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Microsoft networks for small and medium size business – Design and deployment

Diploma thesis

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DECLARATION

I hereby declare that I have worked on my diploma thesis singly and that I have marked out all the citations from the sources, which are attached in the supplements.

In Prague 04/07/2010 ……

Bc. Juraj Píš

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I hereby thank
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Ing. Jiří Vaňek, Ph.D.

Název

Microsoft sítě pro malé a středni společnosti – design a nasazení

Souhrn

Předkládaná práce se zabývá historii, představením a implementací serverového operačního systému pro malé a středně veliké společnosti do 200 zaměstnanců nebo počítačových klientů založených na platformé Microsoft. Práce charakterizuje architekturu, softwarové komponenty and vlastnosti operačního systému Microsoft Windows Small & Essential Business Server 2008. Potom pokračuje designem a reálným nasazením do již existující či nově vytvořené sítě, její základní konfigurací a zabezpečením. Výsledkem této práce je pokrytí historie, základních prvků a součástí Microsoft Windows Small & Essential Business Server 2008 and ilustrací zapojení do zviolené sítě. Práce je pokračování bakalářské práce, ale rozsah je zvětšen a pokrývá také porovnání několika různých operačních systémů od různých výrobců.

Klíčová slova

Microsoft, Microsoft Windows Small Business Server 2008, Microsoft Exchange Server 2007, Microsoft SharePoint Services, Microsoft SQL Server 2008, Novell Open Enterprise Server, Mac OS X Snow Leopard Server

Title

Microsoft Networks for small and mid-size businesses – design and deployment

Summary

Presented work inquires into history, presentation and implementation of server operating system for small and mid-size businesses up to 200 employees or computer clients deployed at the platform from Microsoft. Work characterizes architecture, software components and chances of operating system Microsoft Windows Small & Essential Business Server 2008. Then it continues with design and real deployment of this operating system into existing or newly created network, its basic configuration and security. The outcome of this work is summary of the history, main features and components of Microsoft Windows Small & Essential Business Server 2008 and illustration of its connection to the chosen network. The work is a continuation of bachelor's thesis as the scope of this work is widen and it also compares multiple Operating systems from variety of vendors with Microsoft Solutions.

Key words

Microsoft, Microsoft Windows Small Business Server 2008, Microsoft Exchange Server 2007, Microsoft SharePoint Services, Microsoft SQL Server 2008, Novell Open Enterprise Server, Mac OS X Snow Leopard Server

Contents

Contents 6

1. Introduction 9

2. Objectives of thesis 10

3. Literature Overview 11

4. MS Products for Small and Medium size Networks 13

4.1. Difference between MS SBS 2008 and MS EBS 2008[11] 13

4.2. Description of main parts of MS SBS 2008 and MS EBS 2008 16

4.2.1. Restrictions of MS SBS 2008[12] 18

4.3. Core services of SBS and EBS 19

4.3.1. Development 19

4.3.2. Features 20

4.3.3. Server Core 21

4.3.4. Active Directory 22

4.3.5. Windows PowerShell 24

4.3.6. File storage 25

4.3.7. Hyper-V architecture 26

4.3.8. Protocol and cryptography improvements 27

4.4. Microsoft Exchange 2007 27

4.4.1. New features of MS Exchange as outlined by Microsoft 28

4.4.2. Future development – Exchange 2010 29

4.5. Windows Sharepoint services 3.0 30

4.6. Microsoft SQL Server 2008 31
4.6.1. Future of MS SQL Server 2008 33
4.7. Microsoft Forefront Threat Management Gateway 34
4.8. Microsoft Forefront Security for MS Exchange Server 35
5. History of MS Server products 35
5.1. Windows Server 35
5.1.1. Windows NT 3.1 Server 35
5.1.2. Windows NT 4.0 Server 36
5.1.3. Windows 2000 Server 36
5.1.4. Windows 2003 Server 38
5.2. Windows Small Business Server 39
5.2.1. Windows BackOffice Small Business Server 39
5.2.2. Microsoft Small Business Server 2000 40
5.2.3. Microsoft Small Business Server 2003 40
5.2.4. Microsoft Windows Small Business Server 2008 42
6. Comparison with other SW server products 46
6.1. Novell Open Enterprise Server 47
6.1.1. History of Open Enterprise Server 48
6.1.2. NetWare core protocol (NCP) 52
6.2. Mac OS X 10.6 Snow Leopard Server 53
6.2.1. History of Apple Mac OS X Server[21] 54

6.3. Server market share (Data provided by http://marketshare.hitslink.com) 64
6.4. Comparison of main features 69
6.4.1. Server core 70
6.4.2. Internal communication with clients 72
6.4.3. External communication 78
6.4.4. Additional features 80
7. Implementation of EBS 2008 83
7.1. Overview of the Installation Process[11] 83
7.2. Installation sequence 85
7.3. Installation wizard 86
8. Results 88
9. Bibliography 93
10. Supplements 95
10.1. Picture list 95
10.2. Table list 96

1. Introduction

In present time it is necessary to use modern information technologies in every firm, every company. The sharing of folders, printers, Internet access, emails and other programs which can make the work process considerably faster is a necessity.

That is why Microsoft has developed a product, which can provide all these services. But not only Microsoft is on the market. There is a big number of UNIX systems as well as systems based on Microsoft technologies.

The system developed by Microsoft is called a Microsoft Windows Small Business Server 2008 for small and midsize companies up 75 users. As the market progressed there was a need for yet another complex server package which will be easily deployable but will not require so much of man power as full size server systems. The Microsoft Windows Essential Business Server 2008 was born. It is the Small Business Server in larger scale and can support up to 200 users.

The response to these products from Apple was a Mac OS X Snow Leopard Server, which is a next generation of Mac OS servers designed and produced by Apple Inc. This server is based on UNIX kernel which is different in access to its Hardware and it is supposed to serve as the server OS on Macintosh based networks.

The last product on the market still used by bigger number of companies is Novell Netware. This system has however a decline in popularity which began in the late-1990s. The Novell Netware is usually used in organizations with hybrid infrastructure of NetWare, Linux and Windows servers.

2. Objectives of thesis

Objectives of this thesis are to describe the new Microsoft operating systems for small and mid-size companies as well as to compare them with other server products on the market.

First part of this diploma thesis will consists of the architecture of MS SBS and EBS 2008, their history and comparison of editions. The detailed introduction into the core services of these two operating systems will be covered as well.

Next chapter will introduce another operating systems, namely MAC OS X Snow Leopard Server and Novell Netware. In this chapter, both products will be

compared with each other and with MS products.

The work will then continue with the implementation of Microsoft Small Business Server 2008 and with the implementation of Microsoft Essential Business Server 2008 into the network and the final result of this implementation.

This work is aimed at IT professionals and administrators who are considering installation of new server enviroment into their existing or newly created networks.

This work should outline the situation on the market and should cover basic parts of installation of MS products. However for complete understanding and installation to the existing functional enviroment a professional literature should be used as it is not concern of this thesis to go into a deep detail of the products.

While working on theoretical part of this thesis I have relied on multiple professional books and internet sources. For practical part, mainly work

experience was a big help as well a multiple seminars held by Microsoft, Novell and Apple.

3. Literature Overview

Literature on this subject is quite scarced as there are many books which describe and outline the features and advantages of each operating system, but there is no book which actually compares all three enviroments together.

When talking about solutions for small and medium size companies, most of the books and internet sources points to a Microsoft Windows Small Business Server 2008 and to Microsoft Windows Essential Business Server. However almost none of these links talks about other solutions.

Why? Because there is no other major player on the market.

Charlie Russel and Charon Crawford are in the book about Microsoft Windows Small Business Server stating that this solution is the robust but easy deployable solution for companies which have between 5 and 75 clients. For a bigger companies they point to a larger solution called Windows Essential Business Server. [1]

Another author, namely John Rizzo is pointing out that Mac OS X server is the best solution. What he is not saying is that Snow Leopard server has quite a small support for a Windows users and that it has to be installed solely on Apple hardware. [6]

Jeffrey Harris and Mike Latimer in Open Enterprise Server Administor's Handbook are pointing towards Novell solution for the problem. However they do state that this server solutions is aimed at larger business than smaller companies, which actually need only basic server enviroment with not much problems to be solved. [10]

In magazine CHIP 12/2009 in comparison of client operating systems it is said that there is no big difference between new Microsoft Windows 7 OS and Mac OS X 10.6 Snow Leopard, as both are extremely user friendly, stable and reliable. The Kubuntu linux distribution in this test is beaten quite severly. So from this there can be seen, that Mac OS and Windows can provide the company with stable network and working enviroment from the beginning whereas the linux enviroment will need quite a lot of manpower to be ready and deployable.

For everyday's work it is not important whether IT use Mac OS X or Windows 7. Both system are good. More technically oriented people will prefer Linux, which has its small restrictions. For those who prefer also design, Mac OS is a choice. The rest can use Windows 7 and will not make a mistake. This system is safe, fast with great hardware support. That is not the case of Kubuntu L:inux. [9]

Also the Gartner and IDC reports are showing quite an increase in microsoft solutions to the problem and declining linux market share. Mac OS market shares are quite stable on 4 percents. Today's need are usualy hybrid networks where both windows and macs are deployed therefore both cilent operating systems must be fully integrated and supported.

4. MS Products for Small and Medium size Networks

4.1. Difference between MS SBS 2008 and MS EBS 2008[11]

- Business size:
    - Windows Small Business Server 2008 supports up to 75 simultaneous user or device connections. If the organization projects the need for more than 75 simultaneous connections over a two- to three-year period it should consider moving to Windows Essential Business Server 2008.
    - Windows Essential Business Server supports up to 300 simultaneous connections. If the organization projects the need for more than 30 simultaneous connections it should consider moving to Windows Server 2008 with additional Windows Server solutions.
- IT resource availability:
    - Windows Small Business Server 2008 was designed specifically for organizations with limited in-house IT skills. A streamlined installation experience coupled with intuitive configuration wizards, simplifies the day-to-day management of the network.
    - Windows Essential Business Server 2008 consists of multiple servers, that means a need for an IT support technician who will be capable of administering the IT needs of the organization and will be able to manage the MS EBS.

- However as opposed to having to purchase, install and manage products in isolation, Windows Small Business Server 2008 and Windows Essential Business Server 2008 bring these technologies together into a fully integrated experience. For example, a simple task like adding a user is wizard-driven, allowing administrators to automatically define user Group Membership, create a mailbox, define mailbox quotas, assign Client Access Licenses, or configure My Document folder redirection.

- Network Complexity:
  - Both Windows Small Business Server 2008 and Windows Essential Business Server 2008 include Remote Web Workplace—a dynamically updated Web site that provides a single, simple, and secure entry point into company network. Employees can remotely access business information—such as e-mail, shared folders, and files—or they can remotely connect to their desktop computers at the office.
  - Both Windows Small Business Server 2008 and Windows Essential Business Server 2008 contain technologies that simplify the integration and management of branch office locations. With Distributed File System Replication (DFS-R), the companies can make sure vital business data is securely replicated and always available at branch offices. By adding a Windows Server 2008 server as a Read-Only Domain Controller (RODC) at each branch location, the company can ensure branch users can log on and remain productive

even if connectivity is lost. Microsoft however recommends that organizations with more than two branch offices strongly consider using Windows Essential Business Server 2008.

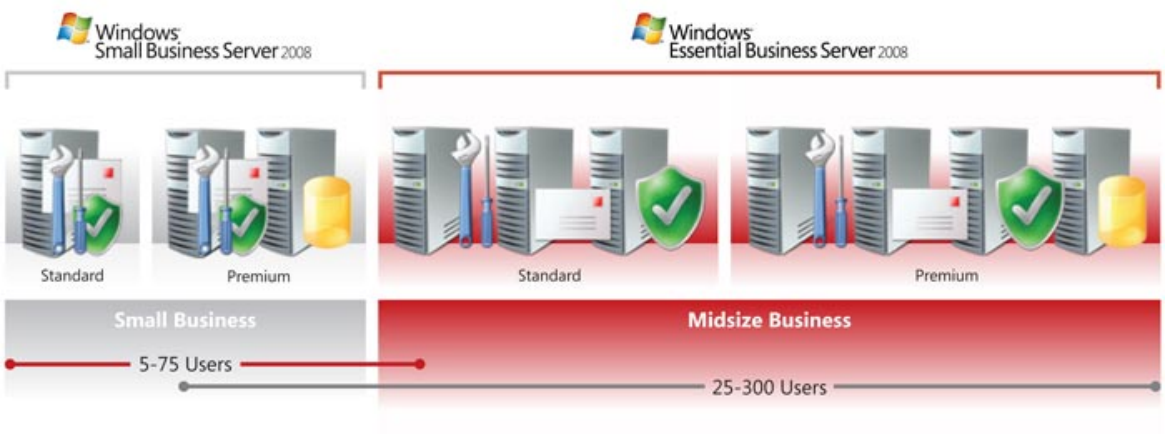
  - Windows Small Business Server 2008 and Windows Essential Business Server 2008 are respectively designed for networks with low to moderate complexity. When network infrastructure requirements become more complex, Microsoft recommends that customers look to Windows Server 2008 combined with other Microsoft Server solutions to meet their infrastructure needs.

- Reliability:
  - Fault tolerance is not a core element in Windows Small Business Server 2008. Adding supplementary Windows servers can provide failover for these core infrastructure services.
  - Windows Essential Business Server 2008 provides two Active Directory domain controllers and two DNS servers for fault tolerance.

- Security:
  - Windows Small Business Server 2008 requires a separate network firewall product for Internet protection. It supports hardware-based firewalls and software-based firewalls, such as Microsoft Forefront Threat Management Gateway. Windows Small Business Server 2008 can

automatically configure most firewall products to help protect company network resources.

- Both the Standard and the Premium Editions of Windows Essential Business Server 2008 include Microsoft Forefront Threat Management Gateway, an enterprise-class firewall. With Forefront Threat Management Gateway, the company can protect internal network resources, publish services to the Internet, and control how the employees use the Internet.



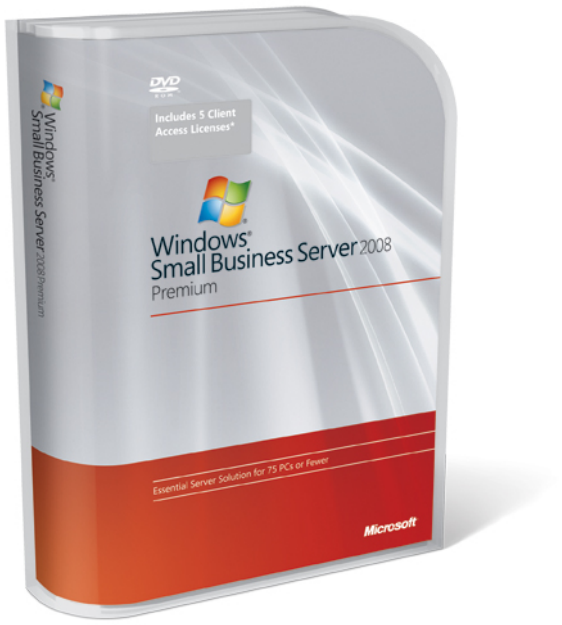
Picture 3-5 Comparison of MS SBS 2008 and MS EBS 2008, www.microsoft.com

4.2. Description of main parts of MS SBS 2008 and MS EBS 2008

MS Windows Small Business Server 2008 and MS Windows Essential Business Server 2008 are complex server operating systems, respectively environments, aimed at small and mid-size businesses. The terms small and mid-size are measured by number of devices and computer operators.

