

ODFT - Enterprises

Feasibility Study of Implementing Next Generation Server Operating System

Comparison study of:

Windows 2003 Enterprise Server vs. Red Hat Enterprise Linux Advance Server

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Table of Contents

Title Page.....Page 1

Notice and Disclaimer.....Page 3

Executive Summary.....Page 4

System Requirements.....Pages 5-11

Cost & Support.....Pages 12-15

Product Updates.....Pages16

Services Offered.....Pages 17-19

System Configurations.....Pages 20-24

Security.....Pages 25-29

Systems Administration.....Page 30

Conclusion.....Pages 31-33

Bibliography.....Page 34

Disclaimer.....Page 35

Notice

This paper is being presented by ODFT - Enterprise as a case study between Microsoft's Windows 2003 Enterprise edition and Red Hat Enterprise Linux Advance server. The case paper presented here is the rightful property of ODFT – Enterprises and is being produced to be reviewed by Chrys de Almeida of TCOM 2044 Legacy systems for the purpose of determining what operating system will be the better solution for the Server OS aspect of the classes' computing needs. This paper is not be reproduced or distributed unless the explicit permission of ODFT – Enterprise is given.

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Executive Summary

The purpose of this paper is to publish the research and testing results of a comparison study between two server operating systems (OS). The operating systems that were selected for review by ODFT – Enterprises will be Microsoft's Windows 2003 Enterprise Edition and Red Hat Enterprise Linux Advance Server edition. ODFT – Enterprises was commissioned by Chrys de Almeida of TCOM 2044 Legacy System to research the chosen operating systems and to compare them based on certain criteria. The criteria being:

- System Requirements
- Cost
- Support
 - Help desk (phone support) - Done
 - Online support (websites, ex. Google search)
 - Product Updates
- Services offered
- System Configurations
- Security
 - Security Advisories and Response time
 - System Administration
- Conclusion

The Research done was a mixture of both documentation widely available on the manufactures' websites, www.microsoft.com and www.redhat.com listing the various components and features of their respective products. In addition to the research of product information located on the manufactures' websites, ODFT – Enterprise continued with various online research methods such as: www.google.com to compare the operation systems (OS) by reports offered by various enthusiasts, which was used to gain insight into 3rd party support for configuration and troubleshooting of the operating systems. However, it should be noted that this method can be slightly dangerous simply because of potential biased reviews. The best example being, that UNIX / Linux enthusiasts are known to hate all things Windows, and vice versa.

One of the key elements of this report is to test the operating systems themselves, to experience how they function from the installation process to the final configuration of the various services that are to be implemented. Most importantly, the security issues of the operating systems selected were probed for potential exploits that they may be vulnerable to, and the way the systems are administrated.

System Requirements

In this section the base (minimum) system requirements for the selected operating systems (OS) will be discussed. By knowing what the base system requirements are, helps to determine whether or not the current equipment in use is capable of installing the selected operating system; so that a production server can be put into operation.

The recommended requirements according to the manufactures' websites describe what is needed in order to get the full potential from the product; will they be able to run on current hardware and whether they will be able to run on the next generation of server technology. In this section we will review the following:

- Minimum System Requirements
- Recommended System Requirements
- Platform Support

First, we look at the minimum system requirements for Microsoft's Windows 2003 Enterprise server edition.

Requirement	Enterprise Edition
Minimum CPU Speed	<ul style="list-style-type: none">• 133 MHz for x86-based computers• 733 MHz for Itanium-based computers*
Recommended CPU Speed	733 MHz
Minimum RAM	128 MB
Recommended Minimum RAM	256 MB
Maximum RAM	<ul style="list-style-type: none">• 32 GB for x86-based computers• 64 GB for Itanium-based computers
Multiprocessor Support **	<ul style="list-style-type: none">• Up to 8
Disk Space for Setup	<ul style="list-style-type: none">• 1.5 GB for x86-based computers• 2.0 GB for Itanium-based computers

* **Important:** The 64-bit versions of Windows Server 2003, Enterprise Edition and Windows Server 2003, Datacenter Edition are only compatible with 64-bit Intel Itanium-based systems. They cannot be successfully installed on 32-bit systems.

** Windows Server 2003 may not use multiple processors with some Intel Pentium Pro or Pentium II Processors. For more information, please review <http://support.microsoft.com/default.aspx?scid=kb:en-us:319091>

The minimum system requirements for Red Hat Enterprise Linux Advance server:

Requirement	Red Hat Advance server
Minimum CPU Speed	<ul style="list-style-type: none"> • 300 MHz for x86-based computers • 733 MHz for Itanium-based computers
Recommended CPU Speed	733 MHz
Minimum RAM	256 MB
Recommended Minimum RAM	256 MB
Maximum RAM	<ul style="list-style-type: none"> • 64 GB for x86-based computers • 96 GB for Itanium-based computers*
Multiprocessor Support **	<ul style="list-style-type: none"> • Up to 16 for x86 based computers* • Up to 8 for Itanium Based computers
Disk Space for Setup	<ul style="list-style-type: none"> • Varied Install depending on required Services • 2.0 GB for full installation of all services

*16 physical CPUs or 8 Hyperthreaded CPUs; AMD K6 (i586) is not supported, Red Hat Enterprise Linux WS and ES support up to 2 physical CPUs (4 Hyperthreaded) CPUs per system

Here is a side by side comparison of the various platforms (CPU's) and memory configurations that the two operating systems are capable of running on. This section is not so much as to show what the current requirements are, but if upgrades are required for the servers in the future, the following chart shows what platforms will be supported.

Features

Key: ● = Feature included ◐ = Feature partially supported ○ = Feature not included

Feature	Win 2k3 Enterprise Edition		Red Hat Advance Server	
Hardware Specifications				
64-Bit Support for Intel® Itanium™-Based Computers¹	●		●	
Hot Add Memory^{2,3}	●		○	
Non-Uniform Memory Access (NUMA)³	●		●	
32 GB RAM Maximum	●		○	
64 GB RAM Maximum⁵	◐		●	
96 GB RAM Maximum⁶	○		●	
2-Way SMP	●		●	
4-Way SMP	●		●	
8-Way SMP	●		●	
16-Way SMP⁷	○		●	
Hard Drive Support	Minimum	Maximum	Minimum	Maximum
IDE HDD	1	24	0	20
SCSI HDD	1	256	0	256
SATA HDD	1	24	0	2
Cluster Suite nodes	Minimum	Maximum	Minimum	Maximum
	2	8	2	8

¹ Both Operating Systems - Applies to 64-bit versions only.

² Windows 2003 Enterprise - Not supported in 64-bit versions of Windows Server 2003.

³ Both Operating Systems - May be limited by lack of support by OEM hardware.

³ Both the 32-bit version of Datacenter Edition and the 64-bit version of Enterprise Edition support up to 64 GB RAM.

⁵ Windows 2003 Enterprise - The 64-bit version of Datacenter Edition supports up to 512 GB RAM.

⁶ Red Hat Enterprise Linux Advance Server - 96Gb applies to HP Integrity systems. Maximum memory for Intel Tiger-based systems is 32GB

⁷ Red Hat Enterprise Linux Advance Server - 16 physical CPUs or 8 Hyperthreaded CPUs; AMD K6 (i586) is not supported, Red Hat Enterprise Linux WS and ES support up to 2 physical CPUs (4 Hyperthreaded) CPUs per system

The system platforms (CPUs) that each operating system is capable of running on yields similar results. Windows 2003 Enterprise Edition and Red Hat Enterprise Advance Server are capable of running on Intel x86, Intel Itanium2 and AMD64 CPUs. It is interesting to note that the minimum (base) requirements favors Windows 2003 Enterprise edition over Red Hat Enterprise Linux Advance server. According to the documentation from Microsoft, Windows Enterprise Edition will run on a P1 133 MHz system with 128 MB of RAM, compared to the Red Hat installation that requires a P2 300 MHz system with 256 MB of RAM. This requirement for Red Hat Enterprise Linux Advance server may only refer to it while running in graphical user interface (GUI) mode; while in command line interface (CLI) the system requirements should be much lower.

