



Server Consolidation and Virtualization

Summary Report

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Date: Thursday, December 08, 2011

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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 the proposal, the MAP Toolkit also generated a Microsoft® Excel® workbook titled **ServerVirtRecommendation** that provides specific recommendations for server virtualization.

If you are curious about the performance and utilization information that the MAP Toolkit used to perform the consolidation analysis, you can generate the Performance Metrics Results report for a detailed performance profile of each machine.

The consolidation recommendations that the MAP tool provides are for planning purposes and for an initial assessment of your consolidation opportunity. Microsoft System Center Virtual Machine Manager 2008 R2 Enterprise Edition is recommended for performing an in depth analysis of server placement.

More information about [Virtual Machine Manager 2008 R2](http://go.microsoft.com/fwlink/?LinkId=106525) is available at <http://go.microsoft.com/fwlink/?LinkId=106525>.

Where Is Your Organization Today?

Using the Server Consolidation and Virtualization Wizard, you specified the hardware configuration (model) for your virtualization host server(s) and the infrastructure they reside on, defined utilization thresholds, chose a list of computers to include in the assessment, and specified the virtualization technology you want to use. Based on these inputs, the assessment was performed for 65 servers. The assessment identified 60 candidate(s) for server virtualization, using Hyper-V R2 SP1™ technology, on the specified hardware configuration.

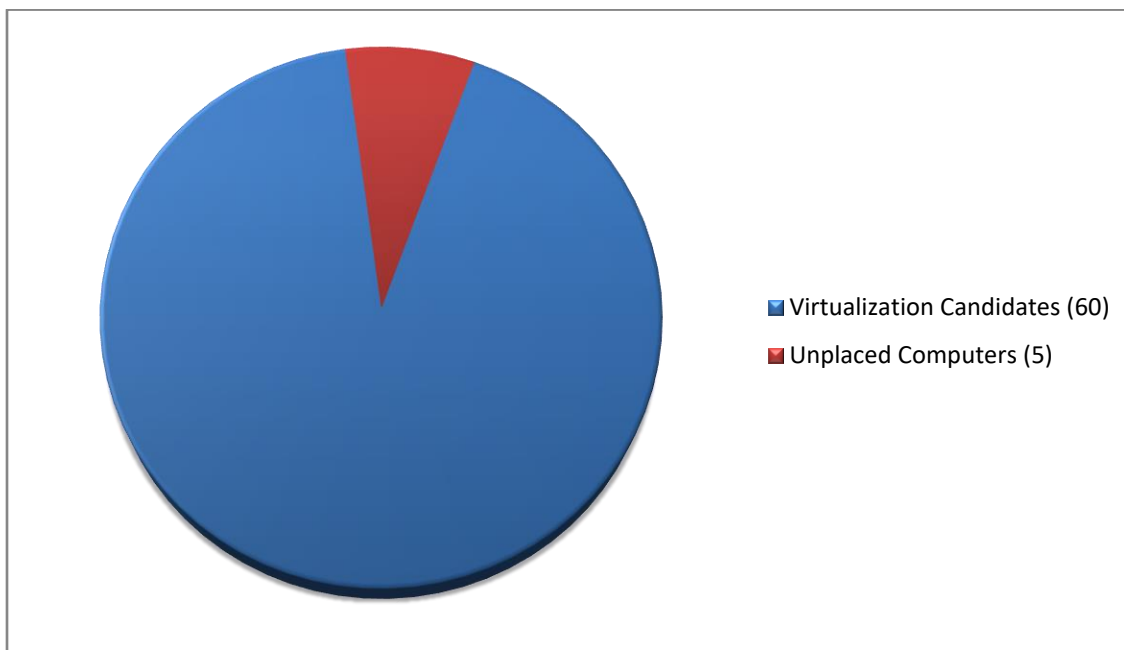


Figure 1. Placed and Unplaced Machines

5 computer(s) could not be included (placed) in the Consolidation recommendation. Please refer to the Server Virtualization workbook for the specific reasons why a computer wasn't included in the consolidation recommendation.