Both packages, as we can call them, include the basic server applications necessary for effective business process and which will serve to most of the business needs.

All the parts, applications, are perfectly combined and linked together therefore they can deliver the maximum efficiency in the IT network area and can also ensure the safety of all the information stored on the network.



Picture 4-1 MS SBS 2008 Premium BOX, www.microsoft.com

As it was stated previously, MS SBS 2008 and MS EBS 2008 are operating on Windows Server 2008 x64 with multiple applications. MS EBS is a multi-server solutions as for every application has its own server. As for the email server the Microsoft Exchange 2007 is used, Sharepoint Services 3.0 and IIS 7.0 are both responsible for internal and

external network and access. In MS EBS is included the Microsoft Forefront Threat Management Gateway for secure access from outside of the company and Microsoft System Center Essentials for easy management of the server environment. In both cases the premium edition includes an additional license of Windows Server 2008 Standard and Microsoft SQL Server 2008.

Because of aim of both products all versions of applications used are in standard versions. However the Small Business Server 2008 is much more restricted than Essential Business Server, but also comes with much lower price.

4.2.1. Restrictions of MS SBS 2008[12]

- Only one computer in the domain can be running Windows Small Business Server. That is not to say that the domain only supports one server. The domain supports multiple servers, but only one of them can be of the Small Business Server operating system. The other servers can be any other operating system, such as Windows Server Standard Edition.
- Windows Small Business Server must be the root of the Active Directory forest.
- Windows Small Business Server cannot trust any other domains, nor has any child domains.
- Windows Small Business Server is limited to 75 users or devices.
- All Windows Small Business Server versions up to SBS 2003 are limited to 4GB of RAM. SBS 2008 requires a minimum of 4GB and supports maximum of 32GB.

- Windows Small Business Server 2008 will only be available for the x86-64 (64-bit) architecture. This is due to requirements of Exchange Server 2007, whose production version is 64-bit.
- Only the Remote Desktop for Administration mode is available because Small Business Server always runs on the domain controller, and only two simultaneous RDP sessions are allowed. Terminal Services in application sharing mode needs to be run on a second server on the network. This however is possible with SBS 2008 Premium Edition which includes a Windows Server 2008 license for running the second server.
- As of SBS 2008 no tape backup units are natively supported.
- Small Business Server 2008 requires installation behind a separate network firewall device. In contrast with SBS 2003, it does not support being installed directly on the edge of the network. ISA server is no longer bundled and a dual-NIC configuration is not possible.

4.3. Core services of SBS and EBS

For evaluation of the core services of SBS and EBS we must look at the basics of Windows Server 2008. The basics of the core services of Windows Server and the history has been covered previously, only new technologies will be explained.

4.3.1. Development

Originally known as Windows Server Codename “Longhorn”, Microsoft chairman Bill Gates announced its official title (Windows Server 2008) during his keynote address at WinHEC on 16 May 2007.

Beta 1 was released on 27 July 2005, Beta 2 was announced and released on 23 May 2006at WinHEC 2006 and Beta 3 was released publicly on 25 April 2007. Release Candidate 0 was released to the general public on 24 September 2007 and Release Candidate 1 was released to the general public on 5 December 2007. Windows Server 2008 was released to manufacturing on 4 February 2008 and officially launched on 27 February 2008.

4.3.2. Features

Windows Server 2008 is built from the same code base as Windows Vista; therefore, it shares much of the same architecture and functionality. Since the code base is common, it automatically comes with most of the technical, security, management and administrative features new to Windows Vista such as the rewritten networking stack (native IPv6, native wireless, speed and security improvements); improved image-based installation, deployment and recovery; improved diagnostics, monitoring, event logging and reporting tools; new security features such as BitLocker and ASLR (improved Windows Firewall with secure default configuration;).NET Framework 3.0 technologies, specifically Windows Communication Foundation, Microsoft Message Queuing and Windows Workflow Foundation; and the core kernel, memory and file system improvements. Processors and memory devices are modelled as Plug and Play devices, to allow hot-plugging of these devices. This allows the system resources to be partitioned dynamically using *Dynamic Hardware Partitioning*; each partition has its own memory, processor and I/O host bridge devices independent of other partitions.

4.3.3. Server Core

Windows Server 2008 includes a variation of installation called *Server Core*. *Server Core* is a significantly scaled-back installation where no Windows Explorer shell is installed. All configuration and maintenance is done entirely through command line interface windows, or by connecting to the machine remotely using Microsoft Management Console. However, Notepad and some control panel applets, such as Regional Settings, are available.

Server Core does not include the .NET Framework, Internet Explorer, Windows PowerShell or many other features not related to core server features. A *Server Core* machine can be configured for several basic roles: Domain controller/Active Directory Domain Services, ADLDS (ADAM), DNS Server, DHCP Server, file server, print server, Windows Media Server, IIS 7 web server and Hyper-V virtual server. Server Core can also be used to create a cluster with high availability using Failover Clustering or Network Load Balancing.

Other core improvements:

- Fully multi-componentized operating system.
- Improved hot patching, a feature that allows non-kernel patches to occur without the need for a reboot.
- Support for being booted from Extensible Firmware Interface (EFI)-compliant firmware on x86-64 systems.
- Dynamic Hardware Partitioning
    - Support for the hot-addition of processors and memory, on capable hardware.
    - Support for the hot-replacement of processors and memory, on capable hardware.

4.3.4. Active Directory

Active Directory roles is expanded with identity, certificate, and rights management services. Active Directory, until Windows Server 2003, allowed network administrators to centrally manage connected computers, to set policies for groups of users, and to centrally deploy new applications to multiple computers. This role of Active Directory is being renamed as Active Directory Domain Services (ADDS). A number of other additional services are being introduced, including Active Directory Federation Services (ADFS), Active Directory Lightweight Directory Services (AD LDS), (formerly Active Directory Application Mode, or ADAM), Active Directory Certificate Services (ADCS), and Active Directory Rights Management Services (ADRMS). Identity and certificate services allow administrators to manage user accounts and the digital certificates that allow them to access certain services and systems. Federation management services enable enterprises to share credentials with trusted partners and customers, allowing a consultant to use his company user name and password to log in on a client's network. *Identity Integration Feature Pack* is included as *Active Directory Metadirectory Services*. Each of these services represents a server role.

Other AD improvements:

- A new "Read-Only Domain Controller" operation mode in Active Directory, intended for use in branch office scenarios where a domain controller may reside in a low physical security environment. The RODC holds a non-writeable copy of Active Directory, and redirects all write attempts to a Full Domain Controller. It replicates all accounts except sensitive ones. In RODC mode, credentials are not cached by default. [21]

Moreover, only the replication partner of the RODC needs to run Windows Server 2008. Also, local administrators can log on to the machine to perform maintenance tasks without requiring administrative rights on the domain.

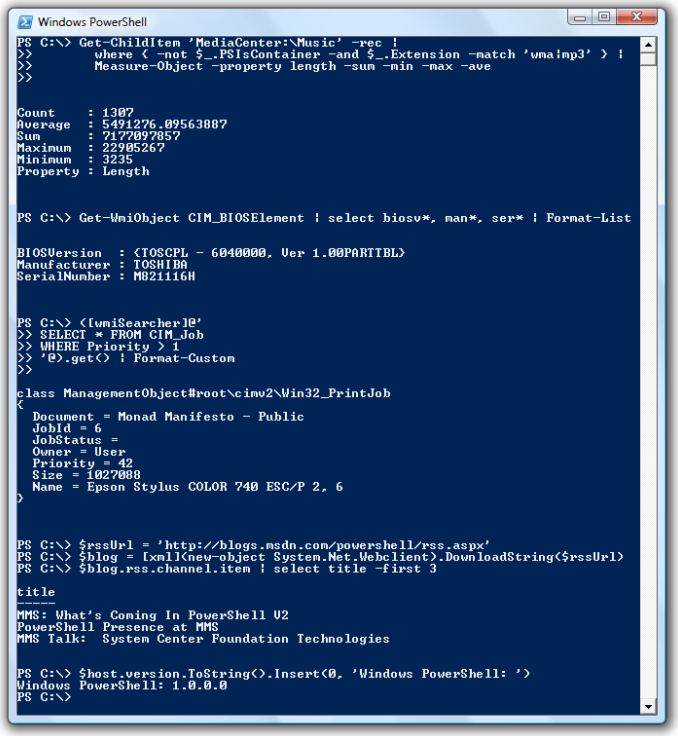
- Restartable Active Directory allows ADDS to be stopped and restarted from the *Management Console* or the command-line without rebooting the domain controller. This reduces downtime for offline operations and reduces overall DC servicing requirements with *Server Core*. ADDS is implemented as a *Domain Controller Service* in Windows Server 2008.

Group Policy improvements:

- All of the Group Policy improvements from Windows Vista are included. Group Policy Management Console (GPMC) is built-in. The Group Policy objects are indexed for search and can be commented on.
- Policy-based networking with Network Access Protection, improved branch management and enhanced end user collaboration. Policies can be created to ensure greater Quality of Service for certain applications or services that require prioritization of network bandwidth between client and server.
- Granular password settings within a single domain - ability to implement different password policies for administrative accounts on a "group" and "user" basis, instead of a single set of password settings to the whole domain.

4.3.5. Windows PowerShell

Windows Server 2008 is the first Windows operating system to ship with Windows PowerShell, Microsoft's new extensible command line shell and task-based scripting technology. PowerShell is based on object-oriented programming and version 2.0 of the Microsoft .NET Framework and includes more than 120 system administration utilities, consistent syntax and naming conventions, and built-in capabilities to work with common management data such as the Windows Registry, certificate store, or Windows Management Instrumentation. PowerShell's scripting language was specifically designed for IT administration, and can be used in place of cmd.exe and Windows Script Host. [21]



Picture 4-2 Windows PowerShell, www.microsoft.com

4.3.6. File storage

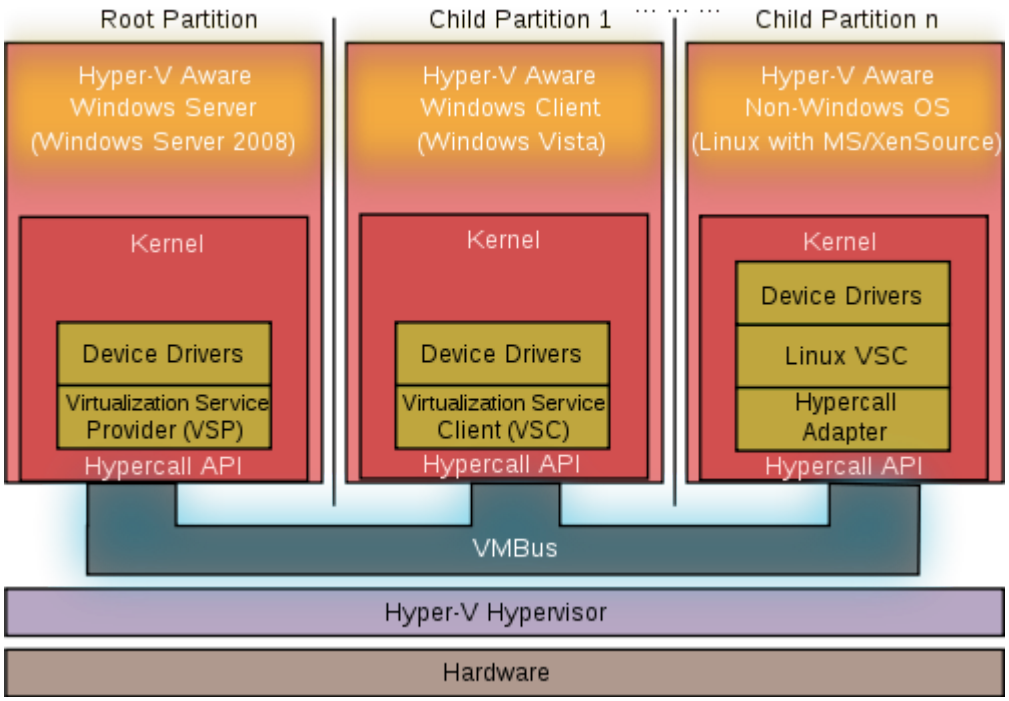
In Windows versions prior to Windows Vista, if the operating system detected corruption in the file system of an NTFS volume, it marked the volume "dirty"; to correct errors on the volume, it had to be taken offline. With self-healing NTFS, an NTFS worker thread is spawned in the background which performs a localized fix-up of damaged data structures, with only the corrupted files/folders remaining unavailable without locking out the entire volume and needing the server to be taken down. The operating system now features S.M.A.R.T. detection techniques to help determine when a hard disk may fail.

Disk management and file storage improvements:

- The ability to resize hard disk partitions without stopping the server, even the system partition. This applies only to simple and spanned volumes, not to striped volumes.
- Shadow Copy based block-level backup which supports optical media, network shares and Windows Recovery Environment.
- DFS enhancements - SYSVOL on DFS-R, Read-only Folder Replication Member. There is also support for domain-based DFS namespaces that exceed the previous size recommendation of 5,000 folders with targets in a namespace.
- Several improvements to Failover Clustering (High-availability clusters).
- Internet Storage Naming Server (iSNS) enables central registration, deregistration and queries for iSCSI hard drives.

4.3.7. Hyper-V architecture

Hyper-V is a hypervisor-based virtualization system, forming a core part of Microsoft's virtualization strategy. It virtualizes servers on an operating system's kernel layer. It can be thought of as partitioning a single physical server into multiple small computational partitions. Hyper-V includes the ability to act as a Xen virtualization hypervisor host allowing Xen-enabled guest operating systems to run virtualized. A beta version of Hyper-V ships with certain x86-64 editions of Windows Server 2008. Microsoft released the final version of Hyper-V on 26 June 2008 as a free download. Also, a standalone version of Hyper-V exists. This version also only supports the x86-64 architecture. While the x86 editions of Windows Server 2008 cannot run the Hyper-V integrations, they can run the Manager Console and Hyper-V tools.



Picture 4-3 Hyper-V technology, www.microsoft.com

4.3.8. Protocol and cryptography improvements

- Support for 128- and 256-bit AES encryption for the Kerberos authentication protocol.
- New cryptography (CNG) API which supports elliptic curve cryptography and improved certificate management.
- Secure Socket Tunneling Protocol, a new Microsoft proprietary VPN protocol.
- AuthIP, a Microsoft proprietary extension of the IKE cryptographic protocol used in IPsec VPN networks.
- Server Message Block 2.0 protocol in the new TCP/IP stack provides a number of communication enhancements, including greater performance when connecting to file shares over high-latency links and better security through the use of mutual authentication and message signing.

4.4. Microsoft Exchange 2007

Exchange Server 2007 was released on November 30, 2006, to business customers as part of Microsoft's roll-out wave of new products. It includes new clustering options, 64-bit support for greater scalability, voice mail integration, better search and support for Web services, better filtering options, and a new Outlook Web Access interface. Exchange 2007 also dropped support for Exchange 5.50 migrations, routing groups, admin groups, Outlook Mobile Access, X.400, and some API interfaces, amongst other features. [4]

Exchange Server 2007 (v8, code name E12, or with SP1 v8.1) runs only on 64-bit x86-64 versions of Windows Server. This requirement applies to supported production environments only; a 32-bit trial version is available

for download and testing. Hence, companies currently running Exchange Server on 32-bit hardware will be required to replace or migrate hardware if they wish to upgrade to the new version. Companies that are currently running Exchange Server on 64-bit capable hardware are still required to migrate from their existing Exchange 2000/2003 servers to a new 2007 server since in-place upgrades are not supported in 2007.