The minimum (base) system requirements only show that the OS is backwards compatible with previous hardware platforms. As for using the minimum system requirements, if a production server that uses the minimum system requirements is still in operation before upgrading to new server operating system takes place, a scheduled time to retire the system and an upgrade should take place.

Looking at what platforms (CPUs) are supported by both operating systems, Red Hat Enterprise Linux seems to have Windows 2003 beaten with a wide arrange of supported platforms (CPUs) and maximum potential system configurations. It should be noted that with the Red Hat distribution its support is limited by a factor of what memory configurations can be used with what processing technology as shown in the diagram below.

		Minimum Memory	Maximum Memory	Comments
X86	Memory:	256MB	64GB	Maximum varies with chosen kernel; Red Hat Enterprise Linux ES supports up to 8GB
	CPUs:	1 (300MHz, i686)	16	16 physical CPUs or 8 Hyperthreaded CPUs; AMD K6 (i586) is not supported, Red Hat Enterprise Linux WS and ES support up to 2 physical CPUs (4 Hyperthreaded) CPUs per system
Itanium2 *	Memory:	512MB	96GB	96Gb applies to HP Integrity systems. Maximum memory for Intel Tiger-based systems is 32GB
	CPUs:	1	8	Red Hat Enterprise Linux WS for Itanium supports up to 2 CPUs per system
AMD64	Memory:	512MB	16GB	
	CPUs:	1	4	Limited to only quad CPU configurations

**Red Hat Enterprise Linux Advance Server CPU to Memory Configurations

By examining the previous table, it would seem that Red Hat Enterprise Advance server is limited in its support for AMD64 platforms with memory configurations, since AMD64 CPUs are limited to quad systems only. Without giving the impression of a bias, the research performed on Microsoft's Windows 2003 Enterprise Edition white pages and with Google search, it appears that there is no limitation with a CPU / Memory configuration as shown in the table below.

		Minimum Memory	Maximum Memory	Comments
X86	Memory:	128MB	32GB	Supports on newer x86 systems the possibility of 64 GB of memory
	CPUs:	1 (133Hz, i686)	16	
Itanium2 *	Memory:	512MB	64GB	Support for 64bit Itanium processing Technology.
	CPUs:	1	8	
AMD64	Memory:	512MB	32GB	
	CPUs:	1	4	Limited to only quad CPU configurations

If a production server is going to favor RAW data processing such as a database server that will do CPU extensive data mining then Red Hat Enterprise Advance server, with the proper CPU / Memory configuration would have a greater advantage over Windows 2003 Enterprise Edition. However, with the CPU / Memory configuration favoring a broader range of support for Windows 2003 Enterprise Edition, it has its advantages as well.

With the CPU / Memory configurations that are supported by Windows 2003 Enterprise edition and Red Hat Enterprise Advance Server now discussed, the drive configurations that are supported by each operating system will be reviewed.

Choosing what operating system has the advantage while configuring it for a purely storage role, such as a network file dump (example: creating mapped user home directories) or as a FTP server. Which operating system will provide the best support for storage options, and what Hard Drive configurations are compatible.

First we examine Microsoft's Windows 2003 Enterprise edition:

IDE Disks	1	24	Number of Drives associated to available naming pool C ~ Z
SCSI Disks	1	256	
SATA Disks	1	24	Number of Drives associated to available naming pool
Devices in a RAID/MD device		27	
Block device size		1TB	
File system size	800MB	1TB	Quoted minimum is for a custom installation. Sparse files can be up to 4TB

*Microsoft Windows 2003 Enterprise Edition disk support

Red Hat Enterprise Linux Advance server:

IDE Disks	0	20	
SCSI Disks	0	256	
SATA Disks	0	2	
Devices in a RAID/MD device		27	
Block device size		1TB	
File system size	800MB	1TB	Quoted minimum is for a custom installation. Sparse files can be up to 4TB

*Red Hat Enterprise Linux Advance Server disk support

Both operating systems offer the possibility of installing a large quantity of storage options. With both Windows 2003 and Red Hat Linux, more than 20 drives can be added. This is the physical limitation of the operating system; however, the physical limitation of the server that will have the disks installed may have a lower ceiling. The factors that determine the amount of drives that can be installed would be the size of the chassis housing the drives, to the power supply, etc. These factors are beyond the scope of this report and will not be covered.

As for running 20 IDE hard drives within a server environment: it is highly unlikely due to their lower performance compared to their Serial ATA and SCSI drive cousins. The requirement for running 20 + IDE drives is not a major factor of this review. However, Windows 2003 Enterprise Edition has the ability to run more than 2 Serial ATA hard drives with faster speeds, higher throughput promised from new Serial ATA technology and the potential for a move into the server market to replace existing SCSI drives, an operating system (OS) with support for a large number of drives would be of an advantage.

There is one advantage that Linux does have over Windows and it is the advantage that you can run a server without having a physical hard drive installed on the computer. With certain Linux distributions a bootable operating system can be run from a CD and will use system memory as a virtual hard drive to run the system. As this is an advantage for Linux, however, if a power failure or accidental restart did occur all processes that were running would be lost along with any data that was being processed.

Cost

With the cost of the operating system that will be selected being almost on par with the cost associated with purchasing of the servers that will be in use. Before a decision is made, the cost of the Media (the disc), support services (whether it be phone support or email support) and the cost of product updates has to be determined. In this section the aforementioned criteria will be examined:

- Media Cost
- Help support
 - Help desk (phone support)
 - Online support (websites, ex. Google search)
 - Product Updates

The media cost of the operating system that is selected is the cost associated with actual purchasing of the disc and in the case of Microsoft's Windows 2003 Enterprise edition a legitimate CD installation key. There is a misconception in the computing world that Linux is a freely distributed operating system in which you don't have to pay the company distributing the operating system for its use; and that you are free to use their product without having to pay a cost for it.

That is a half truth. Red Hat Enterprise Linux Advance server can be obtained for free without having to pay Red Hat for the distribution; and there are no additional costs for installing it on as many multiple machines as are needed. However, there are costs associated with it, such as Red Hat help support. This will be discussed in a separate section shortly.

The Microsoft Windows Server 2003 licensing model consists of a Server operating system license and incremental Client Access Licenses (CALs) and is designed to allow for complete scalability of your cost in relation to your usage. In addition, Microsoft offers several flexible, cost-effective options for licensing.

Product Offering	U.S. Price*	Description
Windows Server 2003, Enterprise Edition, 32-bit version	\$3,999	Enterprise Server product plus 25 CALs (User or Device, chosen after purchase)

*Estimate retail price, maybe purchased at a reduced cost through one of our software retailers.

**Note – This is the cost for 1 copy of Windows 2003 to be run on 1 server, to install on additional servers, additional licenses must be purchased.

When Windows 2003 Enterprise edition is purchased, the owner of the distribution is granted 25 licenses with their copy. These licenses allow the owner to install Microsoft's Windows 2003 Enterprise edition on as many servers that are required up to a maximum of 25; if it is required to be installed on more than 25 servers, additional licenses must be purchased.

