



# Server and Storage Sizing Guide for Windows 7

TECHNICAL NOTES

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## About this Document

This paper is designed to help organizations size their server and storage resources for a Virtual Desktop Infrastructure (VDI) implementation for Windows 7.

This paper provides a high-level overview of the basic steps in sizing the infrastructure and additional items to consider.

**Note:** It is assumed the reader is already familiar with VDI and the related benefits of the technology. If an introduction to VDI is necessary, please see <http://www.vmware.com/products/vdi>

## Introduction

Sizing the server and storage infrastructure for a virtual desktop infrastructure (VDI) can be a complex task and there are no easy answers.

In this paper, we will be focusing on a Windows 7 implementation and the first two steps below in the sizing process. References to Windows XP are also included for those looking to migrate their existing environment to Windows 7.

The key steps in the process are as follows:

- Baseline existing desktop environment
- Estimate VDI hardware needed
- Build proof-of-concept infrastructure
- Validate hardware estimates

## Baseline Existing Desktop Environment

The first step in the process is to gather baseline information on the key user groups that have been identified as good candidates for a VDI environment. The purpose of this step is to understand the performance characteristics of the target users' workload — for instance: What applications do they need? Are the applications more CPU- or memory-intensive? Are there an excessive number of storage operations? What type of network load is being generated by the end user's activities?

**Note:** These steps are applicable whether you're looking at implementing a VDI environment or looking at migrating an existing Windows XP VDI environment to a Windows 7 VDI environment.

A performance monitoring tool will help you gather the necessary baseline information. There are several tools including third-party tools that are out there that can assist you with this process, such as: VMware's Capacity Planner, Liquidware Labs' Stratusphere Fit™, and Lakeside Software's SysTrack. In addition, both Windows XP and Windows 7 ship with the Performance Logs and Alerts tool, called Perfmon. Perfmon allows administrators to capture and graph various performance statistics from both local and remote computers.

Additional information on Perfmon and key attributes to monitor can be found here:

[http://www.vmware.com/files/pdf/VMware\\_VDI\\_Server\\_and\\_Storage\\_Sizing\\_120508.pdf](http://www.vmware.com/files/pdf/VMware_VDI_Server_and_Storage_Sizing_120508.pdf)

## Estimate VDI Hardware Needed

### CPU

For a typical Windows 7 implementation, one virtual CPU should be sufficient. There may be a case for two virtual CPUs if you have installed Windows 7 64-bit, are working with extremely large data sets, or are a Power User and running SAP or Oracle clients or some other CPU-intensive applications. You can monitor these esxstop counters to determine if two virtual CPUs are warranted: PCPU Used, PCPU Util and Core Util.

To calculate the number of VMs per server based on the number of cores, use the following formula:

$$(\text{VMs} / \text{core} * \text{cores/socket} * \# \text{ sockets})$$

### Memory

For a typical Windows 7 implementation, 1GB of RAM should be sufficient. The Native OS alone is approximately 400MB. The goal is to allocate enough memory to hold the set of applications and data while keeping the memory over-commit ratio as low as possible to avoid Windows having to page because there is not enough RAM available in the guest OS. Power Users could require 2GB or more of RAM.

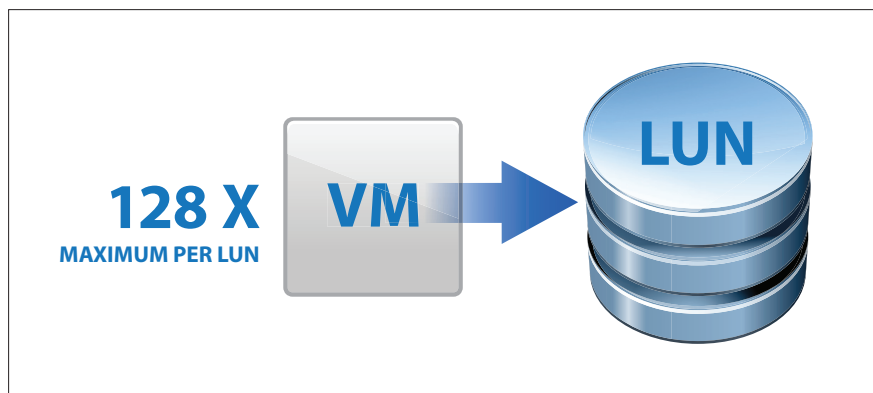
As a guideline, for balance between performance and memory utilization, the virtual machine should have approximately 25 percent more RAM allocated than the maximum active load on the virtual machine. This will avoid Windows writing data to its page file. This keeps the active working set (applications and data) for the virtual machine in RAM instead of virtual memory space.