The first beta of Exchange Server 2007 (then named "Exchange 12" or E12) was released in December 2005 to a very limited number of beta testers. A wider beta was made available via TechNet Plus and MSDN subscriptions in March 2006 according to the Microsoft Exchange team blog. On April 25, 2006, Microsoft announced that the next version of Exchange Server would be called **Exchange Server 2007**.

4.4.1. New features of MS Exchange as outlined by Microsoft

- Protection: anti-spam, antivirus, compliance, clustering with data replication, improved security and encryption
- Improved Information Worker Access: improved calendaring, unified messaging, improved mobility, improved web access
- Improved IT Experience: 64-bit performance & scalability, command-line shell & simplified GUI, improved deployment, role separation, simplified routing
- Exchange Management Shell: a new command-line shell and scripting language for system administration (based on Windows PowerShell). Shell users can perform every task that can be performed in the Exchange Server graphical user interface plus additional tasks, and can program often-used or complex tasks into scripts that can be saved, shared, and re-used. The Exchange

Management Shell has over 375 unique commands to manage features of Microsoft Exchange Server 2007.

- "Unified Messaging" that lets users receive voice mail, e-mail, and faxes in their mailboxes, and lets them access their mailboxes from cell phones and other wireless devices. Voice commands can be given to control and listen to e-mail over the phone (and also send some basic messages, like "I'll be late")
- Increased the database maximum size limit. Database size is now limited to 16TB per database
- Increased the maximum number of storage groups and mail databases per server, to 5 each for Standard Edition (from 1 each in Exchange Server 2003 Standard), and to 50 each for Enterprise Edition (from 4 groups and 20 databases in Exchange Server 2003 Enterprise).
- IT can configure Outlook Anywhere (formerly known as RPC over HTTP) to provide external access to Microsoft Exchange Server 2007 for company clients. If company wants Microsoft Office Outlook 2007 user profiles to be automatically configured to connect to Exchange 2007, they must configure the Autodiscover service. This also provides external URLs for Exchange services such as the Availability service and offline address book.

4.4.2. Future development – Exchange 2010

Microsoft announced the Exchange 2010 to be available from the second period of 2009, and it was released to manufacturing (RTM'ed) on October 9, 2009. Exchange Server 2010 was officially launched on November 9, 2009.

Preliminary changes include: Storage Groups are being eliminated and incorporated into the Information Store. Clustering is now at the Database level, not Server level. LCR and SCC clustering no longer offered. CCR now at Datastore level, not Server Level although the terminology has changed. Clustering functionality is now known as DAG (Database Availability Group). Exchange 2010 is also only available in 64-bit as part of Microsoft's drive for all its future products to be solely 64-bit based. Exchange 2010 will run on Windows Server 2003 with SP2 at least and Windows Server 2008 R2 (also only released in a 64-bit edition).

4.5. Windows Sharepoint services 3.0

Windows Sharepoint Services (WSS) includes several major components:

- An underlying framework including an object model, persistent storage of content and configuration in SQL server databases, and ASP.NET controls for presenting the content
- A management web site for managing a "web farm" consisting of one or more servers hosting one or more web sites
- Built in template sites and pages that can be used to quickly create company own sites and add pages and libraries to existing sites
- Site editing web controls that allow IT to edit the structure of company web site, modify the layout and contents of individual pages, create new workspaces and lists, and edit the schema of existing objects
- An indexer that crawls content databases indexing their contents for fast searching
- A collection of additional template sites and pages, including additional logic in code, known as "Application Templates"

- A configuration wizard that helps IT get an initial site set up within minutes

SharePoint serves content via IIS Web Sites. They can use either Microsoft SQL Server or the Windows Internal Database to store their data. The web sites can be configured to return separate content for Intranet, Extranet and Internet locations. In WSS these deployments have no licensing implications since the WSS software is free, but licenses are required to run Microsoft's commercial portal products.

Multiple WSS servers can be configured as part of a "server farm", which allows them to share configuration and content databases. Server farms can consist of a single server or span hundreds or thousands of servers. Each server in the farm's entire content - for load balancing scenarios - or just selected portions of the content. The data in the farm can be spread into up to 9,900 "content databases." Replication of farm data is handled using SQL Server's replication and clustering abilities.

SharePoint uses a similar LDAP permissions model to Microsoft Windows, via groups of users. This can be provided via Active Directory. Alternatively, other authentication providers can be added through or even HTML Forms authentication.

4.6. Microsoft SQL Server 2008

The current version of SQL Server, SQL Server 2008, (code-named "Katmai") was released (RTM) on August 6, 2008 and aims to make data management self-tuning, self organizing, and self maintaining with the development of *SQL Server Always On* technologies, to provide near-zero downtime. SQL Server 2008 also includes support for structured and semi-structured data, including digital media formats for pictures, audio, video

and other multimedia data. In current versions, such multimedia data can be stored as BLOBs (binary large objects), but they are generic bitstreams. Intrinsic awareness of multimedia data will allow specialized functions to be performed on them. According to Paul Flessner, senior Vice President, Server Applications, Microsoft Corp., SQL Server 2008 can be a data storage backend for *different varieties of data: XML, email, time/calendar, file, document, spatial, etc* as well as perform *search, query, analysis, sharing, and synchronization* across all data types.

Other new data types include specialized date and time types and a *Spatial* data type for location-dependent data. Better support for unstructured and semi-structured data is provided using the new ***FILESTREAM*** data type, which can be used to reference any file stored on the file system. Structured data and metadata about the file is stored in SQL Server database, whereas the unstructured component is stored in the file system. Such files can be accessed both via Win32 file handling APIs as well as via SQL Server using T-SQL; doing the latter accesses the file data as a BLOB. Backing up and restoring the database backs up or restores the referenced files as well. SQL Server 2008 also natively supports hierarchical data, and includes T-SQL constructs to directly deal with them, without using recursive queries.

The Full-Text Search functionality has been integrated with the database engine, which simplifies management and improves performance.

Spatial data will be stored in two types. A "Flat Earth" (GEOMETRY or planar) data type represents geospatial data which has been projected from its native, spherical, coordinate system into a plane. A "Round Earth" data type (GEOGRAPHY) uses an ellipsoidal model in which the Earth is defined as a single continuous entity which does not suffer from the singularities

such as the international dateline, poles, or map projection zone "edges". Approximately 70 methods are available to represent spatial operations for the Open Geospatial Consortium Simple Features for SQL, Version 1.1.

SQL Server includes better compression features, which also helps in improving scalability. It also includes *Resource Governor* that allows reserving resources for certain users or workflows. It also includes capabilities for transparent encryption of data as well as compression of backups. SQL Server 2008 supports the ADO.NET Entity Framework and the reporting tools, replication, and data definition will be built around the Entity Data Model. SQL Server Reporting Services will gain charting capabilities from the integration of the data visualization products from Dundas Data Visualization Inc., which was acquired by Microsoft. On the management side, SQL Server 2008 includes the *Declarative Management Framework* which allows configuring policies and constraints, on the entire database or certain tables, declaratively. The version of SQL Server Management Studio included with SQL Server 2008 supports IntelliSense for SQL queries against a SQL Server 2008 Database Engine. SQL Server 2008 also makes the databases available via Windows PowerShell providers and management functionality available as Cmdlets, so that the server and all the running instances can be managed from Windows PowerShell.

4.6.1. Future of MS SQL Server 2008

SQL Server 2008 R2 (formerly codenamed *SQL Server "Kilimanjaro"*) was announced at TechEd 2009. SQL Server 2008 R2 adds certain features to SQL Server 2008 including master data management system branded as *Master Data Services*, a centralized console to manage multiple SQL Server instances, and support for more than 64 logical processors.

4.7. Microsoft Forefront Threat Management Gateway

Microsoft Forefront Threat Management Gateway(TMG) is a Microsoft Windows based protection solution described by Microsoft as "*enables businesses by allowing employees to safely and productively use the Internet for business without worrying about malware and other threats*". It is a secure Web gateway product built on the foundation of Microsoft Internet Security and Acceleration Server and provides the following high level functionality:

- Web Proxy functionality including:
- Malware inspection
- URL filtering and classification based on Microsoft Reputation Service's infrastructure
- Inspection of HTTPS encrypted connection
- Web Cache
- Stateful, Application-Layer Firewall
- VPN endpoint
- Web and server publishing
    - Publishing of OWA, SharePoint and other Microsoft Office servers
    - Publishing of general purpose servers

Picture 4-4 Microsoft Forefront logo, www.microsoft.com

4.8. Microsoft Forefront Security for MS Exchange Server

Microsoft Forefront Security for Exchange Server integrates multiple scan engines from industry-leading security firms into a comprehensive, layered solution, helping businesses protect their Microsoft Exchange Server messaging environments from viruses, worms, spam, and inappropriate content.

Forefront Security for Exchange Server is an on-premise solution that provides protection for Exchange 2007 Edge, Hub and Mailbox server roles. Customers who purchase Forefront Security for Exchange Server to protect Microsoft Exchange Server 2007 will also be licensed to use Microsoft Antigen for Exchange, Microsoft Antigen for SMTP Gateways, and Antigen Spam Manager to protect their Microsoft Exchange 2000 Server and Microsoft Exchange Server 2003 environments.

5. History of MS Server products

5.1. Windows Server

"Originally, we were targeting NT to the Intel i860 (code-named 'N-Ten)', a RISC processor that was horribly behind schedule. Because we didn't have any i860 machines in-house to test on, we used an i860 simulator. That's why we called it NT, because it worked on the 'N-Ten.'"

Mark Lucovsky
Distinguished Engineer
Windows Server Architect

5.1.1. Windows NT 3.1 Server

Microsoft has made its way into the server market in 1992 with Windows NT 3.1. Windows NT 3.1 had advanced network connectivity options and the efficient NTFS file system.

One of Microsoft's biggest advances initially developed for Windows NT was a new 32-bit API, to replace the legacy 16-bit Windows API. This API was called Win32, and from then on Microsoft referred to the older 16-bit API as Win16. The Win32 API had three main implementations: one for Windows NT, one for Win32s (which was a subset of Win32 which could be used on Windows 3.1 systems), and one for Chicago. Thus Microsoft sought to ensure some degree of compatibility between the Chicago design and Windows NT, even though the two systems had radically different internal architectures. Windows NT was the first Windows operating system based on a hybrid kernel.

5.1.2. Windows NT 4.0 Server

Windows NT 4.0 was a preemptive, graphical and business-oriented operating system designed to work with either uniprocessor or symmetric multi-processor computers. It was the next release of Microsoft's Windows NT line of operating systems and was released to manufacturing on 31 July 1996 (public release on 24 August 1996). It was a 32-bit Windows system available in both workstation and server editions with a graphical environment similar to that of Windows 95. The "NT" designation in the product's title initially stood for "New Technology" according to Microsoft's then-CEO Bill Gates, but now no longer has any specific meaning. Windows NT 4.0 was succeeded by Windows 2000 in February 2000. Windows NT 4.0 is classified as a hybrid kernel operating system.

5.1.3. Windows 2000 Server

Windows 2000 is a continuation of the Microsoft Windows NT family of operating systems, replacing Windows NT 4.0. Originally called Windows NT 5.0, then Windows NT 2000, Microsoft changed the name to Windows 2000

on 27 October 1998. It is also the first Windows version that has been released without a code name, though Windows 2000 Service Pack 1 was codenamed "Asteroid" and Windows 2000 64-bit was codenamed "Janus"

The first beta for Windows 2000 was released in September 1997 and several further betas followed until Beta 3 which was released on 29 April 1999. During development, there was a build for the Alpha which was abandoned some time after RC1 after Compaq announced they had dropped support for Windows NT on Alpha. From here, Microsoft issued three release candidates between July and November 1999, and finally released the operating system to partners on 12 December 1999. The public could buy the full version of Windows 2000 on 17 February 2000. Three days before this event, which Microsoft advertised as "a standard in reliability", a leaked memo from Microsoft reported on by Mary Jo Foley revealed that Windows 2000 had "over 63,000 potential known defects". After Foley's article was published, Microsoft blacklisted her for a considerable time: InformationWeek summarized the release "our tests show the successor to NT 4.0 is everything we hoped it would be. Of course, it isn't perfect either." Wired News later described the results of the February launch as "lackluster". Novell criticized Microsoft's Active Directory, the new directory service architecture as less scalable or reliable than its own Novell Directory Services (NDS) alternative.

"Our core architecture is so solid, that we were able to take NT from 386-25's in 1990 to today's embedded devices, 64-way, 64-bit multiprocessor machines, and $1000 scale-out server blades."

David Thompson
Vice President
Windows Server Product Group

5.1.4. Windows 2003 Server

Windows Server 2003 (also referred to as Win2K3) is a server operating system produced by Microsoft. Introduced on 24 April 2003 as the successor to Windows 2000 Server, it is considered by Microsoft to be the cornerstone of its Windows Server System line of business server products. An updated version, Windows Server 2003 R2, was released to manufacturing on 6 December 2005. Its successor, Windows Server 2008, was released on 4 February 2008.

According to Microsoft, Windows Server 2003 is more scalable and delivers better performance than its predecessor, Windows 2000.

- Internet Information Services (IIS) v6.0 - A significantly improved version of IIS.
- Increased default security over previous versions, due to the built-in firewall and having most services disabled by default.
- Significant improvements to Message Queuing.
- Manage Company Server - a role management administrative tool that allows an administrator to choose what functionality the server should provide.
- Improvements to Active Directory, such as the ability to deactivate classes from the scheme, or to run multiple instances of the directory server (ADAM)
- Improvements to Group Policy handling and administration
- Provides a backup system to restore lost files
- Improved disk management, including the ability to back up from shadows of files, allowing the backup of open files.

- Improved scripting and command line tools, which are part of Microsoft's initiative to bring a complete command shell to the next version of Windows.
- Support for a hardware-based "watchdog timer", which can restart the server if the operating system does not respond within a certain amount of time.

5.2. Windows Small Business Server

5.2.1. Windows BackOffice Small Business Server

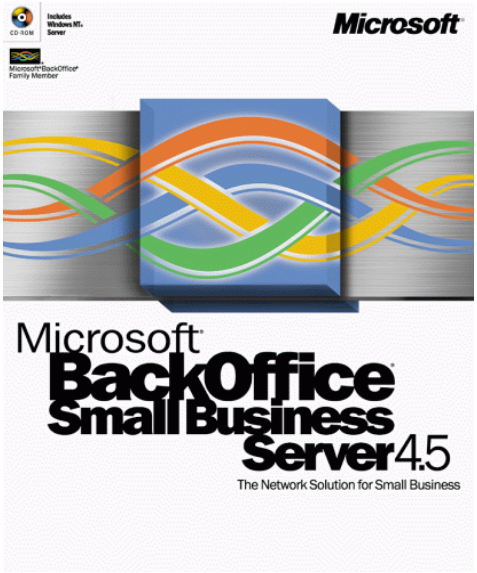
With implementation of first complex server operating system from Microsoft, the BackOffice Small Business Server 4.0 it was a revolutionary step from Microsoft. First time in the history we have had a joined server solution – Windows NT 3.0 SP3, mail server – Exchange Server 5.0 SP1, as a web server and intranet server was used IIS 3.0, database server was SQL Server 6.5 SP3 and other. This product was designed to serve as the only server for small and midsize businesses, which did not need to spend more on server solution.

