Manager 2008 to manage the service and placement of virtual servers.

Server Virtualization

The assessment anticipates substantial value to your organization if you pursue virtualization of the candidate servers. After migration to the virtualized environment expect that your 22 virtual server hosts running Windows Server 2008 R2 Hyper-V will have the expected utilization listed in the following table.

Table 6: Utilization After Virtualization

Virtual Server Host Name	CPU Utilization (%)	Memory Utilization (GB)	IOPS	Network Throughput (MB/s)
Host0	8.38	4.91	75.02	25.19
Host1	10.17	6.1	78.52	25.13
Host2	7.74	6.77	76.31	25.09
Host3	11.33	7.68	88.34	25.12
Host4	29.84	6.21	78.94	25.07
Host5	8.77	7.96	113.47	25.07
Host6	6.32	6.41	74	25.04
Host7	11.1	7.69	740.73	27.06
Host8	9.28	7.82	135.05	25.17
Host9	14.33	5.07	287.13	25.41
Host10	8.36	7.91	80.53	25.05
Host11	18.74	7.93	585.74	26.94
Host12	9.41	7.77	70.2	25.02
Host13	10.79	7.54	74.89	25.41
Host14	9.58	7.63	74.34	25.09
Host15	30.57	7.64	86.36	25.93
Host16	8.8	7.43	69.9	25.04
Host17	12.32	7.83	69.16	25.08
Host18	10.47	7.78	86.24	25.04
Host19	8.75	6.77	69.69	25.19
Host20	12.14	7.92	319.85	25.52
Host21	46.3	6.41	170.2	25.31
Unplaced (Average)	11.08	2.76	32.92	0.07
Average	13.79	7.15	159.3	25.36

Note The MAP tool does not make placement recommendations based on role-specific characteristics of your specific environment. For example, you may have servers that perform multiple roles. There may

also be multiple servers that perform the same role, with each server providing redundancy for that service. You should ensure that virtual machines that provide redundant roles are not deployed on the same virtual server host.

For the specified hardware model (including all unplaced servers), compare the actual results (before virtualization) to the expected results (after virtualization) of consolidating your servers, as shown in the following table.

Table 7: Consolidation Results

Characteristic	Before Virtualization	After Virtualization
Total number of physical servers:	78	27
Memory Utilization (%)	54.31	74.54
Overall CPU utilization (%):	3.81	10.84
Overall Disk IOPS	25.15	128.69
Overall Network throughput (MB/s):	0.09	0
Average number of virtual machines per server:	1	3

Management Technology

From the assessment results, the MAP tool has determined that you will need at least 22 virtual server hosts to consolidate existing workloads at current utilization levels. We recommend that you use Virtual Machine Manager 2008 (Enterprise Edition) to manage your virtual server hosts and virtual machines. We also recommend that you use System Center Operations Manager 2007 to manage and monitor your physical and virtual servers.

Conclusion

Server virtualization gives you more flexibility to provide services, avoid downtime, and test new platforms. In addition to these benefits, you will consume less electricity, require less cooling for your data centers, and use less rack space.

Virtual Server 2005 and Hyper-V technology give you two great options for consolidating your servers using virtualization. The benefits of consolidation and virtualization are realized not only with the virtualization technologies but also through the integrated management technologies in the System Center family of products and features in Windows Server 2008 and Windows Server 2008 R2 platforms.

Next Steps

1. Perform a detailed virtualization placement and virtual server host sizing assessment using Virtual Machine Manager 2008. For more information, go to http://go.microsoft.com/fwlink/?LinkId=106520.
2. Decide which version of Windows Server 2008 you are going to deploy on the virtual server host. For more information about the number of virtual instances (Hyper-V) allowed on each version of Windows Server 2008 go to http://go.microsoft.com/fwlink/?LinkId=106521.
3. Choose a Microsoft Partner that can help you with your virtualization needs: http://go.microsoft.com/fwlink/?LinkId=106522.
4. Visit the TechNet Virtualization Solution Center to obtain more in-depth technical content on Microsoft virtualization technologies at http://go.microsoft.com/fwlink/?LinkId=106523.
5. Visit the Infrastructure Planning and Design Guide site to download the free planning guidance for deploying a Hyper-V infrastructure: http://www.microsoft.com/IPD.

6. Harden your virtualization role with the Hyper-V Security Guide by downloading the latest from: http://technet.microsoft.com/en-us/library/dd569113.aspx.