To calculate the number of VMs per server based on RAM, use the following formula:

$$(\text{HostRAM} / \text{GuestRAM} * \text{GRAM/HRAM Ratio})$$

### Storage

With the Windows 7 64-bit version, an additional 4GB of disk space is required over the Windows 7 32-bit version. This will decrease the number of VMs on your server, unless additional storage can be added.



**Figure 1** - Maximum 128 VMs per LUN for Fiber Channel and an unlimited number of VMs for NFS and iSCSI

Depending on the operations performed and applications that are used, Windows 7 could produce additional I/O especially during boot/logon and the first time applications are opened.

It is extremely important that you baseline your existing environment, build a proof-of-concept infrastructure and run tests to validate your estimates for additional hardware, memory and storage that will be required.

VMware View 4.5 and above offers a tiered storage option. You can place View Composer replicas on Solid State Disk Drives and linked clones on less-expensive drives like SATA. By taking advantage of the new tiered storage option, intensive operations such as provisioning many linked clones at once can be accelerated.

For more information, consult Storage Considerations for VMware View:  
[http://www.vmware.com/files/pdf/view\\_storage\\_considerations.pdf](http://www.vmware.com/files/pdf/view_storage_considerations.pdf)

## Virtual Desktop Configuration

There is no one Virtual Desktop configuration that will meet everyone's needs. This is why gathering baseline information about your existing environment is so important. Based on the information above and the VMware View 4.5 Architecture Planning Guide, configuration guidelines for standard Windows 7 and XP virtual desktops running in remote mode are provided in the table below.

**Note:** Information is provided on XP is for those looking to migrate their existing VDI environments to Windows 7.

ITEM	WINDOWS 7	WINDOWS 7	XP
Operating system	32-bit Windows 7	64-bit Windows 7	32-bit Windows XP (with the latest server pack)
RAM	1 GB	2GB	1GB (512MB low end, 2GB high end)
Virtual CPU	1	1 or 2*	1
System disk capacity	20GB (slightly less than standard)	20GB (slightly less than standard)	16GB (8GB low end, 40GB high end)
User data capacity (as a persistent disk)	5GB (starting point)	5GB (starting point)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic SAS (the default)	LSI Logic SAS (the default)	LSI Logic (not the default)
Virtual network adapter	E1000 (the default)	E1000 (the default)	Flexible (the default)

**Table 1.** Desktop Virtual Machine Examples for Windows 7 and XP, Hosted on an ESX 4.1 Server

\*See CPU section above for more information.

The amount of system disk space required depends on the number of applications required in the base image. The amount of disk space required for user data depends on the role of the end user and organizational policies for data storage. If you use View Composer, this data is kept on a persistent disk.

## Virtual Desktop Configuration by User Type

If you haven't already classified your user base, you will want to. This step will help simplify your analysis as well as your deployment. Users have been classified into three basic categories:

- Task-based workers: Limited applications and limited performance requirements.
- Knowledge workers: Standard office applications and medium performance requirements.
- Power users: Compute-intensive applications and high performance requirements.

The IOPS listed in the table below are guidelines for Windows 7. The IOPS generated will vary based on your definition of the worker types and the applications they use, the environment, storage and whether or not the VMs are optimized.