BackOffice server had simply everything what every company needed for modern internal communication and also communication with the rest of the world through the internet. Also it served as a gateway through which the client computers and other networked devices had communicated with the rest of the world. This gateway was the most secure gateway as it used the most modern technologies of that time. It was a Proxy Server 1.0.

Two years after its initial release the BackOffice server was upgraded to version 4.5, which included the newest versions of the components used in the server. It was for example Service Pack 4 for Windows NT 4.0, Exchange

Server 5.5 Service Pack 2, IIS 4.0, SQL Server 7.0 and also Proxy Server 2.0 and others.

One of the major updates was an option to connect fifty clients compared to twenty-five in first version.



Picture 5-1 FrontPage of the Package MS BackOffice SBS 4.5, www.prodejit.com

5.2.2. Microsoft Small Business Server 2000

In the year 2001, the BackOffice Small Business Server 4.5 was upgraded yet again and was renamed to Microsoft Small Business Server 2000. Its basic contents were Windows 2000 Server, Exchange 2000 Server, Exchange 2000 Server, IIS 5.0, SQL Server 2000 and the newest version of the former Proxy Server, The Microsoft Internet Security and Acceleration (ISA) Server 2000.

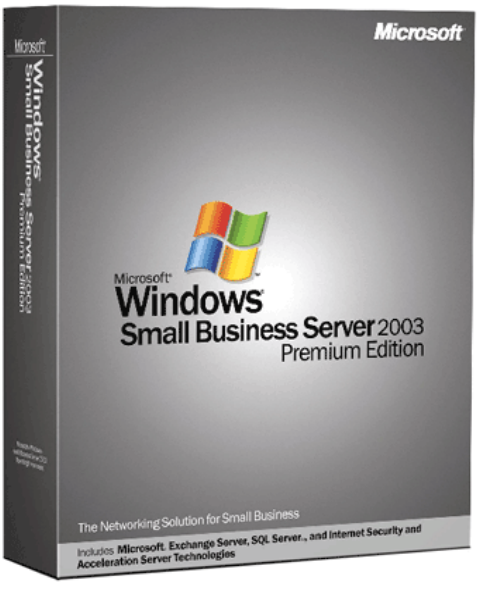
5.2.3. Microsoft Small Business Server 2003

Another major upgrade was in the year 2003. The introduction of Microsoft Windows Small Business Server 2003 with its new components

which were the newest Windows Server 2003, Exchange Server 2003, IIS 6.0 and Sharepoint Services 2.0. The number of allowed clients was raised to seventy-five.

With the arrival of this new server solution the new licensing options were introduced as well. The client licensing divided between user and HW clients was gone. One client was either PC or user. Also two new versions of MS SBS 2003 were introduced. The Standard version and the Premium version which included SQL Server 2000 and ISA Server 2000.

After the introduction of Service Pack 1 for Windows Server 2003 was MS SBS 2003 Premium expanded to include two new products. The ISA Server 2004 and in the year 2005 SQL Server 2005 Workgroup edition.



Picture 5-2 MS SBS 2003 Premium Edition, www.alza.cz

Next major upgrade of Microsoft Small Business Server was in the year 2006 where the 2003 R2 edition was introduced and which included the newest versions of Microsoft Server products. The most important addition was Windows Server Update Services 2.0 which can serve as the update server for all the clients in the network therefore eliminating the need of downloading all the updates multiple times but only once to the server and then distribute among the clients.

5.2.4. Microsoft Windows Small Business Server 2008

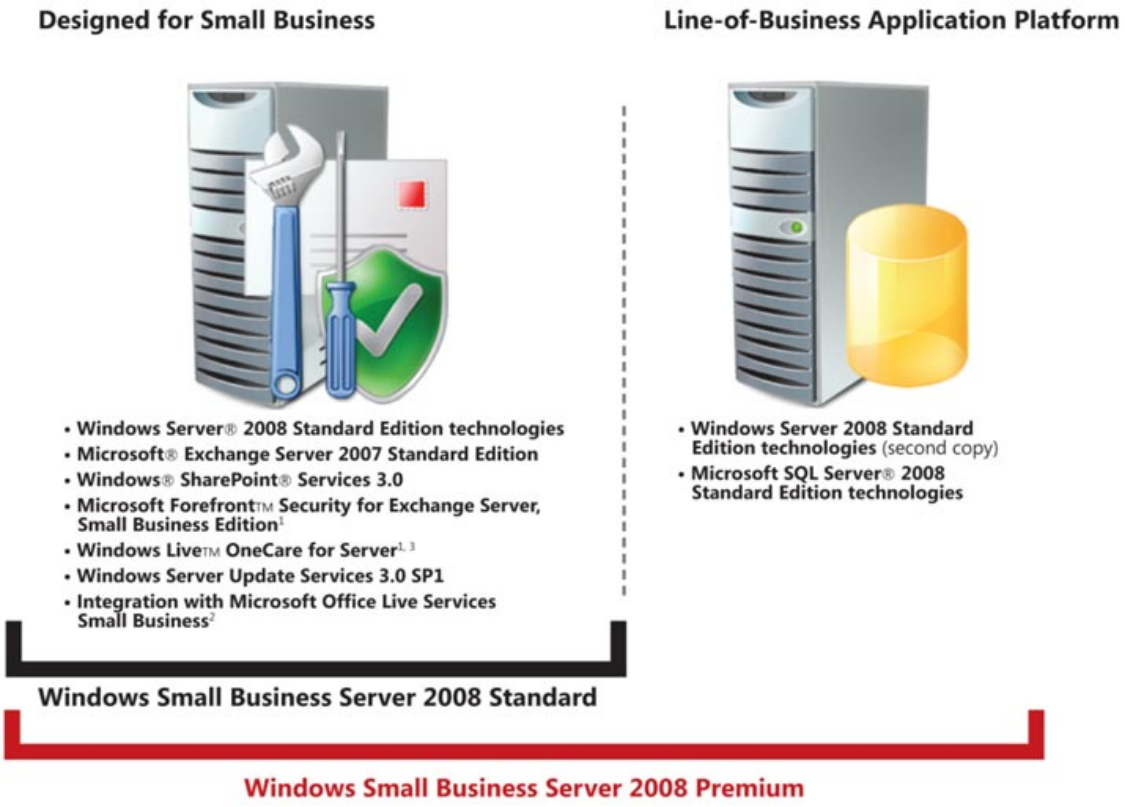
In the year 2008 was introduced new version of the Microsoft Windows Small Business Server 2008. This is the first fully 64-bit server operating system from Small Business Server family. The 64-bit means that the server can use more than 4 GB of RAM memory, It can use much bigger address space.

The MS SBS 2008 has implemented the Windows Server 2008 together with Exchange 2007, Windows SharePoint Services 3.0 and IIS 7.0. It also includes 120-day trial subscriptions of new security products from Microsoft, namely, Forefront Security for Exchange and Windows Live OneCare for Server.

Also the server scenario was changed accordingly to the difference between standard and premium editions. The standard edition of SBS 2008 is a single server edition for small businesses. The premium version contains a license for additional Windows Server 2008 and SQL Server 2008 Standard Edition, with the option to run the SQL Server on either the main SBS server, or a second server. The premium edition is therefore targeted at dual-server scenarios such as terminal services application sharing, Line of

Business applications, edge security, secondary domain controllers and virtualization.

Main difference between older versions of MS SBS, such as 2000, 2003, 2003 R2, and 2008 version is that MS SBS 2008 cannot serve as the edge server, thus it does not support more than one NIC (Network Interface Controller). This means that companies which want to implement the Microsoft Windows Small Business Server 2008 must put additional firewall device between the network and the internet. If the dual-server scenario is implemented, the additional Windows Server 2008 can serve as the edge server but it will still need firewall software.



Picture 5-3 MS SBS 2008 Server scenarios, www.microsoft.com

In addition to features present in previous versions, new features include[7]:

- A streamlined administration and management console that is designed around tasks to be accomplished rather than underlying technologies
- Built-in support for registering and configuring domain name and DNS records via multiple registrars
- Monitoring reports that gather data from both servers and clients on the network, including Security Center status (anti-virus, spyware and client firewall] from all the clients
- New features in the Remote Web Workplace, such as the ability to define default and allowed PCs for each user
- Office Live Small Business integration for and configuring a public website or extranet
- New server backup features, based on the incremental block-based backup technology in Windows Server 2008 (the tape backup is no longer supported via native tools, but continues to be supported via 3rd parties)

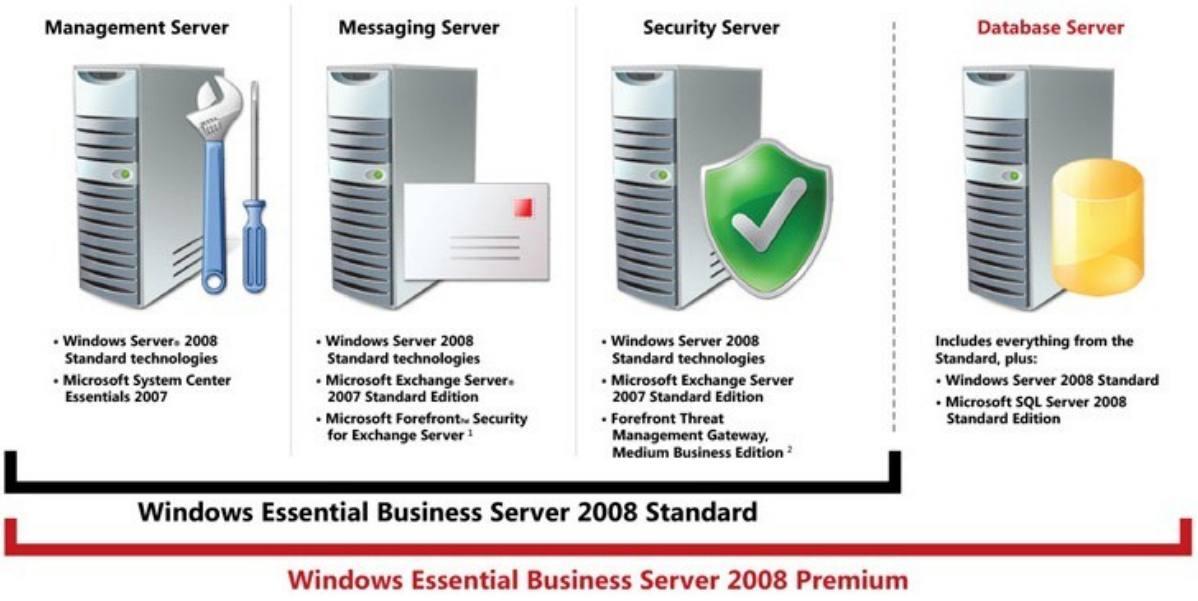
As the newest step until now was widening of business targeted by complex

server scenarios. The introduced on 16 September 2008 was Microsoft Windows Essential Business Server, code named *Centro*, which is aimed at mid-size businesses (up to maximum of 300 Users and/or Devices).

Built from Windows Server 2008 codebase, two editions are available: Standard and Premium. The Standard edition includes three Windows Server 2008 x64 Standard Servers and on top of those three servers: Microsoft Exchange 2007, Microsoft System Center Essentials, Microsoft Forefront Security for Exchange Server and Forefront Threat Management

Gateway (Medium Business Edition) formerly known as Microsoft Internet Security and Acceleration Server.

The Premium edition adds another Windows Server 2008 Standard Edition and the Microsoft SQL Server 2008 Standard database software.



Picture 5-4 MS EBS 2008 Server scenarios, www.microsoft.com

Essential Business Server features a single administration/management console, through which the collection of managed clients and servers can be monitored and managed. Third party software can also utilize the same console to present and administrative interface to their software. Computers Associates Inc. and Symantec had announced that they will use the management console for their CA ARCserve Backup, Backup Exec and Endpoint Protection products respectively. Essential Business Server also includes Remote Web Workplace, an out-of-the-box feature that enables IT to easily set up security-enhanced remote access to company client computers and Outlook Web Access.

The version of Windows Server that is part of Small Business Server 2008 and Essential Business Server 2008, Windows Server 2008 for Windows Essential Server Solutions (WinWESS) or Windows Server 2008 Standard FE is available outside the product suite, supporting a maximum of 15 Client Access Licenses.

6. Comparison with other SW server products

In this chapter will be covered comparison of Microsoft Windows Small Business Server 2008 with another two server operating systems. First server operating system is Mac OS X 10.6 Snow Leopard Server and second is Novell Open Enterprise Server 2.

All three operating systems are major players on the market however even though Novell used to be the most succesfull company on the market but with the entrance of Microsoft to the server market, Novell has started to loose its position quite rapidly.

Apple's Mac OS X server operating system was first introduced in the year 2000 and from then Apple is securing its position among Mac users and is trying to promote the server products with cooperation with other desktop and mobile products as its support is focused towards its own SW. Another major difference between MAC OS server and other SW server producers is in availability as MAC OS can be installed only on Apple branded HW. More to this feature is covered in chapter about Mac OS server operating system.

6.1. Novell Open Enterprise Server

Novell Open Enterprise Server (OES) is the successor product to Novell, Inc.'s NetWare operating system, based on Suse Linux Enterprise Server. Originally released in March 2005, the current (2009) release is OES 2 SP2.

Novell Open Enterprise Server (OES) is best thought of as a platform for delivery of -level shared network services (file, print, directory, clustering, backup, storage management, PKI, web applications, etc.) and common management tools. OES can run atop either a Linux or a NetWare kernel.

Picture 6-1 Novell Open Enterprise Server BOX, www.novell.com

Clustered configurations can include nodes with either kernel types, and most services can migrate freely between the platforms. Thus, customers can deploy the platform selection that best suits their needs, as opposed to being locked into a single platform.

When installed using a Linux kernel, the product is known as OES-Linux. This uses SUSE Linux Enterprise Server (SLES) as its platform. Atop the SLES install, daemons are added to provide NCP, eDirectory, NSS, iPrint and other services delivered by OES.

When installed using a NetWare kernel, the product is known as OES-NetWare. This uses NetWare v6.5 as its platform. Atop the NetWare install, NLMs are added to provide Apache web server,Tomcat,OpenSSH, NCP, eDirectory, NSS, iPrint and other services delivered by OES.

OES 2 was released on October 8, 2007. It includes NetWare 6.5 SP7, which supports running as a paravirtualized guest inside the Xen hypervisor and new Linux-based version using SLES 10.

New features include[21]:

- 64-bit support
- Virtualization
- Dynamic Storage Technology, which provide Novell Shadow Volumes
- Domain services for Microsoft Windows
- AFP

6.1.1. History of Open Enterprise Server

In 2003, Novell announced the successor product to NetWare: Open Enterprise Server (OES). First released in March 2005, OES completes the separation of the services traditionally associated with NetWare (e.g. Directory Services, file-and-print) from the platform underlying the delivery of those services. OES is essentially a set of applications (eDirectory, NetWare Core Protocol services, iPrint, etc.) that can run atop either a Linux or a NetWare kernel platform. Clustered OES implementations can even

migrate services from Linux to NetWare and back again, making Novell one of the very few vendors to offer a multi-platform clustering solution.