Product Offering	Processor Support	Standard Edition	Premium Edition
Red Hat Enterprise Linux Advance Server	Intel x86	\$1499	\$2499
	Intel Itanium 2 and EM64T, AMD64, IBM Power Series	\$1992	\$2998

*Retail price that is issued from Red Hat website, all prices are in USD

**Note – This is the cost for 1 copy of Red Hat Enterprise Advance Server edition to be run on 1 server, to install on additional servers and to receive user support additional license have to be purchase.

A cost comparison between Microsoft’s Windows 2003 Enterprise edition and Red Hat Enterprise Linux Advance server shows that on a per media expense basis, Red Hat is the more cost effective solution; especially if the operating system will only be running on an Intel x86 platform. Since the costs are on a per year basis, if after a years time the contract is to be renewed and the servers in production will be on an Intel Itanium platform, then a new licensing agreement can be purchased at an additional cost.

It should be mentioned that the cost of Windows 2003 Enterprise edition displayed above is the suggested retail price that Microsoft is offering it for. With a quick search of Google for retailers that have Windows 2003 Enterprise edition for sale the prices vary from approx \$700 ~ \$4000 USD.

Compare prices on the Microsoft Windows Server 2003 Enterprise Edition (P72-00001) For PC



Product rating: ★★★★★

Designed for medium to large businesses, Windows Server 2003, Enterprise Edition, is the recommended operating system for servers running applications such as networking, messaging, inventory, and customer service systems; databases; and e-commerce ... [Read full description...](#)

Price range: \$715.88 - \$3998.80

Sort by price: [Low to high](#) | [High to low](#)

** <http://www1.shopping.com/xPC--PD-20740195--NS-1>

With the opportunity to purchase Windows 2003 Enterprise edition at a substantially lower cost than Red Hat Enterprise Advance server with standard support options, Windows 2003 Enterprise edition offers a greater range of support for different hardware platforms.

Determining which operating system to purchase on cost alone is a difficult decision; especially in the case of Red Hat Enterprise Advance server which offers several price ranges for different platform support. However, the decision on what operating system to purchase should not be weighed solely on the cost of the operating system (OS). The support offered by the manufacturer and the cost associated with it should also be a major factor.

In the following section, the support options for Windows 2003 Enterprise edition and Red Hat Enterprise Edition Advance server will be discussed. A comparison of what support options are available for the cost brackets and what additional costs that might have to be paid.

The following table shows the product support that is offered for Microsoft Windows 2003 Enterprise Edition.

Product Offering	Support Available	Cost for support	Additional Information
Windows 2003 Enterprise Edition	Phone Support	\$245	5-pack Phone Support Contract for \$1225 U.S.
	Email Support	\$99	Response within 24 hours

The following table shows the product support that is offered for Red Hat for their Enterprise Advance server. Each edition has a different level of support and a different cost associated with that support.

	Standard Editions	Premium Editions
Red Hat Enterprise Linux Advance Server		
Intel x86	\$1499	\$2499
Intel Itanium2 and EM64T, AMD64, IBM POWER series	\$1992	\$2988
Easy ISOs: OS, Source, and Documentation ISO Images	✓	✓
Red Hat Network Update Module Service 1-year	✓	✓
OS Updates	✓	✓
Installation and Documentation Media (CDs)	✓	✓
Printed Documentation: Installation Guide	✓	✓
Web Support	24/7	24/7
Phone Support	North Am: 9-9 ET M-F	24/7 (severity 1)
Web Response Time/SLA	Global: 9-5 GMT/CET M-F	1 business day
Phone Response Time/SLA	2 business days	1 hour (severity 1)
Scope of Coverage	4 hours	1 year: Premium Coverage
	1 year: Standard Coverage	

The advantage that Red Hat Linux has over Microsoft Windows 2003 would be that the cost associated with its support, is the cost for the distribution. Compared to Microsoft's Windows 2003, where at the best cost of \$700 maybe more cost effective in the short term; however, if product service is required the initial cost begins to rise.

Example being:

Red Hat Enterprise Edition = \$3000 unlimited support for 1 year.

Microsoft Windows 2003 Enterprise Edition = \$700 + (10 x \$245) = \$3150

If one decides not to go with a support option from Red Hat or Microsoft, one can rely on online documentation and various message forms. However, this options leads to the possibility of misleading or outdated documentation. To show the power of online support from using one of the greatest web based tools, www.google.ca , which can be used to assist in researching on how to configure various services for Microsoft Windows 2003 Enterprise Edition and for Red Hat Enterprise Linux Advance server.

Example: How to configure a DNS server

Microsoft Windows 2003 Enterprise Server:



The screenshot shows a Google search interface. The search bar contains the text "Windows 2003 DNS Server". Below the search bar, there are radio buttons for "the web" (selected) and "pages from Canada". To the right of the search bar are links for "Advanced Search" and "Preferences". Below the search bar, a blue bar indicates "Results 1 - 100 of about 884,000 for Windows 2003 DNS Server". The first search result is titled "Microsoft Windows Server 2003 DNS Server Role" and includes a snippet: "... Windows Server 2003 DNS Server Role. The Domain Name System (DNS) is the TCP/IP name resolution service that is used on the Internet. ...". Below the snippet is the URL "www.microsoft.com/technet/prodtechnol/windowsserver2003/serverroles/dnsserver/default.mspx - 23k - Cached - Similar pages".

Red Hat Enterprise Linux Advance Server:



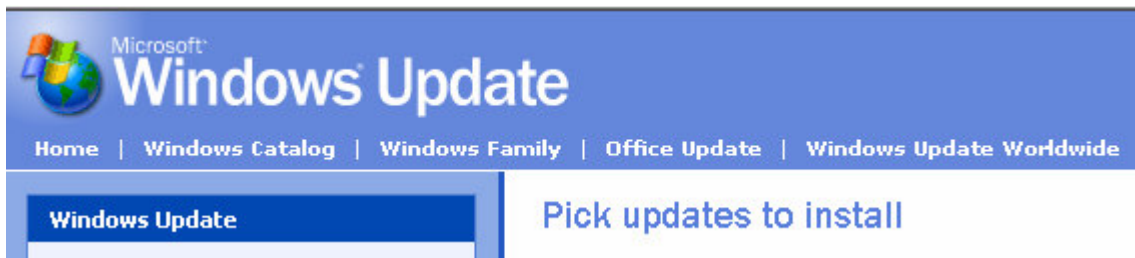
The screenshot shows a Google search interface. The search bar contains the text "RedHat Enterprise Advance Server DNS Server". Below the search bar, there are radio buttons for "the web" (selected) and "pages from Canada". To the right of the search bar are links for "Advanced Search" and "Preferences". Below the search bar, a blue bar indicates "Results 1 - 100 of about 43,300 for RedHat Enterprise Linux Advance Server DNS Server". The first search result is titled "redhat.com | AS" and includes a snippet: "... Enterprise Linux or Fedora Project? ... SMB/NFS); Print; Accelerated Web (tux); Advanced firewall (arptables ... authentication (Kerberos); News; Backup; Dump server (Netdump ...". Below the snippet is the URL "www.redhat.com/software/rhel/as/ - 15k - Cached - Similar pages".

If it is decided to go with the “fend for ourselves” approach for support then Red Hat Enterprise Advance Server will be the most cost effective option. Even if it is decided to go with the support option from Red Hat it would be more cost effective if support is required from Microsoft after a certain number of instances of using said support.