After consolidation, you can expect to require 2 infrastructure(s) containing a total of 16 physical server(s) with common storage, storage system IOPS, and network throughput. The following figure shows the resulting environment, after consolidating your servers:

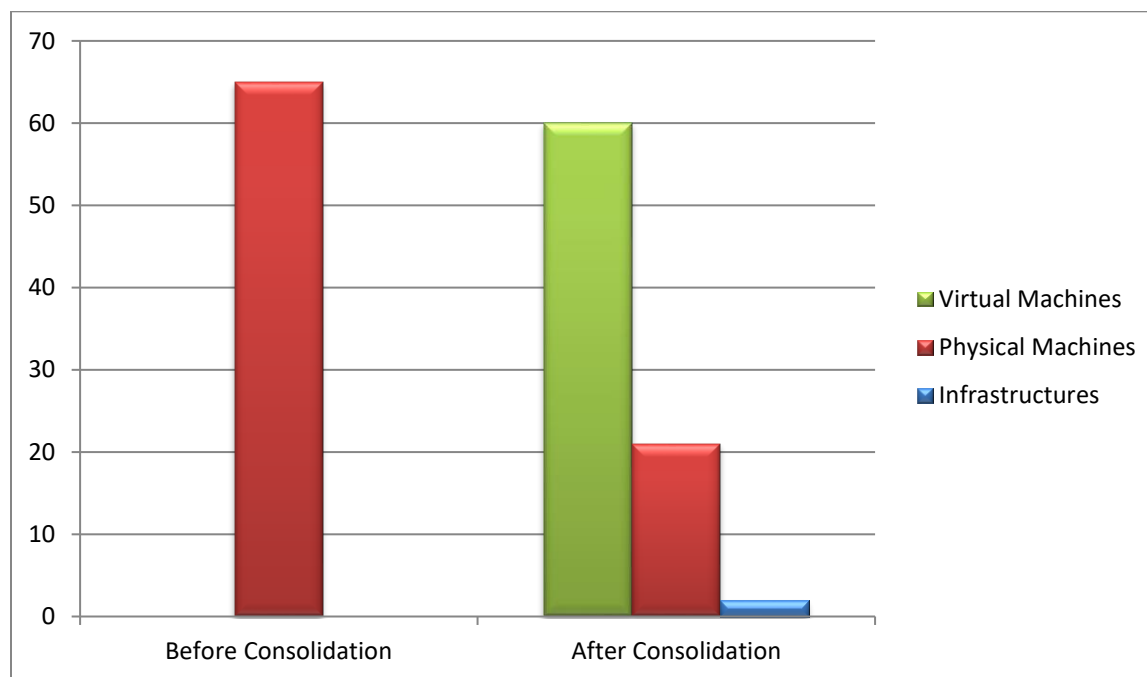


Figure 2. Virtual Machines, Physical Machines, and Infrastructures Before and After Consolidation

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 virtualization 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 virtualization hosts, 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 System Center 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.

Windows Server 2008 R2 Hyper-V Technology

Windows Server 2008 R2 SP1 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 virtualization host hardware is greatly enhanced when compared to Virtual Server 2005 R2 or Windows Server 2008 R2 Hyper-V. Windows Server 2008 R2 SP1 Hyper-V technology provides the following features:

- Dynamic Memory enables customers to better utilize the memory resources of Hyper-V hosts by balancing how memory is distributed between running virtual machines. Memory can be dynamically reallocated between different virtual machines in response to the changing workloads of these machines.
- Additional hardware support now allows up to 64 logical processors in the host processor pool
- Live Migration allows you to move running VMs from one Hyper-V physical host to another without any disruption of service or perceived downtime.
- Cluster Shared Volumes enable multiple Windows Servers to access SAN storage using a single consistent namespace for all volumes on all hosts.
- Dynamic VM storage allows hot plug-in and hot removal of storage while a VM is running.
- 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 virtualization 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 Windows Server 2008 R2 Hyper-V provide a platform that is highly scalable, easily managed, and very reliable.

Windows Server 2008 R2 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 virtualization 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. For more information and a link to the Microsoft Deployment Toolkit to help you automate your deployment and provisioning process, see the [Deployment TechCenter](http://go.microsoft.com/fwlink/?LinkID=105753) at <http://go.microsoft.com/fwlink/?LinkID=105753>.

Microsoft Private Cloud Fast Track Program

Microsoft Private Cloud Fast Track solutions provide a turnkey approach for delivering preconfigured and validated implementations of the private cloud. With local control over data and operations, IT professionals can dynamically pool, allocate, and manage resources for agile infrastructures-as-a-service (IaaS). In addition, business unit managers can deploy line-of-business applications with speed and consistency using self-provisioning (and decommissioning) and automated data center services in a virtualized environment.

If you are curious about consolidation recommendations using a Microsoft Private Cloud Fast Track Solution, the MAP Toolkit offers a separate set of consolidation features, assessments, and reports for Private Cloud Fast Track.

Management Technologies

The System Center family of management technologies provides the best tools for managing your IT environment and virtualized infrastructure. For more information about any of the technologies described in this section, see the [System Center](http://go.microsoft.com/fwlink/?LinkId=106526) site at <http://go.microsoft.com/fwlink/?LinkId=106526>.