Consequent to Novell's acquisitions of Ximian and SuSE, a German Linux distributor, it is widely observed that Novell is moving away from NetWare and shifting its focus towards Linux. Much recent marketing seems to be focussed on getting faithful NetWare users to move to the Linux platform in future releases. The clearest indication of this direction is Novell's controversial decision to release Open Enterprise Server in Linux form only. Novell later watered down this decision and stated that NetWare's 90 million users would be supported until at least 2015. Some of Novell's NetWare supporters have taken it upon themselves to petition Novell to keep NetWare in development. [21]

- OES was released in March 2005 and included NetWare 6.5 SP3 and SLES 9 SP1.
    - OES SP1, released in September 2005, was based on NetWare 6.5 SP4 and SLES 9 SP2.
    - OES SP2, released in January 2006, was based on NetWare 6.5 SP5 and SLES 9 SP3.
- OES 2, based on NetWare 6.5 SP7 and SLES 10 SP1, was released in early October 2007.
    - OES 2 SP1 was released in December 2008, was based on NetWare 6.5 SP8 and SLES 10 SP2.
    - OES 2 SP2 was released in November 2009, based on SLES 10 SP3

	Open Enterprise		NetWare		
Feature	**V 2**	**V 1**	**V 6.5**	**V 6.0**	**V 5.1**
Content & Application/Open Source Service					
SUSE Linux Enterprise Server 9	○	●	○	○	○
SUSE Linux Enterprise Server 10	●	○	○	○	○
Mono	●	●	○	○	○
JBoss	●	●	○	○	○
Apache Web Server	●	●	●	●	○
Tomcat Servlet Engine	●	●	●	●	○
MySQL Database	●	●	●	●	○
Perl Scripting Support	●	●	●	●	○
PHP Scripting Support	●	●	●	○	○
FTP Support	●	●	●	●	○
SOAP Server	●	●	○	●	○
UDDI Server	●	●	○	○	○
DNS/DHCP Servers	●	○	●	●	○
XEN Virtual Machine	●	○	○	○	○
Networking and Productivity Services					
Novell iFolder	●	●	●	●	○
iPrint	●	●	●	●	○
NetStorage	●	●	●	●	○
File Versioning	●	○	●	○	○
Novell Client for Windows	●	●	●	●	●
Novell Client for Linux	●	●	○	○	○
Novell Client for Vista	●	○	○	○	○
Directory-integrated DNS/DHCP Servers	●	○	●	●	○
Apple Filing Protocol Support	●	○	○	○	○
CIFS Support	●	○	○	○	○
64-bit eDirectory	●	○	○	○	○
Management Services					
Domain Services for Windows	●	○	○	○	○
Upgrade Utility	● ⓘ	○	○	○	○
Remote Upgrades (RPM Support)	●	●	○	○	○
YaST	●	●	○	○	○
Server Consolidation Migration Utility	●	●	●	○	○
Global Directory	●	●	●	●	●
Directory Synchronization	●	●	●	○	○
Multi-factored Authentication	●	●	●	○	○
Graded Authentication	●	●	●	○	○
Advanced Authentication Support	●	●	●	○	○
Storage Resource Management	●	●	○	○	○
Global Server Management	●	●	●	○	○
Global Health	●	●	●	○	○
Auditing	◐	●	●	●	○
Storage and Clustering Services					
Dynamic Storage Technology	●	○	○	○	○
Business Continuity Clustering	●	○	●	●	○
Storage Scalability	●	●	○	●	○
Native Windows Client Support for 4 GB Files	●	●	●	○	○
Native Mac OS X Client support for 4 GB Files	●	●	●	○	○
Native UNIX, Linux Client Support for 4 GB Files	●	●	○	○	○
Snapshot Backup	●	○	●	○	○
Fibre Channel SAN Support	●	●	●	●	○
ISCSI SAN Support	●	●	●	○	○
Cluster Services	●	●	●	●	○
GEO Site Failover	●	●	●	●	○
Other Features					
Multi-processor Support	●	●	○	●	○
Support for more than 4gb of RAM	●	○	○	○	○
64-bit CPU Support	●	○	○	○	○

Table 6-1 Main differences between different Novell versions[15]

OES 2 was released on October 8, 2007. It includes NetWare 6.5 SP7, which supports running as a paravirtualized guest inside the Xen hypervisor and new Linux based version using SLES10.

New features include

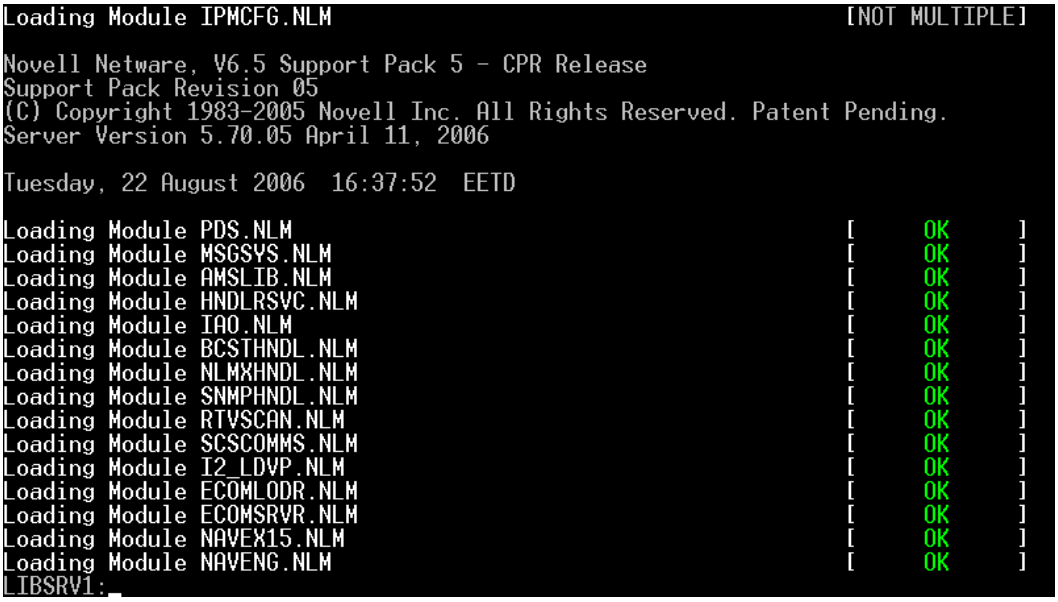
- 64bit support
- Virtualization
- Dynamic Storage Technology, which provide Shadow Volumes
- Domain services for Windows (provided in OES 2 service pack 1)

Table on the next page specifies the differences between versions of Novell NetWare and its succesor Open Enterprise Server.

While Novell NetWare is still used by some organizations, its ongoing decline in popularity began in the mid-1990s, when NetWare was the de facto standard for file and print software for the Intel x86 server platform. Modern (2009) NetWare and OES installations are used by larger organizations that may need the added flexibility they provide.

Microsoft successfully shifted market share away from NetWare products toward their own in the late-1990s. Microsoft's more aggressive marketing was aimed directly to management through major magazines; Novell NetWare's was through IT specialist magazines with distribution limited to select IT personnel.

Novell did not adapt their pricing structure accordingly and NetWare sales suffered at the hands of those corporate decision makers whose valuation was based on initial licensing fees. As a result organizations that still use NetWare, eDirectory, and Novell software often have a hybrid infrastructure of NetWare, Linux, and Windows servers.



Picture 6-2 Novell NetWare console screen, printscreen

6.1.2. NetWare core protocol (NCP)

The NetWare Core Protocol (NCP) is a network protocol used in some products from Novell, Inc. It is usually associated with the NetWare operating system, but parts of it have been implemented on other platforms such as Linux, Windows NT and various flavors of Unix. [21]

It is used to access file, print, directory, clock synchronization, messaging, remote command execution and other network service functions. TCP/IP and IPX/SPX (obsoleted, technical support is provided only for NetWare platform) are the supported underlying protocols. TCP/IP implementations use TCP/UDP port 524 and rely on SLP for name resolution.

Novell eDirectory uses NCP for synchronizing data changes between the servers in a directory service tree.

Most network protocols in use at the time NetWare was developed didn't trust the network to deliver messages. A typical client file read would work something like this:

1. Client sends read request to server
2. Server acknowledges request
3. Client acknowledges acknowledgement
4. Server sends requested data to client
5. Client acknowledges data
6. Server acknowledges acknowledgement

In contrast, NCP was based on the idea that networks worked perfectly most of the time, so the reply to a request served as the acknowledgement. Here is an example of a client read request using this model:

1. Client sends read request to server
2. Server sends requested data to client

All requests contained a sequence number, so if the client didn't receive a response within an appropriate amount of time it would re-send the request with the same sequence number. If the server had already processed the request it would resend the cached response, if it had not yet had time to process the request it would only send a "positive acknowledgement". The bottom line to this 'trust the network' approach was a 2/3 reduction in network transactions and the associated latency.

6.2. Mac OS X 10.6 Snow Leopard Server

Mac OS X Server is a Unix server operating system from Apple Inc. The server edition of Mac OS X is architecturally identical to its desktop counterpart, except that it includes work group management and administration software tools. These tools provide simplified access to key

network services, including a mail transfer agent, a Samba server, an LDAP server, a domain name server, and others. Also included (particularly in later versions) are numerous additional services and the tools to manage them, such as web server, wiki server, chat server, calendar server, and many others.

Mac OS X Server is the operating system of Xserve computers, rack mounted server computers designed by Apple. Also, it is optionally preinstalled on the Mac mini and Mac Pro and is sold separately for use on any Macintosh computer meeting its minimum requirements.

Picture 6-3 Mac OS X Server Boxes, www.aple.com

Mac OS X Server is a server operating system which enables organizations to collaborate, communicate, and share information. It is based on an open source foundation called Darwin and uses open industry standards and protocols.

Mac OS X Server includes services and applications for file sharing, sharing contact information and calendars, schedule events, send secure instant messages, conduct live video conferences, send and receive email, contribute to and comment in wikis, publish a companywide blog, produce and distribute podcasts, and set up websites.

6.2.1. History of Apple Mac OS X Server[21]

Mac OS X was first mentioned in Apple's OS strategy announcement at the 1998 WWDC. Jobs said that OS X would ship in the fall of 1999, and

would inherit from both Mac OS and Rhapsody. Moreover, backward compatibility would be maintained to ease customers into the transition.

Mac OS X did come out in 1999, as Mac OS X Server 1.0 (March 16, 1999), a developer preview of the desktop version, and as Darwin 0.1. Mac OS X beta was released on September 13, 2000.

At the time of this writing, Mac OS X has seen seven major releases: 10.0 ("Cheetah", March 24, 2001), 10.1 ("Puma", September 29, 2001), 10.2 ("Jaguar", August 13, 2002), 10.3 ("Panther", October 24, 2003), 10.4 ("Tiger", April 29, 2005), 10.5 ("Leopard", October 26, 2007), and 10.6 ("Snow Leopard", August 28, 2009).

The first version of Mac OS X was Mac OS X Server 1.0. Mac OS X Server 1.0 was based on Rhapsody 5.3, a hybrid of OPENSTEP from NeXT Computer and Mac OS 8.5.1. The GUI looked like a mixture of Mac OS 8's Platinum appearance with OPENSTEP's NeXT-based interface. It included a runtime layer called Blue Box for running legacy Mac OS-based applications within a separate window. There was discussion of implementing a 'transparent blue box' which would intermix Mac OS applications with those written for Rhapsody's Yellow Box environment, but this would not happen until Mac OS X's Classic environment. Apple File Services, Macintosh Manager, QuickTime Streaming Server, WebObjects and NetBoot was included with Mac OS X Server 1.0.

Server 1.0 contains a mix of features from the classic Mac OS, NeXTSTEP and Mac OS X. It has a single menu bar across the top of the screen like Mac OS but file management is performed in Workspace Manager from NeXTSTEP instead of the Mac's Finder. The user interface still uses the Display PostScript-based window server from NeXTSTEP, instead of the Quartz-based Window Server which would appear a year later in Mac OS X

Public Beta. Windows with unsaved content display a black dot in the window close button like NeXTSTEP. The Dock and the Aqua appearance were not included; these were later added to Mac OS X.

"Carbon", essentially a sub-set of "classic" Mac OS API calls, was also absent. This meant that the only native applications for OS X Server 1.0 were written for the "Yellow Box" API, which went on to become known as "Cocoa". Furthermore, Apple's own FireWire was not supported.

Server 1.0 also includes the first version of a NetBoot server, which allows computers to boot from a disk image over a local network. This was particularly useful in a school or other public-machine setting, as it allowed the machines to be booted from a single OS copy stored on Server 1.0, making it difficult for users to damage the OS by installing software – as soon as they signed out, the machine would re-boot with a fresh OS from the NetBoot server.

To run classic Mac OS applications, Mac OS X Server 1.0 includes the "Blue Box" which essentially ran a copy of Mac OS 8.5.1 in a separate process as an emulation layer. This became the "Classic Environment" in Mac OS X, though it was no longer Mac OS 8.5.1 being run, but the latest version of Mac OS 9.

After introdution of Mac OS X Server 1.0 came a new version which was developed from client OS Mac OS X 10. Mac OS X Server 10.0 included the new Aqua user interface, Apache, PHP, MySQL, Tomcat, WebDAV support, Macintosh Manager and NetBoot.

Mac OS X version 10.0, code named “Cheetah”, is the first major release of Mac OS X, Apple’s desktop and server operating system. Mac OS X v10.0 was released on March 24, 2001 for a price of US$129. It superseded the Mac OS X Public Beta and preceded Mac OS X v10.1.

Mac OS X v10.0 was a radical departure from the previous “classic” Macintosh operating system and was Apple’s long awaited answer to the call for a next generation Macintosh operating system. It introduced a brand new code base completely separate from Mac OS 9's, as well as all previous Apple operating systems. Mac OS X introduced the new Darwin Unix-like core and a totally new system of memory management. It proved to be a rocky start to the Mac OS X line, plagued with missing features and performance issues, although it was praised for being a good start to an operating system still in its infancy, in terms of completeness and overall operating system stability.

Mac OS X version 10.1, code named “Puma”, is the second major release of Mac OS X, Apple’s desktop and server operating system. It superseded Mac OS X v10.0 and preceded Mac OS X v10.2. Version 10.1 was released on September 25, 2001 as a 'free update' to version 10.0. Starting with version 10.1.2, Apple made Mac OS X the default operating system on new Macs.

The operating system was handed out for no charge by Apple employees after Steve Jobs' keynote speech at the Seybold publishing conference in San Francisco. It was subsequently distributed to Macintosh users on October 25, 2001 at Apple Stores and other retail stores that carried Apple products. The operating system was better received than Mac OS X version 10.0, although critics claimed that the operating system was still lacking features and was plagued with bugs.

Mac OS X version 10.2 “Jaguar” was the third major release of Mac OS X, Apple’s desktop and server operating system. It superseded Mac OS X v10.1 code name Puma and preceded Mac OS X v10.3 “Panther”.

The operating system was generally well-received by Macintosh users as a large step forward in the areas of stability, general speed enhancements, and the lineup of both graphical and command line applications available; however, many critics still claimed that significant user interface speed issues existed and that the operating system was still immature and awkward to use.