Product Updates

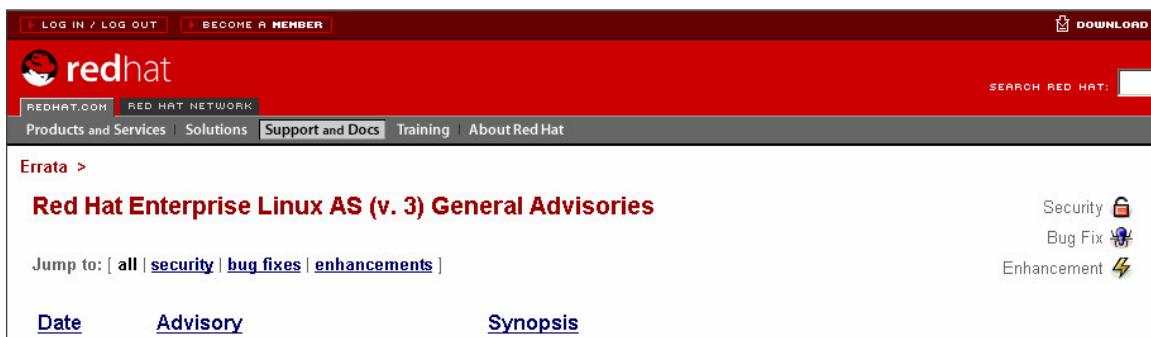
Both products require periodic updates to ensure that any known security exploits have been rectified; or to correct any known bugs that may have been discovered since the products release.

Microsoft offers free with its product an interactive web based updating system, where the user uses the product update service that comes with all Windows Operating systems. Connected to a remote Microsoft server, it selects the required updates that are needed to enhance the functionality of their computer and begins to download them.



Updates can also be downloaded automatically to allow the operating system to update itself; this frees up the user to work on other activities.

Red Hat Linux takes another approach to product updates compared to Microsoft's interactive website that downloads the necessary patches, updates and installs them automatically for the user. In order to install product updates for their Red Hat operating system, the patches and updates have to be manually downloaded from the Red Hat website.



Once the product update has been downloaded, the user must then manually have to run the .RPM packages. There are advantages and disadvantages to this approach. The advantages being: as an administrator there is more control over what packages are going to be downloaded and installed; and the assurance that only the packages that are required are installed. The major disadvantage to this would be the time constraints associated with downloading and manually installing the required packages. The Windows "scan and install" approach makes updating and patching the system a more efficient approach to updating.

Service Offered

In this section, a comparison of the services that are offered by both operating systems; whether or not Red Hat Enterprise Linux Advance Server or Microsoft's Windows 2003 Enterprise Edition are multipurpose operating systems that are capable of handling a diverse set of server roles. In the following pages the services that are offered from both operating systems will be analyzed; also whether cross support between the operating systems are possible for future considerations.

Microsoft Windows 2003 Enterprise Edition

Server Roles

- File and print server.
- Web server and Web application services.
- Mail server.
- Terminal server.
- Remote access and virtual private network (VPN) server.
- Directory services
- Streaming media server.
- Domain Name System (DNS)
- Dynamic Host Configuration Protocol (DHCP) Server
- Windows Internet Naming Service (WINS)
- Streaming media server.

Additional features offered with Microsoft's Windows 2003 include:

- **Active Directory.** [Active Directory](#) is the directory service for the Windows Server 2003 family. It stores information about objects on the network and makes this information easy for administrators and users to find, providing a logical, hierarchical organization of directory information.
- **Management services.** Windows Server 2003 contains management tools, including [Microsoft Software Update Services \(SUS\)](#) and server configuration wizards. In addition, command-line tools let administrators perform most tasks from the command console.
- **Storage management.** Windows Server 2003 introduces features for [storage management](#), making it easier to manage and maintain disks and volumes, backup and restore data, and connect to storage area networks (SANs).
- **Terminal Services.** Terminal Services let you deliver Windows-based applications, or the Windows desktop itself, to virtually any computing device—including those that cannot run Windows.
- **XML Web Services.** [IIS 6.0](#) is an important component of the Windows Server 2003 family. IIS is installed by default in a locked-down state. Security is increased because the system administrator enables or disables system features based on application requirements
- **Networking and communications.** [Networking and communications](#) has never been more critical for organizations. Employees need to connect to the network. Partners, vendors, and others outside the network need to interact efficiently with key resources, and security is more important than ever. Networking improvements and new features in the Windows Server 2003 family extend the versatility, manageability, and dependability of network infrastructures.
- **Enterprise UDDI services.** [Enterprise UDDI services](#), a dynamic and flexible infrastructure for XML Web Services. This standards-based solution enables companies to run their own internal UDDI service for intranet or extranet use. IT administrators can catalog and manage the programmable resources in their network.

Red Hat Enterprise Linux Advance server

Server Roles

- File and print server. (Samba, NFS, FTP, wu-ftp, tftp-server)
- Web server and Web application service (Apache)
- Mail server. (IMAP, Mailman)
- Extended remote shell access/mgmt (SSH)
- Remote access and virtual private network (VPN) server.
- Directory services (LDAP)
- Network authentication
- Domain Name System (DNS) (Bind)
- Dynamic Host Configuration Protocol (DHCP) Server
- Netdump-server
- Advanced Firewall (arptables)
- Remote boot / image server

Additional features offered with Microsoft's Windows 2003 include:

- **Support for Samba 3.** Greatly improved interoperability with Microsoft Active Directory. Is able to join an Active Directory realm as a member server and authenticate user using LDAP / Kerberos. Improved Windows 2000/XP/2003 printing support. Support for migrating from a windows NT 4.0 Domain to a Samba domain and maintaining user, group and domain SIDs. Support for client and server SMB signing to ensure compatibility with default Windows 2003 security settings
- **Bundled Stronghold.** Red Hat's secure web server solution, previously available as a separate layered product for Enterprise Linux AS, has been updated to Apache version 2 and included as part of the base Red Hat Enterprise Linux product set.
- **Management Module.** Provides systems grouping, role-based administration and systems permissions, scheduled actions, custom content channels, and channel/errata management tools. The RHN Management Module is recommended for enterprises wishing to scale their Linux deployments efficiently.
- **Provisioning Module.** In addition to Update and Management functionality, Provisioning adds features to make the deployment and configuration as easy as the management of systems. With functionality such as automated kickstart actions, remote configuration management, snapshot-based rollback, recovery,
- **Logical Volume Manager.** Provides enterprise-strength storage management.
- **Diskless systems.** Supports deployment of diskless clients
- **Enhanced Java.** Using Java implementations from BEA and IBM.
- **Extra packages.** The Extras CD includes IBM Java and BEA JRockit. The RHN Extras channel also provides MySQL and PostgreSQL server components (client-side components are included as part of the base Red Hat Enterprise Linux distribution).

Both of the operating systems (OS), offer similar services; such as is in the case of Microsoft's Windows Active Directory Service and Red Hat Linux Samba Domain. In each case it allows the network administrator to create individual, group and privileged user accounts. Microsoft's and Red Hat's operating systems are capable of running a varied array of services, such as DNS, DHCP, FILE, and PRINT services.

Even with comparable services being offered by both Operating systems there are individual characteristics that are unique to both. In the case of Microsoft's Window's 2003 Enterprise Edition, it would be the Windows Media Services. This package allows a Windows 2003 machine to run as a streaming media server. The Red Hat Enterprise

Linux Advance server also has a few unique packages, such as: being used as a remote server for client to boot to allowing a diskless terminal.

Determining which operating system is the clear winner based on which features are offered is a difficult decision. However, favoring Red Hat Linux would be the advantage of working with Microsoft's products, especially connecting to Microsoft's Windows Active Directory Services, Print services or allowing Windows client machines to access to Red Hat services using SAMBA.

System Configurations

With the pace of business today, having a viable solution in place to meet the requirements of the user is critical. Testing between both operating systems to determine which one can have a set of similar services configured put into operation with the least amount of time. Requiring fewer steps would be an advantage to time strapped system administrators.