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 R2

Virtual Machine Manager 2008 R2 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 R2 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:

- Virtualization host model
- Current server utilization
- Consolidation recommendations

Virtualization Host Model

When you ran the Server Virtualization and Consolidation Wizard, you provided the hardware configuration (model) for the virtualization hosts. This model is used for each of the virtualization 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 virtualization host, run the wizard again and increase the hardware resources specified for the virtualization host model.

Table 1. Host and Guest Utilization Thresholds

Property	Value
CPU Utilization Rate (%)	100
Memory Utilization Rate (%)	100
Disk I/O Per Second - IOPS Utilization Rate (%)	100
Storage Utilization Rate (%)	100
Network Throughput Utilization Rate (%)	100

Table 2. Infrastructure Settings

Characteristics	Configuration
Number of Hosts	8
Total Disk I/O Per Second (IOPS)	50000
Total SAN Storage (TB)	4
Total Network Throughput for virtual machine traffic (Gbps)	20

Table 3. CPU of the target host machine

Central Processing Unit Characteristics	Configuration
CPU	AMD Opteron 6168
CPU Speed (GHz)	1.90
CPU Count	2
Cores per CPU	12
Hyperthreads Per Core	1
L2 Cache Size (KB)	7168
L3 Cache Size (KB)	24576

Table 4. Physical disk and IOPS for the target host machine

Storage Characteristics	Configuration
Max Disk IOPS	
Total Available Storage (GB)	

Table 5. Network adapters and memory for the target host machine

Network Adapter and Memory Characteristics	Configuration
Total Network Throughput available for guests (Mbps)	10240
Amount of memory (GB)	40.00

Current Server Utilization

Table 6 displays summary utilization information for the machines selected in the assessment. For any summary groups with utilization values equal to 0 or “No Data” you will have to collect performance data again for the related machines using the Performance Metrics Wizard. If computers are unplaced due to inadequate resources on the virtualization 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 6: Current Server Utilization

Placement Type	Number of Servers	Average CPU (%)	Average Memory (GB)	IOPS	Average Network Throughput (MB/s)
Total number of servers	65	3.82	8.36	41.56	0.17
Unplaced: Missing Inventory Data	0	No Data	No Data	No Data	No Data
Unplaced: Missing Performance Data	0	No Data	No Data	No Data	No Data
Unplaced: Other Errors	0	No Data	No Data	No Data	No Data
Unplaced: Utilization exceeds host thresholds after virtualization	5	4.63	45.8	89.83	1.24
Virtualization Candidate	60	3.75	5.24	37.53	0.08

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 R2 to manage the service and placement of virtualization host.

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 16 virtualization hosts running Hyper-V R2 SP1 will have the expected utilization listed in the following table.

Table 7: Infrastructure Utilization After Virtualization

Infrastructure Name	Disk I/O Utilization (IOPS)	Disk Space Utilization (GB)	Network Utilization (MB/s)
Infrastructure1	1439.95	4087.77	2.79
Infrastructure2	316.93	1710.92	0.76

Table 8: Host Utilization After Virtualization

Infrastructure Name	Virtualization Host Name	CPU Utilization (%)	Memory Utilization (GB)	IOPS	Network Throughput (MB/s)
Infrastructure1	Host1	11.23	38.66	235.17	0.48
Infrastructure1	Host2	13.94	39.29	876.75	0.77
Infrastructure1	Host3	8.16	37.32	83.75	0.22
Infrastructure1	Host4	7.42	33.76	98.11	1.08
Infrastructure1	Host5	9.44	32.19	211.55	0.26
Infrastructure1	Host6	7.11	32.98	122.53	0.7
Infrastructure1	Host7	10.02	25.14	65.55	0.13
Infrastructure1	Host8	0	0	0	0
Infrastructure2	Host9	8.26	39.86	238.91	0.31
Infrastructure2	Host10	12.93	39.63	92.45	0.46
Infrastructure2	Host11	5.51	5.48	49.66	0.05
Infrastructure2	Host12	0	0	0	0
Infrastructure2	Host13	0	0	0	0
Infrastructure2	Host14	0	0	0	0
Infrastructure2	Host15	0	0	0	0
Infrastructure2	Host16	0	0	0	0

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 virtualization host.

Management Technology

From the assessment results, the MAP tool has determined that you will need at least 16 virtualization hosts to consolidate existing workloads at current utilization levels. We recommend that you use Virtual Machine Manager 2008 R2 (Enterprise Edition) to manage your virtualization hosts and virtual machines. We also recommend that you use System Center Operations Manager 2007 R2 to manage and monitor your physical machines and virtualization hosts.

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.

Hyper-V technology gives you 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 virtualization host sizing assessment using [Virtual Machine Manager 2008 R2](#). For more information, go to <http://go.microsoft.com/fwlink/?LinkId=106520>.
2. Decide which version of [Windows Server 2008 R2](#) you are going to deploy on the virtualization 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>.