The 10.2 Mac OS X Server release includes updated Open Directory user and file management, which with this release is based on LDAP, beginning the deprecation of the NeXT-originated NetInfo architecture. The new Workgroup Manager interface improved configuration significantly. The release also saw major updates to NetBoot and NetInstall. Many common network services are provided such as NTP, SNMP, web server (Apache), mail server (Postfix and Cyrus), LDAP (OpenLDAP), AFP, and print server. The inclusion of Samba version 3 allows tight integration with Windows clients and servers. MySQL v4.0.16 and PHP v4.3.7 are also included.

With Mac OS X Server v10.3, Apple has integrated popular open source software technologies and created innovative management tools to make it easy to provide powerful standards-based server solutions.

The 10.4 release adds 64-bit application support, Access Control Lists, Xgrid, link aggregation, e-mail spam filtering (SpamAssassin), virus detection (ClamAV), Gateway Setup Assistant, and servers for Software Update, iChat Server using XMPP, Boot Camp Assistant, Dashboard and weblogs.

On August 10, 2006 Apple announced the first Universal Binary release of Mac OS X Server, version 10.4.2, supporting both PowerPC and Intel processors. At the same time Apple announced the release of the Intel-based Mac Pro and Xserve systems.

Another major release of Mac OS X Server was version 10.5. This version was one of the biggest upgrades in the history of Mac OS X server releases as it made Apple finaly confrontable with Microsoft server OS and Novell Netware.

The main features included:

- Simplified Setup. The redesigned Server Assistant steps IT through configuration of key server applications, networking settings, and user accounts. Once setup is complete, the new Server Preferences application allows IT to manage key services. A new Server Status Dashboard widget provides at-a-glance information on the status of services, as well as on disk space and CPU use.

1. Podcast Producer. An end-to-end solution for producing professional-quality podcasts is ideal for product training, sales presentations, university lectures, or employee updates. With the Podcast Capture application in Mac OS X 10.5 Leopard, users can capture audio and video, record onscreen actions, or submit existing QuickTime content to the server. Once the content is uploaded, Podcast Producer in Leopard Server automatically publishes it in formats optimized for playback on almost any device, from HD video to iPod, iPhone, or Apple TV.
2. Wiki Server. With Leopard Server users can create collaborative web pages, called wikis, complete with group calendar, blog, and mailing list archive. With the wiki server members can create blog entries, tag and cross-reference material, upload files and images, add comments, and perform keyword searches. Wiki server maintains the complete history, so IT can always revert to a previous version of any page.
3. iCal Server. Leopard Server includes a calendaring platform that makes it easy for individuals and groups to share calendars, coordinate events,

schedule meetings and reserve resources. iCal Server was the first commercial calendar server to support the open CalDAV standard.

4. Spotlight Server. Designed for workgroups with shared documents, projects, and file archives. It works with Mac OS X Leopard clients to search content stored on shared volumes across the entire network. Spotlight Server works with the Quick Look and Cover Flow features in Leopard to scan though files—without needing to open them.
5. Infrastructure enhancements. With the release of Leopard Server, Mac OS X Server is now an Open Brand UNIX 03 Registered Product conforming to the SUSv3 and POSIX 1003.1 specifications for the C API, Shell Utilities, and Threads. Mac OS X Server can compile and run all existing UNIX 03-compliant code. Many services in Leopard Server—including Apache 2, MySQL 5, Postfix, Podcast Producer, and QuickTime Streaming Server—are 64-bit, able to take maximum advantage of the processing power and addressable memory of 64-bit system hardware. Leopard Server is also 32-bit compatible, 32-bit and 64-bit applications can run side by side, both at native performance.
6. RADIUS Server. Leopard Server includes FreeRADIUS for network authentication. It ships with support for wireless access stations however can be modified into a fully functioning FreeRADIUS server.

PHP, MySQL, Apache, and BIND versions:

	10.5	10.5.1	10.5.2	10.5.3	10.5.4	10.5.5	10.5.6	10.5.7	10.5.8
PHP	5.2.4	5.2.4	5.2.4	5.2.5	5.2.5	5.2.6	5.2.6	5.2.8	5.2.11
MySQL	5.0.45	5.0.45	5.0.45	5.0.45	5.0.45	5.0.45	5.0.67	5.0.67	5.0.82
Apache	2.2.6	2.2.6	2.2.6	2.2.8	2.2.8	2.2.8	2.2.9	2.2.11	2.2.13
BIND	9.4.1-P1	9.4.1-P1	9.4.1-P1	9.4.1-P1	9.4.2-P1	9.4.2-P2	9.4.2-P2	9.4.3-P1	9.4.2-P3

Table 6-2 Versions of the web technologies in various versions of Mac OS X 10.5 server

Last released version of Apple's server operating system is a derivation from client OS Mac OS X 10.6 Snow Leopard. Its release made Mac OS X server much more stable and it brought new technologies between the majur upgrades are:

- Full 64-bit operating system. On appropriate systems with 4GB of RAM or more, Snow Leopard Server uses a 64-bit kernel to address up to a theoretical 16TB of RAM.
- iCal Server 2 with improved CalDAV support, a new web calendaring application, push notifications and the ability to send email invitations to non-iCal users.
- Address Book Server provides a central location for users to store and access personal contacts across multiple Macs and synchronized iPhones. Based on the CardDAV protocol standard.
- Wiki Server 2, with server side Quick Look and the ability to view wiki content on iPhone.
- A new Mail Server engine that supports push email so users receive immediate access to new messages. However, Apple's implementation of push email is not supported for Apple's iPhone.
- Podcast Producer 2 with dual-source video support. Also includes a new Podcast Composer application to automate the production process, making it simple to create podcasts with a customized, consistent look and feel. Podcast Composer creates a workflow to add titles, transitions and effects, save to a desired format and share to wikis, blogs, iTunes, iTunes U, Final Cut Server or Podcast Library.
- Mobile Access Server enables iPhone and Mac users to access secured network services, including corporate websites, online

business applications, email, calendars and contacts. Without requiring additional software, Mobile Access Server acts as a reverse proxy server and provides SSL encryption and authentication between the user's iPhone or Mac and a private network.

Picture 6-5 Inside of Apple XSERVE "XEON", rack photo

Picture 6-6 Rack with XSERVE G4 and XSERVE G5, rack photo

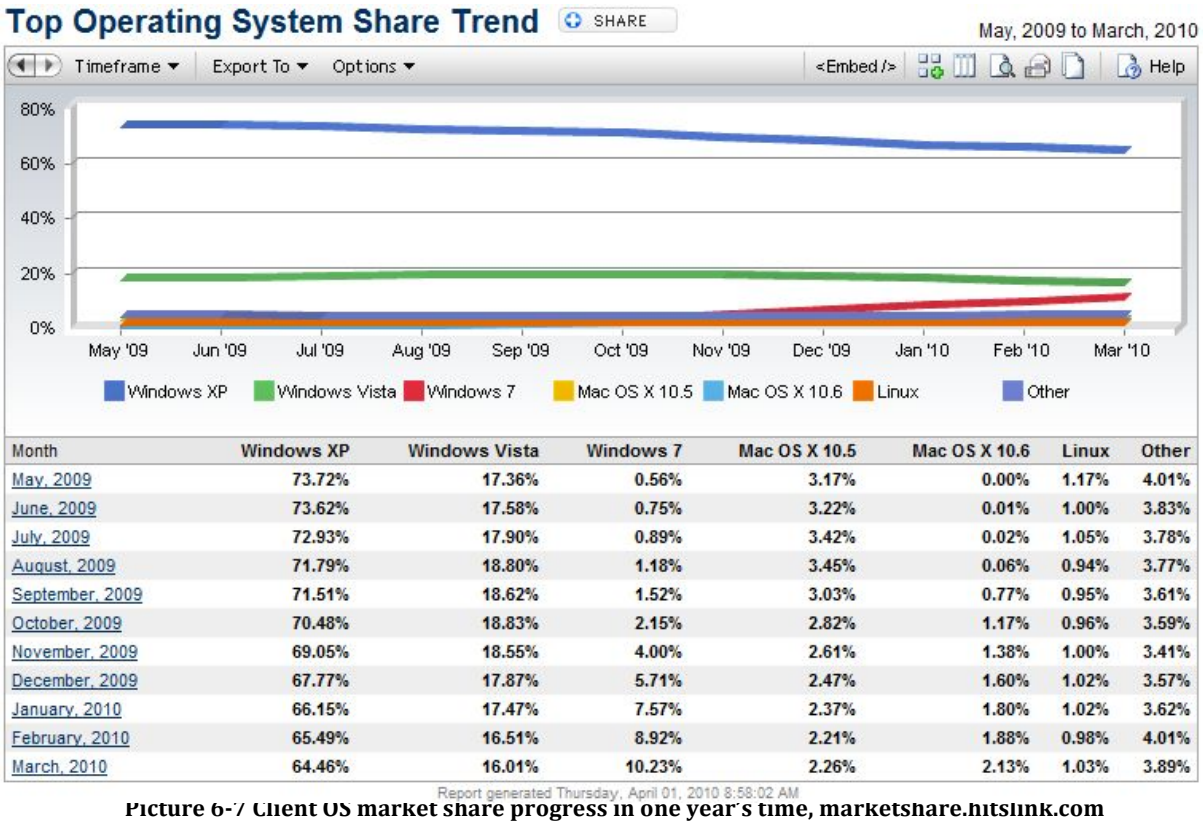
6.3. Server market share (Data provided by http://marketshare.hitslink.com)

First difference between these three server operating systems aimed at small and medium sized companies and probably the biggest one is the actual market share.

When the market share of server OS is being considered it is very interesting also comparing it to market share of client OSs.

Charts below clearly show the dominancy of Windows client operating systems. The very interesting is increase in percentage of Windows 7 installations, where we can see, that Windows 7 is actually taking its market share from older operating systems, namely Windows XP and Vista. Mac OS X 10.6 is also shifting its market share from previous versions but in comparison with data one year old the total installations of Mac OS X client increased by one percent. Linux is holding its position on one percent market share where it will most likely stay even in the future. Other operating systems are usually represented by mobile devices and other systems, which can be used for connection to the internet. The data for this chart are collected with analization of used OS when accessing websites such as bbc.co.uk, cnn.com, google.com and others.

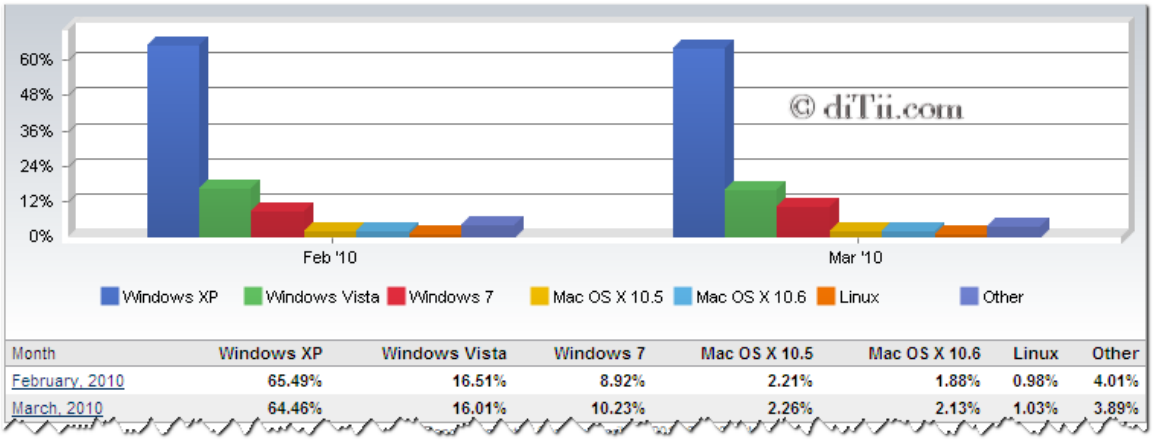
Microsoft disclosed that it sold more than 60 million copies of Windows 7 by the end of 2009, and now this growth has continued through the first quarter of 2010 crossed into double-digit market share numbers. “between Feb and Mar 2010, Windows dropped a sizeable 0.54% points from 92.12% to 91.58%. More specifically, Windows XP dropped 1.03% points from 65.49% to 64.46%, Windows Vista dipped 0.50% points from 16.51% to 16.01%, and Windows 7 jumped 1.31% points from 8.92% points to 10.23%.”[20]



Month	Windows XP	Windows Vista	Windows 7	Mac OS X 10.5	Mac OS X 10.6	Linux	Other
May, 2009	73.72%	17.36%	0.56%	3.17%	0.00%	1.17%	4.01%
June, 2009	73.62%	17.58%	0.75%	3.22%	0.01%	1.00%	3.83%
July, 2009	72.93%	17.90%	0.89%	3.42%	0.02%	1.05%	3.78%
August, 2009	71.79%	18.80%	1.18%	3.45%	0.06%	0.94%	3.77%
September, 2009	71.51%	18.62%	1.52%	3.03%	0.77%	0.95%	3.61%
October, 2009	70.48%	18.83%	2.15%	2.82%	1.17%	0.96%	3.59%
November, 2009	69.05%	18.55%	4.00%	2.61%	1.38%	1.00%	3.41%
December, 2009	67.77%	17.87%	5.71%	2.47%	1.60%	1.02%	3.57%
January, 2010	66.15%	17.47%	7.57%	2.37%	1.80%	1.02%	3.62%
February, 2010	65.49%	16.51%	8.92%	2.21%	1.88%	0.98%	4.01%
March, 2010	64.46%	16.01%	10.23%	2.26%	2.13%	1.03%	3.89%

Report generated Thursday, April 01, 2010 8:58:02 AM

Picture 6-7 Client OS market share progress in one year's time, marketshare.hitslink.com



Month	Windows XP	Windows Vista	Windows 7	Mac OS X 10.5	Mac OS X 10.6	Linux	Other
February, 2010	65.49%	16.51%	8.92%	2.21%	1.88%	0.98%	4.01%
March, 2010	64.46%	16.01%	10.23%	2.26%	2.13%	1.03%	3.89%

Picture 6-8 Client OS market share difference between February 2010 and March 2010, marketshare.hitslink.com

Ofcourse this is a comparison of client OS market share. When looking at the server OS market share, there is a problem with getting the actual data as Apple is not dislosing its actual markate share. Also the problem with Mac OS X server operating system is in its licensing as it can only be installed on Apple branded hardware while other operating systems can be installed on virtally any hardware deployed, which meets the requirements needed for running the operating system.

Therefore the data collected are not really showing the difference in small and medium size market but rather in worldwide server market, where the share is mainly split between Windows and Linux. The rest of server operating systems is occupying very small portion of the market.

According to IDC's data, Windows is still the dominant player. The fourth quarter 2009 was more robust than the third, in terms of total revenues and units. Windows' share of the total stayed constant unit-wise, yet declined, dollar-wise, when compared to the previous calendar quarter.