USER/WORKER TYPE	APPLICATIONS (Open simultaneously)	VM CONFIG	IOPS
Task-based (Light)	Limited (1-5 apps open at one time)	1 Virtual CPU 1GB Memory	3-7
Knowledge (Medium)	Standard office (5+ apps open at one time)	1 Virtual CPU 1GB Memory	8-16
Power User (Heavy)	Compute intensive (5+ apps open at one time)	1 Virtual CPU 2GB Memory	17-25
Power User (Heavy)	Compute intensive (5+ apps open at one time)	2 Virtual CPU 2+GB Memory	26+

## Optimizing Windows 7

Microsoft Windows is a complex operating system incorporating thousands of built-in features. Many of the user convenience features were designed for a dedicated resource usage model, such as a dedicated physical PC with abundant RAM and CPU resources. When the desktop hardware container moves from a dedicated physical PC to a virtual hosted desktop, it is crucial that each running process provide value to the user experience. It is this point where many of Windows' user convenience features designed to enhance the user experience actually have the opposite effect by taxing the shared resource pool of physical RAM and CPU from the vSphere host, causing poor application performance.

To provide a better user experience and enhance the overall scalability and performance of your VMware View Virtual Desktop Infrastructure, you'll want to optimize your Windows 7 image. You will find the VMware View Optimization Guide for Windows 7 here: <http://www.vmware.com/files/pdf/VMware-View-OptimizationGuideWindows7-EN.pdf>

## VMware View Requirements

The following information has been gathered from the View 4.5 Installation Guide. Please consult the latest Installation Guide for the most up-to-date data.

You will want to install the following on your Windows 7 VM:

- View Agent component assists with session management, single signon and device redirection. You must install View Agent on all virtual machines, physical systems and terminal servers that will be managed by View Manager.
- Important: If you use Windows 7 in a virtual machine, the virtual machine must be hosted on an ESX 4.0 or ESX 4.1 server. For ESX 4.0, the version must be ESX 4.0 Update 2 or higher. For ESX 4.1, the version must be ESX 4.1 or higher.
- View Client is used to connect Users to their View desktops. You must install View Client or View Client with Local Mode on a supported operating system.
  - View Client with Local Mode is supported only on Windows systems and only on physical computers. In addition, to use this feature, your VMware license must include View Client with Local Mode.
  - A Windows 7 or Windows Vista View desktop that is created on an ESX 3.5 host cannot produce 3D and Windows Aero effects. This limitation applies even when the desktop is checked out for local use on a Windows 7 or Windows Vista client computer. Windows Aero and 3D effects are available only if the View desktop is created using vSphere 4.x.

## Other Design Considerations

### User Profiles

User profiles include all user-specific settings of a user's environment, including program items, network connections, printer connections, mouse settings, window size and position, screen colors and desktop preferences.

There are three types of profiles available for use in a terminal services environment from Microsoft—local, roaming and mandatory profiles. Which profile type an organization decides to go with will be dependent on the decision made about the overall environment.

- Local profiles are used when the settings in the profile don't matter as a user roams from desktop to desktop.
- Roaming profiles allow user settings to be persistent across logins and across machines, ensuring a consistent user experience no matter which desktop a user logs into.
- Mandatory profiles provide groups of users with a single profile and changes to the profile are discarded upon logoff.

In addition to deciding on the type of profile(s), the size of the profile is also important when using roaming profiles. Administrators have the ability to exclude folders from a profile, while redirecting others to the network, and using policies to configure settings such as Temporary Internet Files Settings to minimize the size of the profile. Roaming and Mandatory profiles should be measurable in KB rather than MB. A properly designed and implemented profile solution will help to ensure quick logon times for users.

Third-party solutions are available to help you plan and manage user profiles. One solution is Liquidware Labs' ProfileUnity product which not only offers profile support and fast logins, it also offers powerful automated desktop configuration and deployment integrity features such as user profile management, migration, and portability of any Windows XP/2000/Vista/7 session.

## Migration from XP to Windows 7

For those organizations that are planning a migration from Windows XP to Windows 7, upgrading 100s or 1000s of desktop devices is costly and time consuming. Windows XP applications will not automatically be compatible with Windows 7. For example Web-based apps that work great on Internet Explorer 6, may not run on Internet Explorer 8 with Windows 7. Additionally, many organizations have customer applications driving their businesses; recoding and recertifying their applications for Windows 7 is a time-consuming and costly endeavor.

Start the transition to Windows 7 by virtualizing your existing Windows applications with VMware ThinApp™. Application virtualization removes the dependency of applications from the underlying operating system so you can run a single application across multiple Windows operating systems. This helps to streamline application migration, ease the burden of cost and complexity for IT and create a seamless transition for end users.