The following section uses excerpts from a document provided by VeriTest, a company that was commissioned by Microsoft to audit the amount of time and number of steps required to install and deploy similar configurations of Microsoft Windows Small Business Server (SBS) 2003 and Red Hat Enterprise Linux ES 2.1.

While they are not the same operating system that was chosen for our review, the characteristics between them and the cost in both time and resources to configure both operating systems are extremely similar. The reason for using the VeriTest report to show the amount of time required to configure both Microsoft Windows services and Red Hat Linux services was due to our inability to configure Red Hat Linux is limited by a lack of experience. If we had performed the test ourselves it would have created invalid results. More information on the test that were performed and the steps that were taken can be found in full at the following link:

<http://www.veritest.com/clients/reports/microsoft/mssmbiz.pdf>

Summary of VeriTest Report

A set of deployment tasks were to be complete as part of the installation process of each operating system. The tasks included a set of installation and configuration operations required to set up a typical small business environment containing a single server, client system, and Internet connectivity provided via a hardware router. The tasks included the following:

1. Install the operating system and core services (E-mail, DNS, DHCP, Web, File/Print). Configure an external hardware firewall/router device providing Internet connectivity. Configure the server to host a shared contact directory for the small business client. Configure the server to have a synchronized username/password infrastructure for the applications used in tasks two, three and four. Add a user and a Windows XP client to the network, and send external e-mail.
2. Build a basic performance/usage monitoring and reporting infrastructure for the network
3. Build an intranet web site for information worker collaboration
4. Configure the network such that information workers and administrators can perform remote management and access key business data while working remotely

Engineers audited the amount of time and number of steps required to complete the 4 deployment tasks listed above for each operating system. Microsoft engineers performed the actual deployment tasks for Windows SBS 2003. Microsoft commissioned a third party Linux consulting firm to perform the deployment tasks for Red Hat Enterprise Linux ES 2.1. Both parties reviewed the deployment tasks in advance and designed a set of procedures satisfying the requirements. The Microsoft engineers and Linux consultants executed a dry run of each deployment task before the final audited run.

VeriTest performed the audits on two different operating system configurations – full installation and OEM installation. In the full installation configuration, each operating system was loaded from scratch from CD media onto the server. For the OEM installation configuration, the operating system image was preinstalled on the server before starting the audit. VeriTest audited all four installation and configuration tasks for the full installation configuration and audited task 1 for the OEM installation. Figure 1 shows the elapsed time in hours:minutes:seconds and the number of steps required to execute tasks 1 – 4 for the full installation configuration for each operating system.

	Windows SBS 2003		Red Hat Enterprise Linux ES 2.1	
Task	Time (hr:min:sec)	Steps	Time (hr:min:sec)	Steps
1	3:46:23	94	4:20:44	311
2	0:18:00	9	0:31:19	57
3	0:07:19	0	0:53:35	87
4	0:22:31	22	1:41:26	100
Total	4:34:13	125	7:27:04	555

Figure 1: Full installation configuration audit results

The Windows SBS 2003 full installation required a total of 4 hours 34 minutes 13 seconds and 125 steps to complete all four deployment tasks. In contrast, the Red Hat Enterprise Linux ES 2.1 full installation deployment required 7 hours 27 minutes 3 seconds to complete – almost 2 hours and 53 minutes more than Windows SBS 2003. Additionally, the Red Hat Enterprise Linux ES 2.1 deployment required more than 4.4 times the number of steps (555 vs. 125) compared to Windows SBS 2003. The difference in the number of steps was primarily due to the use of GUI wizards for most tasks in Windows SBS 2003 vs. executing commands through the shell in Red Hat Enterprise Linux ES 2.1.

Also, unlike Windows SBS 2003, the monitoring and reporting solution used for Red Hat Enterprise Linux ES 2.1 did not support sending performance and usage reports to an email address at regular intervals. The Linux consultants estimated that this support could be added through custom scripting at a cost of 24 hours of development time. Figure 2 shows the elapsed time and the number of steps required to execute task 1 for the OEM configuration for each operating system.

Windows SBS 2003			Red Hat Enterprise Linux ES 2.1	
Task	Time (hr:min:sec)	Steps	Time (hr:min:sec)	Steps
1	0:59:06	69	2:47:07	240
Total	0:59:06	69	2:47:07	240

Figure 2: OEM installation configuration audit results

As in the full installation configuration, Windows SBS 2003 required less time and fewer steps to complete task 1 compared to Red Hat Enterprise Linux ES 2.1. The Linux deployment required an additional 1 hour 48 minutes (2.8 times longer) and 170 more steps (3.3 times more steps) than Windows Small Business Server 2003 vs. Red Hat Enterprise Linux ES 2.1 2

Both the Windows SBS 2003 and the Red Hat Enterprise Linux ES 2.1 deployments provided the core services required for task 1 (DNS, DHCP, Web, File, E-mail). Both deployments successfully passed the task 1 verification steps. One major difference in the deployments was a richer set of e-mail services provided by the Windows SBS 2003 Exchange solution compared to SMTP/POP/IMAP in the Red Hat Enterprise Linux ES 2.1 solution. Also, the Windows SBS 2003 installation included support for automatically configuring a Universal Plug-and-Play router, while the Red Hat Enterprise Linux ES 2.1 installation required manual router configuration.

The integrated Windows SBS 2003 monitoring and reporting solutions provided more features and capabilities than the 3rd party monitoring solutions (Big Brother) implemented in Red Hat Enterprise ES 2.1 deployment. Both solutions provided basic monitoring of system services and e-mail notification of alerts. However, the Windows SBS 2003 monitoring solution provided additional advanced capabilities such as scheduled usage and performance reports. These features were not available in the Red Hat Linux Enterprise ES 2.1 deployment by default, but could have been added through additional scripting.

The Windows SBS 2003 deployment included integrated Web portal support through Windows Share Point Services. The Red Hat Linux Enterprise ES 2.1 deployment provided Web portal support through the third party PHP-Nuke application. Both solutions provided a shared Web site for clients with support for uploading and downloading content.

Windows SBS 2003 provided an integrated remote management solution using Windows Remote Desktop. Red Hat Enterprise Linux ES 2.1 included support for Secure Shell remote access by default and VPN support through the third party Poptop application. Both deployments provided secure remote management access to server and client systems for administrators and normal users.

There were two major differences in the deployment process for tasks 1 – 4, which directly impacted the number of steps results. First, the Windows SBS 2003 deployment solution was largely Wizard driven compared to the command line steps performed in the Red Hat Enterprise Linux. The use of Wizards served to structure the installation process, reduce the amount of user input required, and reduce the opportunity for error. For example, the Wizard driven installation process insulated the user from editing complex configuration files such as DNS zone files and DHCP scope files. Second, the Windows SBS 2003 deployment did not require any external third party applications to satisfy the deployment requirements. All of the applications (core services, monitoring, Web portal, remote management) were included as part of the default initial Windows SBS 2003 installation.

The default initial installation of Red Hat Enterprise Linux ES 2.1 did not include the necessary applications to satisfy the deployment requirements for parts of tasks 1 – 4 (specifically server monitoring, Web portal, address book/contact management, and VPN remote access). Therefore, third party applications providing support for those features were installed after the default Red Hat Enterprise Linux ES 2.1 installation requiring additional time and steps. In addition to integrated applications, the Windows SBS 2003 deployments included integrated management tools providing centralized management support for core services and client administration.