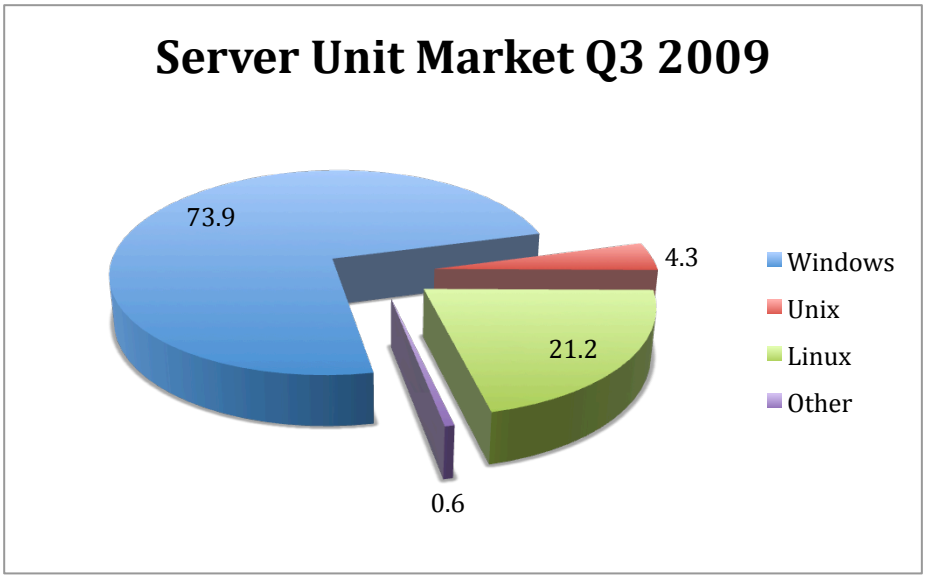
That said, Windows is still far and away the No. 1 server operating system, in terms of units, and the definite leader in terms of dollars.

Here's IDC's OS share data break out[19].

Vendor	Q4 2009 Revenue	Market Share	Q4 2008 Revenue	Market Share	Revenue Growth Q409/Q408
1. IBM	$4,590	35.4%	$4,910	36.4%	-6.5%
2. HP	$3,950	30.5%	$3,920	29.1%	0.8%
3. Dell	$1,489	11.5%	$1,425	10.6%	4.5%
4. Sun	$1,032	8.0%	$1,247	9.3%	-17.3%
5. Fujitsu	$595	4.6%	$556	4.1%	7.2%
Others	$1,296	10.0%	$1,422	10.5%	-8.9%
All Vendors	**$12,952**	**100%**	**$13,480**	**100%**	**-3.9%**

Table 6-3 IDC 2010 report on server HW sales

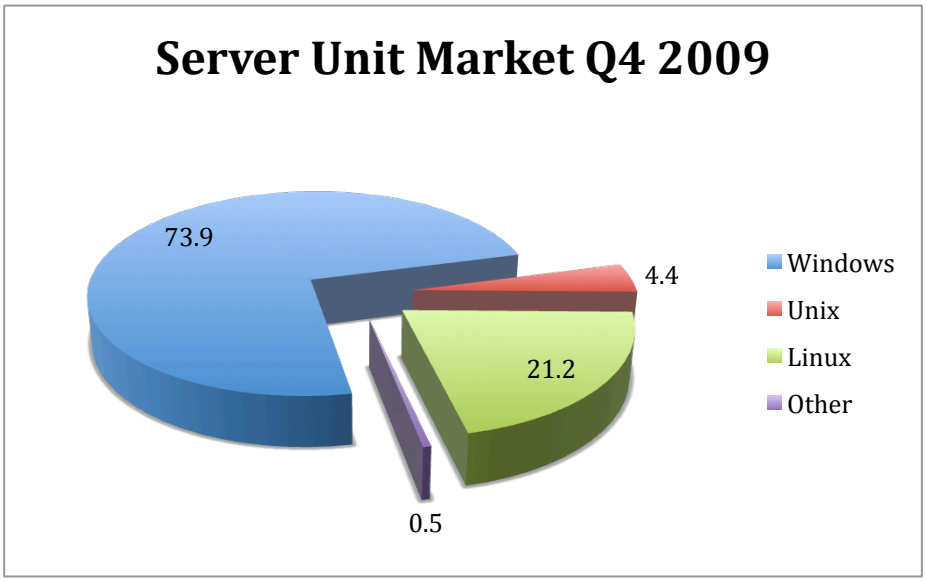
This is the table of major HW producers. Due to licensing restrictions on Apple Mac OS X server, for finding the Apple market share we can look between the vendors of HW and there we can see no Apple brand. From this we can safely assume, that Apple si not major player on the market.



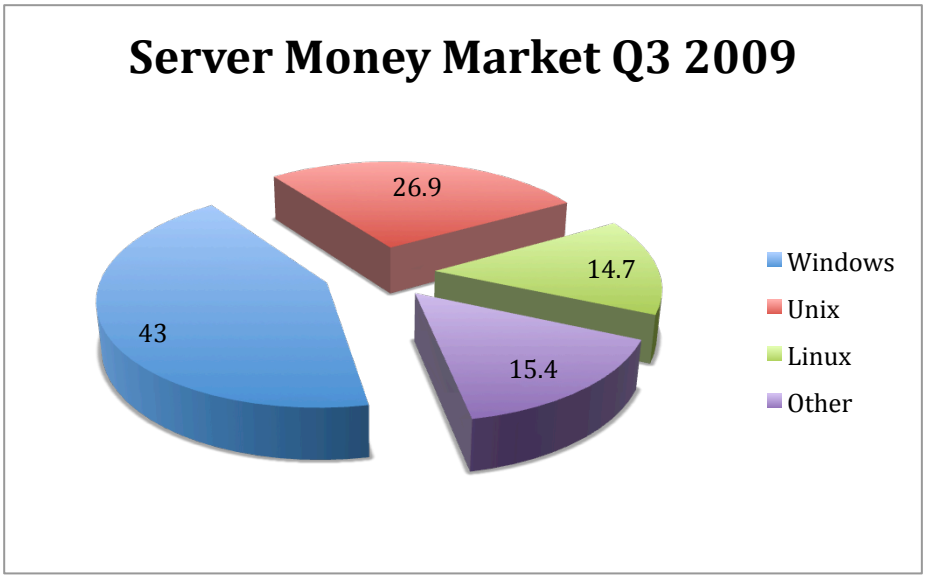
Picture 6-9 Server Unit Market share in Q3 2009, excel graph

Units	Q3 2009	% market	Q4 2009	% market
Windows	1248200	73,9	1434225	73,9
Unix	72001	4,3	84851	4,4
Linux	357491	21,2	412041	21,2
Other	11167	0,6	10849	0,5
Total	**1688859**		**1941966**	

Table 6-4 Server Unit Market share in 2009



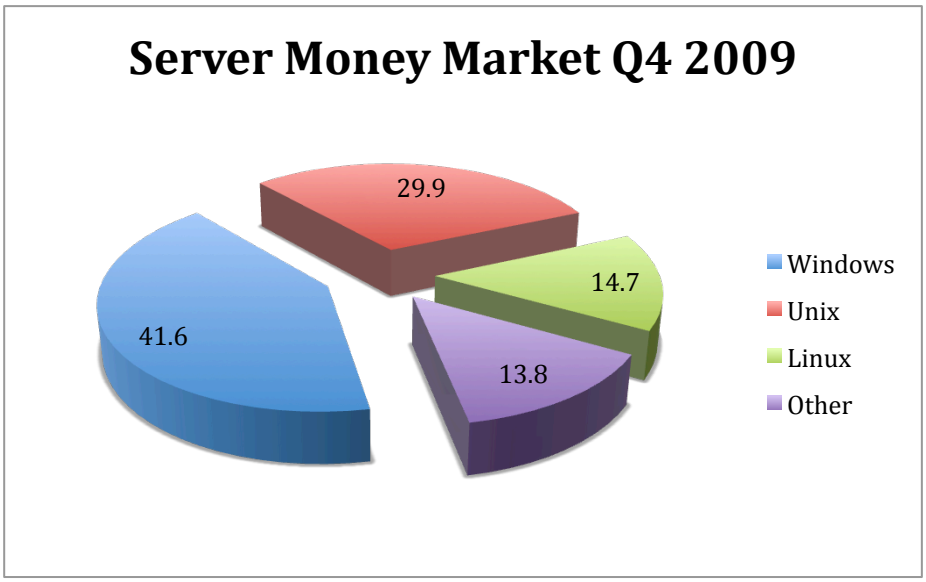
Picture 6-10 Server Unit Market share in Q4 2009, excel graph



Picture 6-11 Server Sales Market share in Q3 2009, excel graph

U.S. Dollars (in millions)	Q3 2009	% market	Q4 2009	% market
Windows	4487	43	5393	41,6
Unix	2803	26,9	3877	29,9
Linux	1537	14,7	1905	14,7
Other	1596	15,4	1777	13,8
Total	**10423**		**12952**	

Table 6-5 Server SalesMarket share in 2009



Picture 6-12 Server Sales Market share in Q4 2009, excel graph

Windows beats Linux when it comes to servers by well over a three-to-one margin, as it has for at least a year.

IDC recently issued a report about worldwide server use, which primarily focused on server hardware, with IBM in the lead, followed by HP, Dell, Sun, and Fujitsu.

Just as interesting are the figures for market share by operating system. The research shows that Windows Server had a 73.9% market share for the fourth quarter of 2009, with Linux at 21.2%. Those numbers are precisely the same -- down to the tenth of a percentage point -- as they were a year previous.

When it comes to revenue, Windows cleans up as well, with nearly $5.4 billion in revenue for the quarter, compared to a little over $1.9 billion in revenue for Linux.

6.4. Comparison of main features

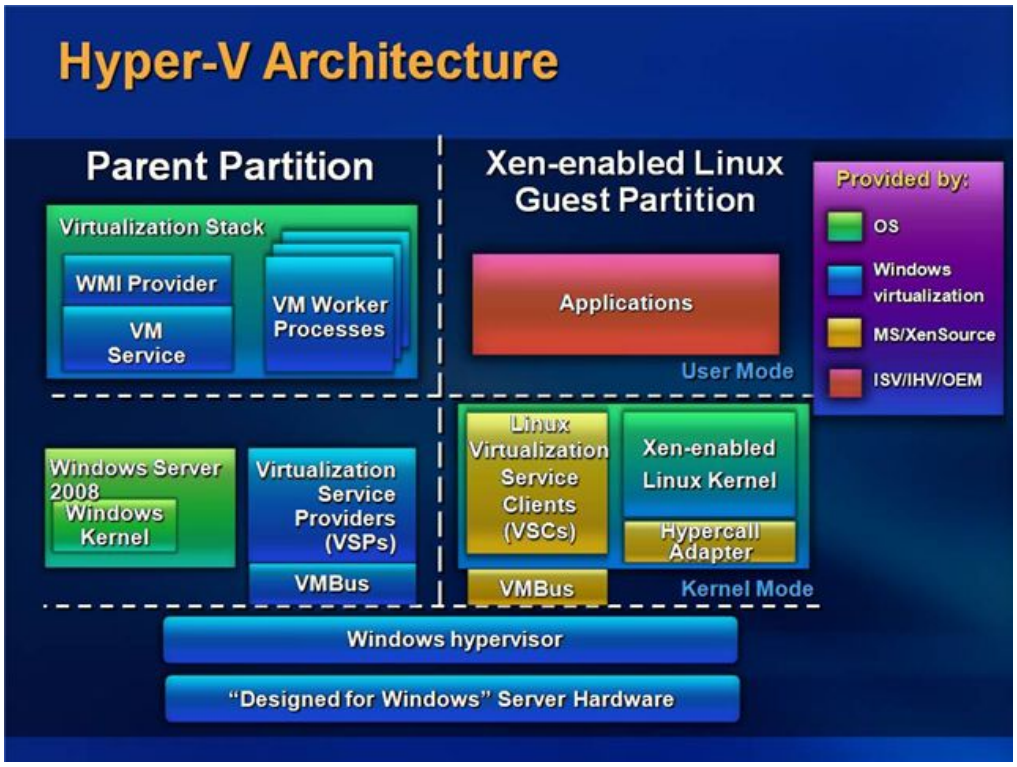
This chapter and following lower chapters will cover the main differencies between the above mentioned server operating systems. In first part there will be a comparison of core services, namely if the server solution must have its own operating system or if it is a layer above the operating system. Second part will cover its domain and directory services as well as internal communication and cooperation portals. Third part will cover its external communication capabalities such as mail services, unified messaging, web access from outside the internal network.

The last subchapter will cover the additional services which may be included in the complex solution, like firewall, antivirus solutions, database services and other interesting features. Also the hardware requirements will be compared in between the systems.

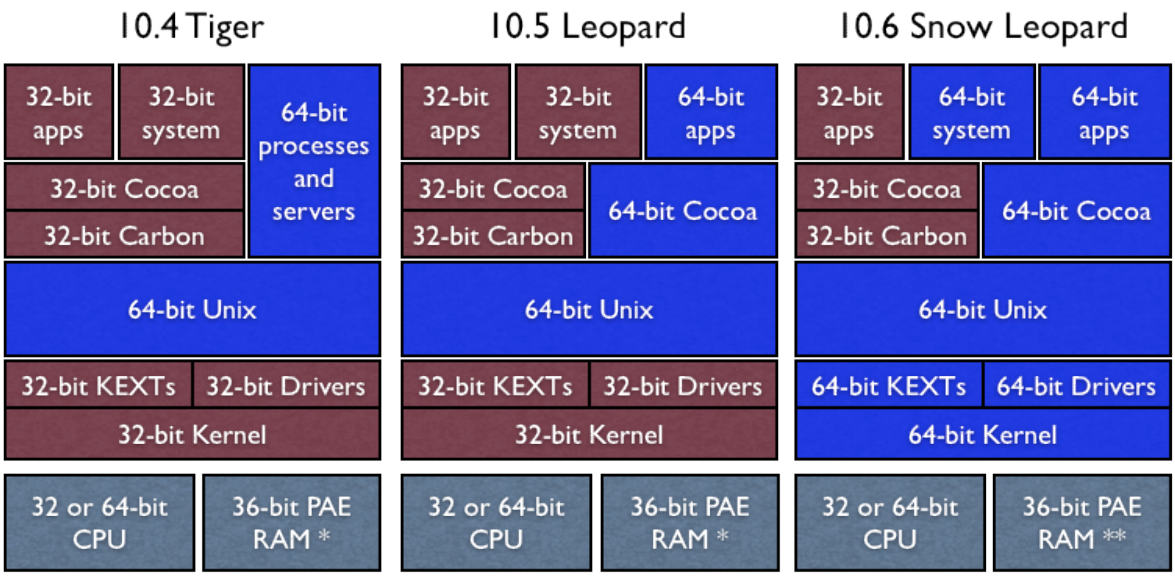
6.4.1. Server core

The difference between Microsoft solutions, Mac OS solution and Novell solutions is in their core. Where Microsoft has fully integrated Windows server 2008 core into the package, the Apple's server is identical to client OS with minor changes and added features. Novell has always delivered its server solution not as a operating system but rather as solution above the server core. Therefore it needs the actual operating system to run. This system can either be Windows operating system (server version is strongly preffered as it is more reliable when running 24/7) or it can be Linux distribution where Novell recommends usage of SUSE edition.

The Windows server solutions are aimed at usage of virtualization technology asi this will greatly lower the cost on secondary payments, such as electricity, multiple hardware and sometimes, multiple operators.