Information about Windows 7 Migration can be found here: <http://www.vmware.com/solutions/desktop/windows7-migration.html>

## Applications – ThinApp

VMware ThinApp simplifies application delivery by isolating applications from the underlying operating system and plugging directly into existing virtual and physical desktop management tools and infrastructure. VMware ThinApp encapsulates applications inside a Virtual OS that transparently merges a virtual system environment with the real system environment.

VMware ThinApp now supports Windows 7. You can now package legacy applications from older versions of Windows such as Windows XP and Windows Vista into VMware ThinApp packages for deployment on Windows 7. By ThinApp'ing your current applications, you'll avoid costly recoding and regression testing and accelerate deployment of business applications to Windows 7 more quickly and securely.

Additional information about VMware ThinApp can be found here: <http://www.vmware.com/products/thinapp/overview.html>

# Build Proof-of-Concept Infrastructure and Validate Hardware Estimates

The last two steps in sizing your server and storage infrastructure are:

- Build a proof-of-concept infrastructure
- Validate hardware estimates

Additional information about these steps can be found here: [http://www.vmware.com/files/pdf/VMware\\_VDI\\_Server\\_and\\_Storage\\_Sizing\\_120508.pdf](http://www.vmware.com/files/pdf/VMware_VDI_Server_and_Storage_Sizing_120508.pdf)

## Summary

Whether you are looking at implementing a VDI environment for the first time with Windows 7 or migrating from an existing Windows XP VDI environment, it is important to take the time and follow the steps as outlined in the VMware VDI Server and Storage Sizing Guide. Be sure to take extra care in designing the storage. Depending on the storage you have in your environment, check with the Vendor; chances are, they've created Reference Architectures that will provide you with additional guidelines for number of VMs, etc.

## About the Author

Fred Schimscheimer is a Senior Technical Marketing Engineer at VMware. In this role, he works as part of the product marketing team as an expert in storage and workloads for virtual desktop solutions.

## Resources

VMware View Optimization Guide for Windows 7

<http://www.vmware.com/files/pdf/VMware-View-OptimizationGuideWindows7-EN.pdf>

VMware Compatibility Guide

[http://partnerweb.vmware.com/comp\\_guide2/search.php](http://partnerweb.vmware.com/comp_guide2/search.php)

VMware View Installation Guide

[http://www.vmware.com/pdf/view45\\_installation\\_guide.pdf](http://www.vmware.com/pdf/view45_installation_guide.pdf)

VMware View Architecture Planning Guide – View 4.5, View Manager 4.5, View Composer 2.5

[http://www.vmware.com/pdf/view45\\_architecture\\_planning.pdf](http://www.vmware.com/pdf/view45_architecture_planning.pdf)

Server and Storage Sizing For VMware VDI: A Prescriptive Approach

[http://www.vmware.com/files/pdf/VMware\\_VDI\\_Server\\_and\\_Storage\\_Sizing\\_120508.pdf](http://www.vmware.com/files/pdf/VMware_VDI_Server_and_Storage_Sizing_120508.pdf)

Virtual Desktop Infrastructure – A Guide to Implementation Best Practices

[http://www.vmware.com/files/pdf/vdi\\_implementation\\_best\\_practices.pdf](http://www.vmware.com/files/pdf/vdi_implementation_best_practices.pdf)

Storage Considerations for VMware View – Best Practices

[http://www.vmware.com/files/pdf/view\\_storage\\_considerations.pdf](http://www.vmware.com/files/pdf/view_storage_considerations.pdf)

Interpreting esxtop Statistics

<http://communities.vmware.com/docs/DOC-9279>

### Performance Monitoring Tools

VMware Capacity Planner

<http://www.vmware.com/files/pdf/VMware-Capacity-Planner-DS-EN.pdf>

Lakeside Software, Inc. – SysTrack

<http://www.lakesidesoftware.com/VDI%20Assessment%20and%20Planning.php>

Liquidware Labs – Stratusphere Fit™

<http://liquidwarelabs.com/products/stratusphere.asp>

### Profile Tools

Liquidware Labs ProfileUnity™

<http://www.liquidwarelabs.com/products/profileunitypro.asp>