The combination of a Wizard driven installation process plus integrated applications and management tools helped to reduce the number of steps and installation time for Windows SBS 2003 compared to Red Hat Enterprise Linux ES 2.1 in the deployment scenarios audited by VeriTest. Wizards reduced the amount of user input required and integrated applications eliminated the need to download, install, and configure separate applications. This led directly to the lower elapsed time and number of steps results for the Windows SBS 2003 deployments compared to Red Hat Enterprise Linux ES 2.1. For example, the task 1 deployment for Red Hat Enterprise Linux ES 2.1 in the OEM installation configuration required 2.8 times more elapsed time and 3.3 times the number of steps compared to Windows SBS 2003.

The Red Hat Enterprise Linux ES 2.1 deployments did have two advantages compared to Windows SBS 2003. First, the Linux operating system and utilities, as well as third party applications, include source code through the open source development model. This provides support for customizing and tailoring the operating system to meet specific deployment needs. Windows SBS 2003 does not include source code. Second, even though downloading and installing third party applications for the Red Hat Enterprise Linux ES 2.1 deployments required additional time and steps, it also provided deployment flexibility not found in Windows SBS 2003. The integrated applications for Windows SBS 2003 were fixed by design, while the modular design of Linux allowed more control and choice over the services and applications deployed.

End of VeriTest report

In summation: what the VeriTest report proved is that Microsoft's Windows 2003 is a more time efficient operating system to install and configure. This is made so by using the famed Microsoft wizard interface to help set up a varied array of services. This has its disadvantages: the configuration for Microsoft's Windows 2003 server is not as flexible in the configurations as Red Hat, as modules for different services can be added on a needed basis. However, the VeriTest report may criticize Linux for requiring more steps and a larger amount of time to install. It also shows that with Red Hat Linux the extra time that is spent configuring the operating system to suit your needs is on a system by system basis. Ergo, the administrator has more control and choices over the services and applications to be deployed.

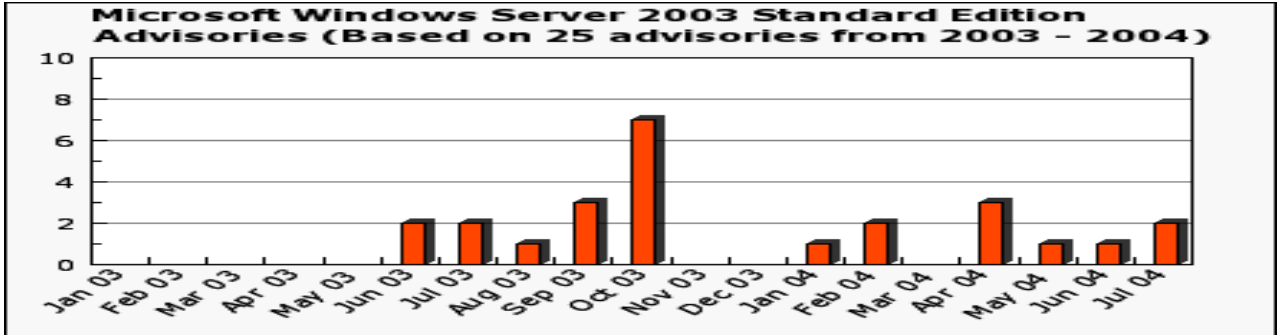
Security

Now for the most important aspect when it comes time to select the operating system that will be used on the companies servers: Security. The security aspect of this report will cover several key issues. They are:

- Security Advisories and Response Time
- System Administration

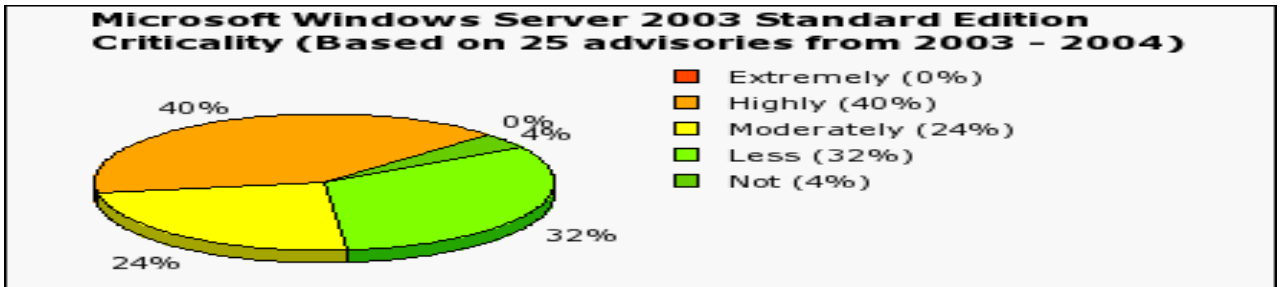
Security Advisories are warnings put out by the manufacturers for the operating systems notifying their clients that possible threats have been discovered. The advisories make the customers aware that a possible problem needs to be patched to prevent a malicious attack on their equipment. Deciding what operating system to choose, we need to analyze the security advisories that have been put out by both companies' products, the number of potential threats, severity of the threat and the amount of time that was required to resolve the issue. In the following sections each operating system will be discussed, showing the advisories issued for both and the ranking of the severity of those warnings.

Microsoft Windows 2003

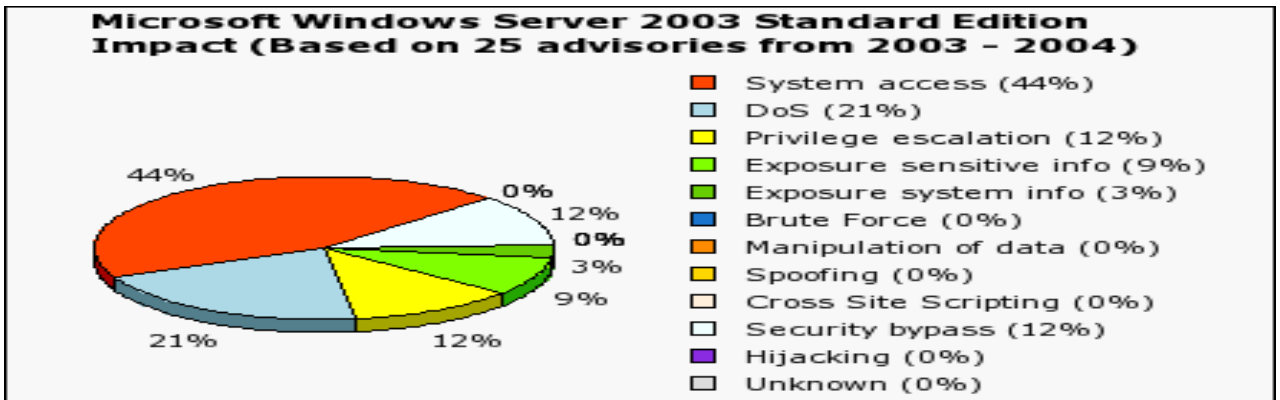


*Security Advisories for Microsoft Windows 2003

The following graphs illustrates from Microsoft's release date of Jun 2003 until July 2004 that Windows 2003 has had approx 23 advisories. In the next diagram, it shows the severity of the advisories.

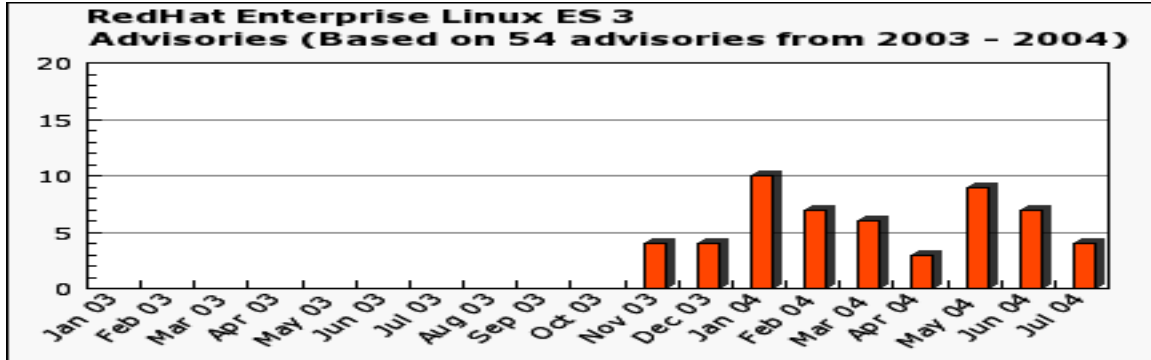


With 40% (approx 9) security advisories with a HIGHLY critical rating, 24% (approx 6) advisories with a moderately critical rating and the remaining 36% (approx 8) advisories not serious enough to threaten the operation of the server.

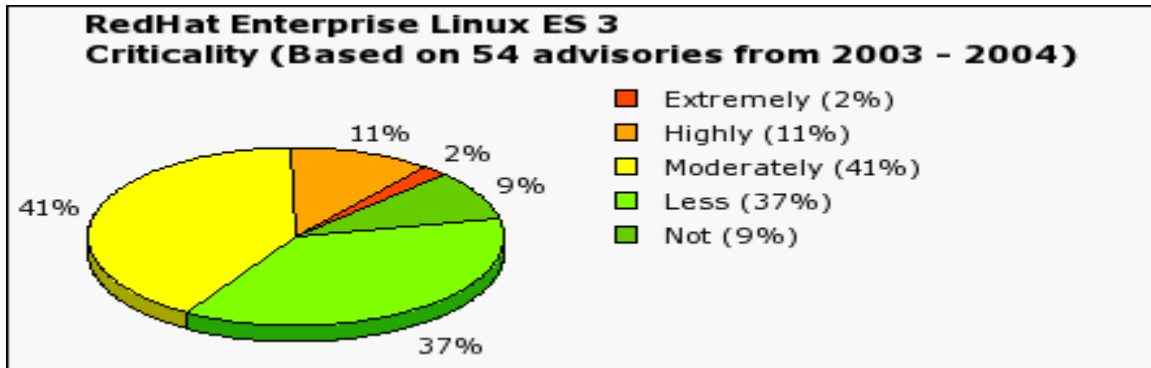


The remaining graph shows what the threats encompassed and what possible threat to the system they may have been. The majority of the advisories, 68% covered threats that could possibly threaten system security; whether it is system access, bypassing security or elevating privileges. The remaining percentage covers attacks that could lead to possible denial of service (DOS) attacks.

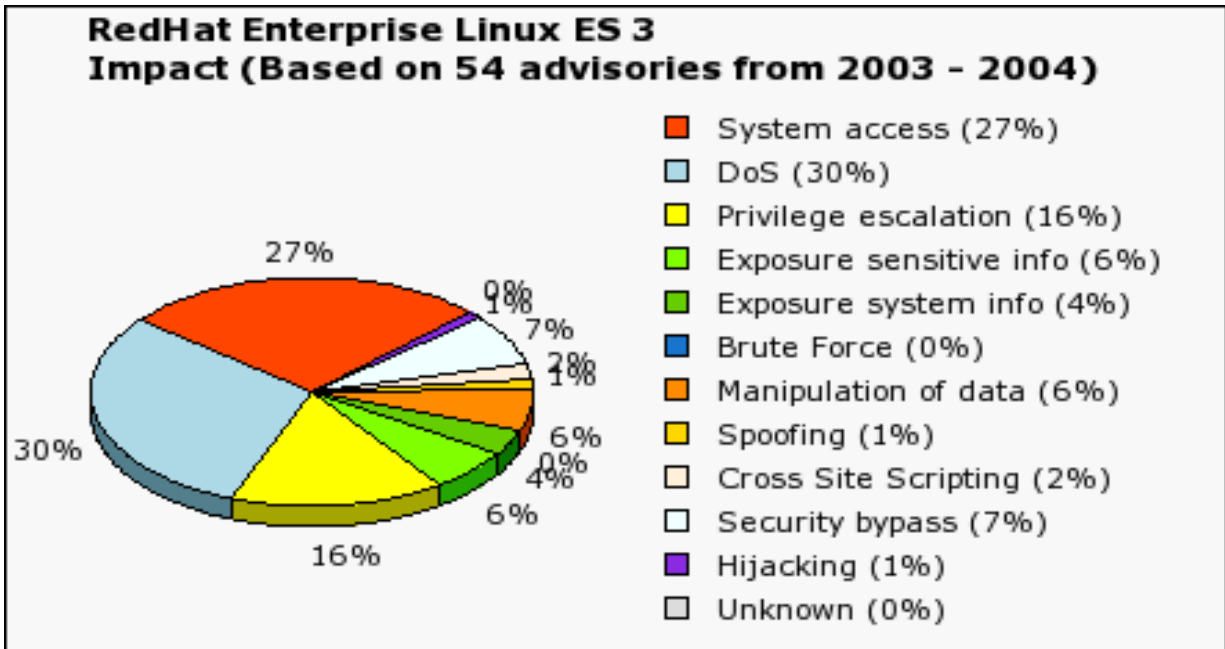
Red Hat Enterprise Linux



The following graphs shows from Red Hat's release date of Nov 2003 until July 2004 that Red Hat Enterprise Linux has had approx 52 advisories, roughly 2.5 times more than Microsoft and in less time. The next diagram shows the severity of the advisories:



With the release of Red Hat Enterprise Linux, it came with 2% (approx 1) of possible extremely critical advisories. With 11% (approx 6) security advisories with a HIGHLY critical rating, 41% (approx 22) advisories with a moderately critical rating and the remaining 46% (approx 24) advisories not serious enough to threaten the operation of the server.



The remaining graph shows what the threats encompassed and what possible threat to the system they may have been. The majority of the advisories, 53% covered threats that could possibly threaten system security; whether it is system access, bypassing security or elevating privileges. 30% of possible attacks were potential denial of service attacks (DOS). Looking at the graph, there were two advisories for possible alarming attacks, 6% of the advisories were for manipulation of data, and most alarming of all, 1% of the advisories covered a possible system hijacking advisory.

With security threats known it is the responsibility of the manufacturer to release a series of patches and updates to resolve the problem. The response time of the manufacturer is of issue when the decision is made to choose which operating system (OS) will be used. Referencing the Forrester report, a report that was written to assess how well each operating system vendor responded with fixes to vulnerabilities, how thorough each was in fixing all the disclosed security holes, and how each operating system ranked against the others in the severity of the vulnerabilities.

“The metrics measured what Forrester described as "days of risk"--the number of total days between a vulnerability being made public and its first patch, the percentage of the vulnerabilities actually patched--"there's no credit for fixing 20 percent of vulnerabilities lightning-fast and ignoring the rest," said Koetzle--and the percentage of the vulnerabilities rated as "high" by the U.S. government's National Institutes for Standards and Technology's ICAT project.

Microsoft did the best job at patching vulnerabilities fast, even though it ranked had the largest percentage of its security holes rated as high, said Koetzle. During the year's worth of vulnerabilities, Microsoft posted just 25 days at risk; Red Hat posted second with 57 vulnerable days.

Measuring each operating-system vendor's thoroughness record, Forrester found that Microsoft again led the pack by patching all of the 128 severe problems discovered within Windows. Red Hat was second at 99.6%.”

The Forrester report acknowledges both Microsoft’s and Red Hats diligent work when it comes to ensuring that their products are up to date and that known security problems are fixed within a reasonable amount of time. Microsoft led the way with 100% of the known security issues having been resolved and with the fewest days of vulnerability (25 days). Red Hat was ranked number two in the Forrester report with 99.6% of known security issues resolved and within 57 days of vulnerability.

Systems Administration

The final point when it comes to making the decision of what operating system (OS) will be chosen, whether it be Microsoft's Windows 2003 Enterprise Edition or Red Hat Enterprise Linux Advance Server will be in the way its administration policies are set.

In the Windows 2003 environment, any user whose permissions are elevated to the proper level can become a systems administrator, responsible for the installation of additional software packages, hardware or general systems maintenance. This elevation of rights has its advantages and risks associated with it. With additional users allowed administrative access to a particular machine, users can install, maintain, and upgrade the server on a regular basis. What if an inexperienced user whose rights are placed too high, they might unintentionally download and install products that might effect the overall systems performance. Once more in the Windows environment the separation of a user from the system root is not there. If a user accidentally deletes or overwrites a critical system file the possibility of a major systems crash could occur.

Within the Red Hat Linux environment the user's rights are more restricted. Due to a strong separation between a normal user and the privileged root user, a Linux user would have to be running as root to really do any damage to the system. A user could potentially damage their own home directory, but the damage would be limited to that area.

Conclusion

Throughout this report neither manufacturer offered a product that would be vastly superior compared to the other. However, each product does have their advantages and disadvantages.

When it comes to platform support, the Red Hat Enterprise Linux Advance server offers a more powerful product running on the Intel Itanium platform with support for 96 GB of memory. This option would be better suited for a data-mining application server requiring a vast amount of resources. As for a wider range of support for the varied platforms, Microsoft's Windows 2003 Enterprise Edition offers a more leveled support for the x86 and AMD64 class platforms.

For a potential storage line of services whether it be a server hosting mapped network drives or used as a raw FTP server, Microsoft's Windows 2003 Enterprise edition offers more support for IDE, Serial ATA (with proper device driver) support. As for the SCSI drive option, in the server environment SCSI technology is a more preferred option, simply because of reliability. Each manufacturer offers support for the maximum number of SCSI drives.

For the cost associated for purchasing the operating systems (OS), Red Hat has the advantage of being free to obtain; if help support is not required. At which point the cost of Red Hat Enterprise Linux jumps quite a bit. Microsoft's Windows 2003 Enterprise edition is offered from Microsoft at a suggested retail price of approx \$4000 USD which is more expensive than Red Hat with the support option; but with a little research, a copy of Window's 2003 Enterprise Edition with 25 licenses was found for approx \$700 USD. The only advantage of going with Red Hat Enterprise Linux over Microsoft Windows 2003 for the support option would be: Red Hat offers a 1 year subscription per license for unlimited help support. In comparison, Microsoft's help service has to be paid for on per usage basis. The disadvantage of Red Hat Enterprise Linux would be if the help support option is purchased and never used; which would be a substantial waste of funds that can be better used on infrastructure or server support.

For 3rd party support, such as online documentation that might be found using www.google.ca, both operating systems have a wealth of information available to them. The advantage to Microsoft is that there is only one Windows 2003. When it comes to Linux, searching for help can be a little more difficult. There are currently more than 6 major distributions of Linux, with different flavors and configurations

Product updates are of a major concern to system administrators. To system administrators, it is of paramount importance to ensure that the more recent advisories are patched in an efficient manner so that the system will be able run smoothly and swimmingly so that those with malicious intent will be precluded from hijacking the equipment. Both companies offer regular product updates. Microsoft takes the form of an interactive website, where the necessary updates are downloaded and automatically installed by the operating system. With Red Hat distribution, a slightly different approach

is procured. The necessary updates have to be downloaded, then the rpm's have to be run to ensure the updates are applied. This approach requires more time, but allows hands on interaction with the system.

Microsoft's Windows 2003 Enterprise Edition and Red Hat's Enterprise Linux Advance server are both multipurpose operating systems that are capable of handling a diverse set of server roles. Both are capable of running the necessary services that will be required, such as DNS, DHCP, FTP. Each operating system offers a directory service used to manage users, groups and privileged accounts. The advantages of the services offered, favor Red Hat Enterprise Linux if it will be migrating into a Windows Active Directory Service, with Samba, Red Hat can migrate into an ADS network and work with existing services. This is where Red Hats' distinction ends, if a network will offer no Windows based services. Microsoft's Windows 2003 Enterprise Edition offers its own distinct services such as Windows Streaming Media.

When the selection is finally made on which operating system is chosen for production, the time required to install and configure the necessary services must be taken into consideration. Microsoft's Windows 2003 Enterprise edition offers a speedy service through its famed wizard approach. While it does make the job considerably faster compared to Red Hat Enterprise Linux, it is not as flexible as installing and configuring the packages manually. As shown in the VeriTest report, having two engineering teams, both considered experts in their fields installing and configuring their respective products.

With the ever crucial security concerns that administrators are facing on a daily basis, the requirements of the next operating system that will be used, must be reliable in addressing security problems and probing for potential security risks. When vulnerabilities are discovered, it is the responsibility of the manufacturer to offer patches and updates to resolve the issue before it causes potential system wide damages and lost productivity. Both Red Hat and Microsoft endeavour to resolve problems before they arise. However, each company does have security vulnerabilities. With thorough research more security vulnerabilities have been discovered in regard to Red Hat Enterprise Linux, and thus consigned with a more severe rating compared to Microsoft's Window's 2003 Enterprise Edition. It should be said, that just because an operating system may have more known bugs, that it doesn't necessarily mean that it is a bad thing. It comes down to how fast a company can release an update to resolve the problem.

Quoting the Forrester report, Microsoft and Red Hat both work extremely hard in assuring their products are as secure as possible with releasing updates to plug possible security holes. Microsoft led the way by releasing their updates in a timely fashion and by having the fewest vulnerable days. Red Hat came in a very close second with 99.6% of known security risks plugged and with 57 days of vulnerability. However, as the Forrester report stated

"After the vendor releases a patch, it's up to all the customers to apply it," said Koetzle. And customers often don't patch. Koetzle's analysis of the nine highest-profile Windows security incidents from 2001 through March 2003 showed that although Microsoft's patches predated the outbreaks by an average of 305 days, most companies hadn't applied those patches."

The last remaining issue when it comes to making the decision of what operating system (OS) that will be chosen, will be in the way its administration policies are set. Windows's and Linux offer different methods for restricting users' rights on the system. However, Linux does a better job of restricting the amount of global power the user has, unless that user is logged in as the root account. Most of the damage that can be done is limited to that users' home directory. Compared to a Windows environment where even an average user can effect system wide changes if a user is unaware of what they're doing. Uninformed users can corrupt, modify or erase crucial system configuration files and render the operating system nonfunctional.

With all the arguments in mind, the final question must be asked: Which operating system is better?

Simply put, neither operating system is better, each system has a way of working well for the tasks that it is required to do. Each one has its strengths and weaknesses. However, a decision must be made as to which operating system will be chosen for implementation, based on the criteria above

Requirements	Operating System
System Requirements	Microsoft
Cost	Red Hat
Support Help desk (phone support) - Done Online support (websites, ex. Google search) Product Updates	Both
Services Offered	Red Hat
System Configuration	Microsoft
Security Security Advisories and Response time System Administration	Microsoft

Microsoft Windows 2003 Enterprise Edition meets more of the required criteria than Red Hat Enterprise Linux Advance server and would therefore be the correct choice for the next operating system for implementation.

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Search Engine used

www.google.ca

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