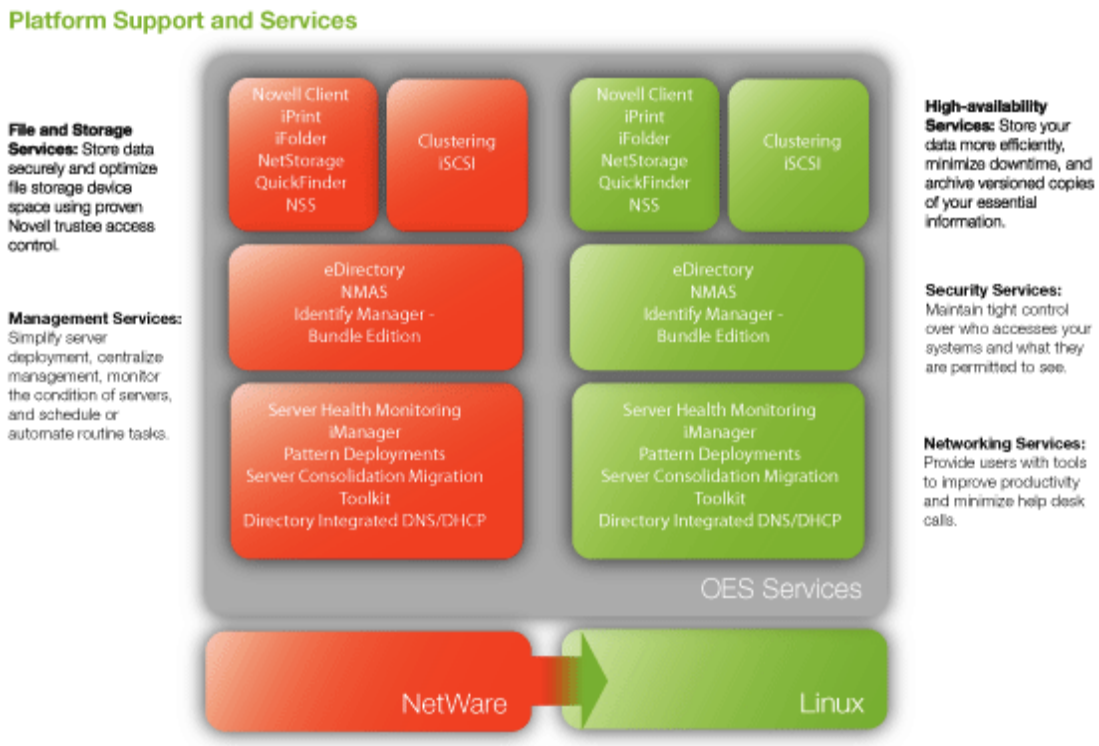
Picture 6-13 Windows Server 2008 R2 virtualization technology Hyper-V R2, www.microsoft.com



Running 64-bit software requires a 64-bit CPU, such as the Intel Core 2 Duo. Snow Leopard will still be able to run on 32-bit machines, as it will deliver both 32 and 64-bit versions of its included apps. Any graphical 64-bit apps need to have their user interface built using Cocoa. Leopard currently only supplies two 64-bit apps: Chess and Xcode (along with some other 64-bit development apps).
** PAE is hardware support for up to 32GB of RAM on certain Mac models, beyond the 32-bit limit of 4GB of RAM. It does not require having a 64-bit CPU or 64-bit kernel to access under Mac OS X.*
*** Snow Leopard's 64-bit kernel will eventually allow for more RAM than PAE currently supports.*

Picture 6-14 Mac OS X 10.4 – 10.6 OS Layers, www.apple.com

This shows the main difference in HW usage. The Mac OS X server is designed to run on specific hardware with no real option for differencies where Microsoft Hyper-V technology helps stabilizing the system with optimal hardware usage. Open Enterprise Server version 2 is the system designed to run on already preinstalled operating system however it does support running in virtual machine with very core service taken from SUSE Linux.



Picture 6-15 Open Enterprise Server services, www.novell.com

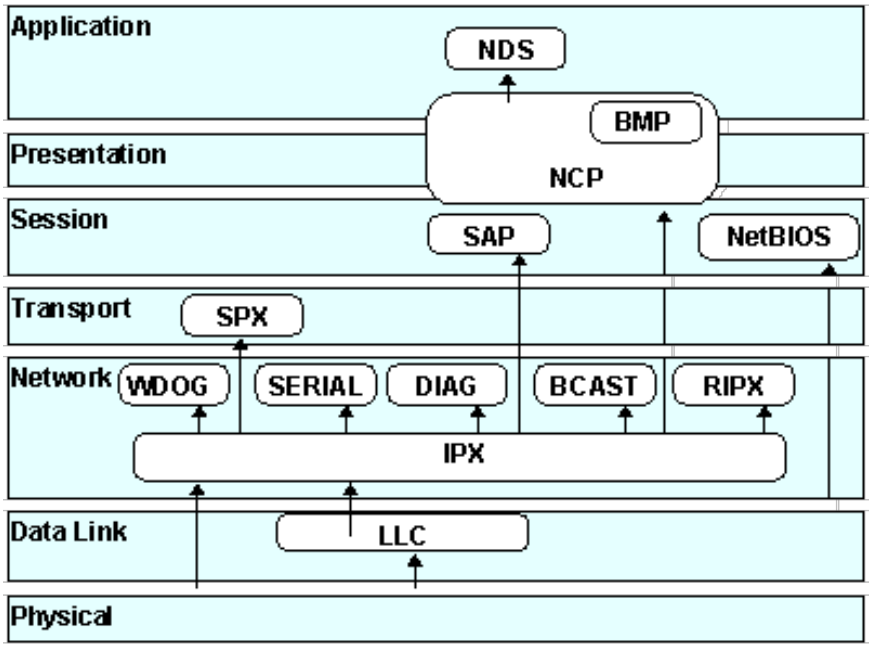
6.4.2. Internal communication with clients

Internal communications are usually handled with the use of some kind of electronic directory. Ofcourse there is also a difference in use of network transport protocol, where Open Enterprise Server 2 is still using Netware protocol.

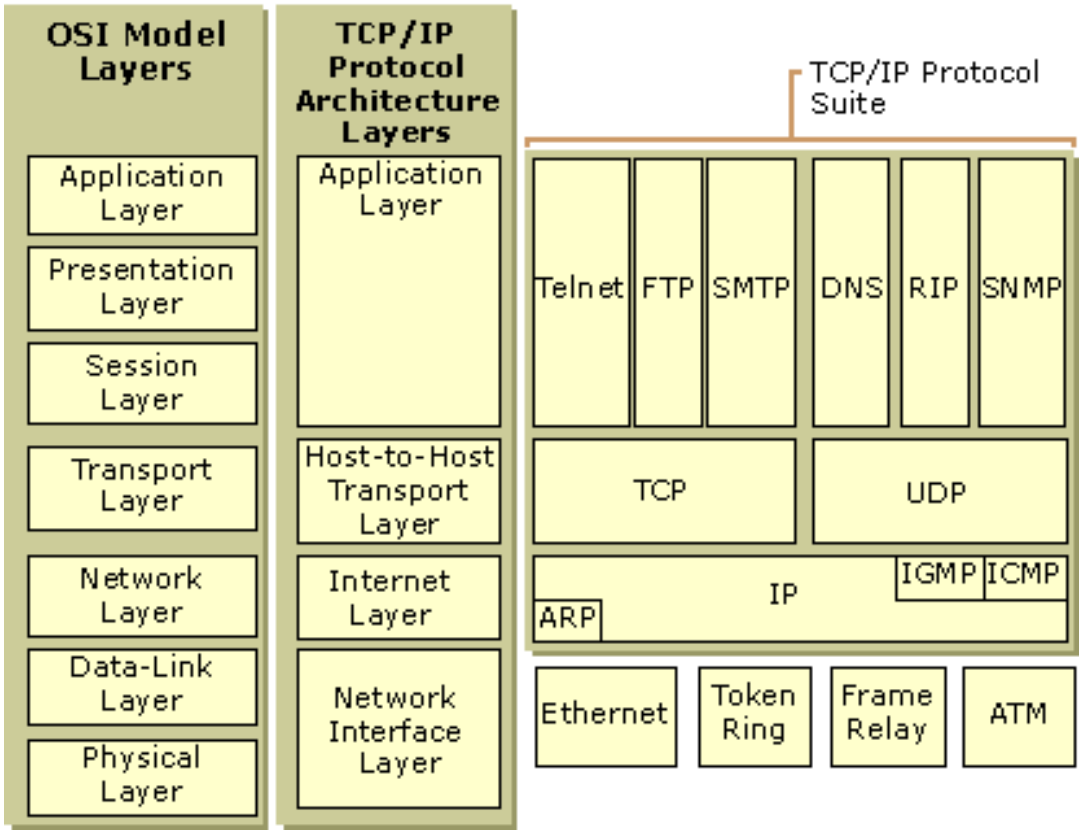
The Netware protocol is based on outdated IPX technology. IPX usage has declined in recent years as the rise of the Internet has made TCP/IP ubiquitous. Novell's initial attempt to support TCP/IP as a client protocol, called NetWare/IP, simply "tunnelled" IPX within IP packets, allowing NetWare clients and servers to communicate over pure TCP/IP networks. However, due to complex implementation, and a significant loss in performance due to the tunnelling overhead, NetWare/IP was largely ignored except as a mechanism to route IPX through TCP/IP-only routers

and WAN links. NetWare 5.x introduced native support for NCP over TCP/IP, which is now the preferred configuration. The successor to NetWare, Open Enterprise Server, comes in two flavors: OES-NetWare, which provides legacy support for IPX/SPX (deprecated), and OES-Linux, which only supports TCP/IP.

Apple used to be using its own appleralk protocol however after couple years this protocol was abandoned and Apple has decided to use a TCP/IP protocol.



Picture 6-16 IPX Protocol Architecture Layers, www.wikipedia.com



Picture 6-17 TCP/IP Protocol Architecture Layers, www.wikipedia.com

As for the Directory services Apple has been using Open Directory which is the LDAP directory service model implementation from Apple Inc.

In the context of Mac OS X Server, Open Directory describes a shared LDAPv3 directory domain based on OpenLDAP and a corresponding authentication model composed of Apple Password Server and Kerberos 5 tied together using a modular Directory Services system.

The term Open Directory can also be used to describe the entire directory services framework used by Mac OS X and Mac OS X Server. In this context, it describes the role of a Mac OS X or Mac OS X Server system when it is connected to an existing directory domain.

With the release of Mac OS X Leopard (10.5) Apple chose to move away from using the NetInfo directory service (originally found in NeXTSTEP and

OpenStep) which had been used by default for all local accounts and groups in every release of Mac OS X from 10.0 to 10.4. Mac OS X 10.5 now uses Directory Services and its plugins for all directory information. Local accounts are now registered in the Local Plugin, which uses XML property list (plist) files stored in /var/db/dslocal/indices/Default/ as its backing storage.

Novell is from the beginning been using its own directory service called eDirectory. eDirectory is a hierarchical, object oriented database used to represent certain assets in an organization in a logical tree, including people, positions, servers, workstations, applications, printers, services, and groups.

eDirectory uses dynamic rights inheritance, which allows both global and specific access controls. Access rights to objects in the tree are determined at the time of the request and are determined by the rights assigned to the objects by virtue of their location in the tree, any security equivalences, and individual assignments. The software supports partitioning at any point in the tree, as well as replication of any partition to any number of servers. Replication between servers occurs periodically using deltas of the objects. Each server can act as a master of the information it holds (provided the replica is not read only). Additionally, replicas may be filtered to only include defined attributes to increase speed (for example, a replica may be configured to only include a name and phone number for use in a corporate address book, as opposed to the entire directory user profile).

The software supports referential integrity, multi-master replication, and has a modular authentication architecture. It can be accessed via LDAP, DSML, SOAP, ODBC, JDBC, JNDI, and ADSI. eDirectory can scale to over one billion objects.

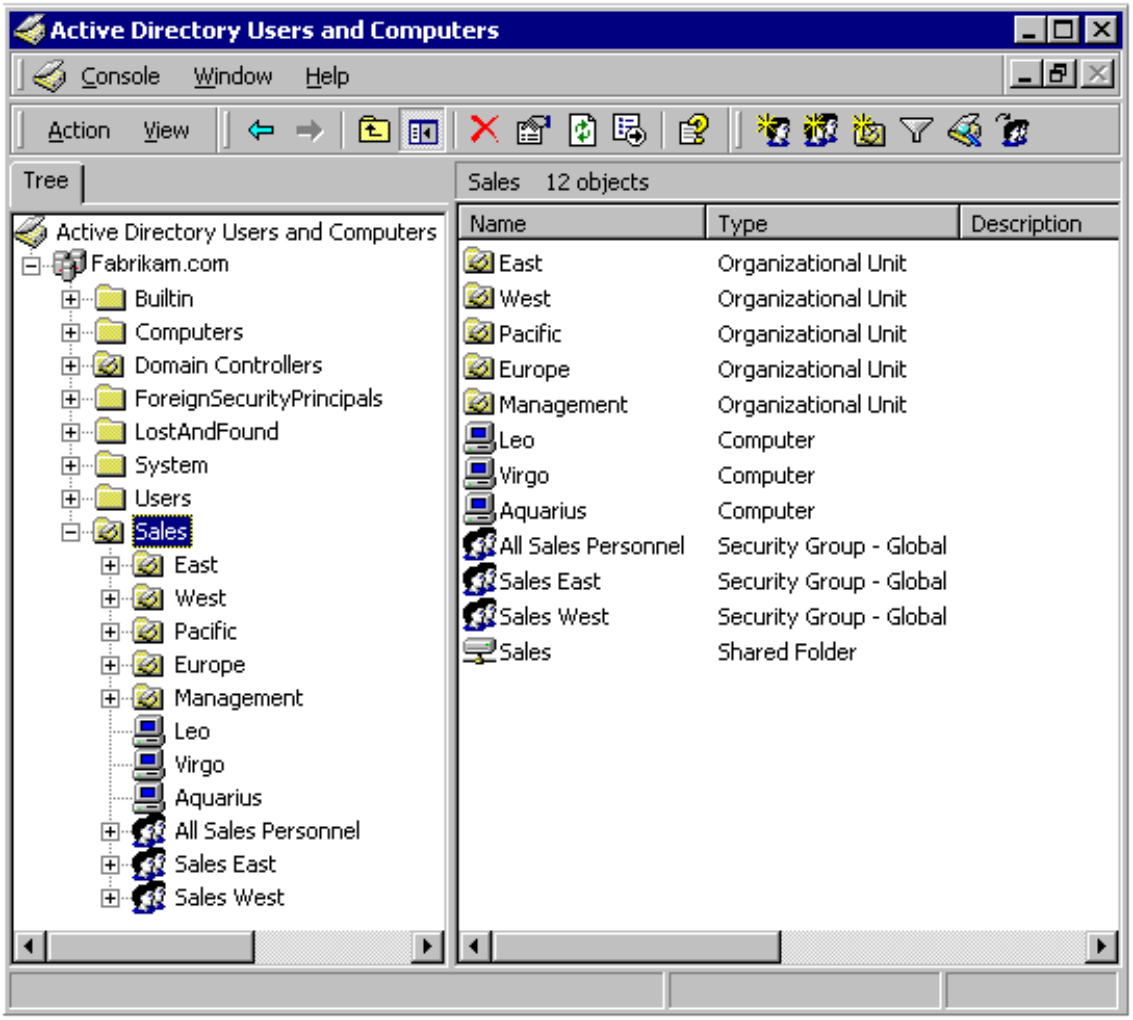
Active Directory is a technology created by Microsoft that provides a variety of network services.

Active Directory was previewed in 1999, released first with Windows 2000 Server edition, and revised to extend functionality and improve administration in Windows Server 2003. Additional improvements were made in Windows Server 2003 R2. Active Directory was refined further in Windows Server 2008 and Windows Server 2008 R2 and was renamed Active Directory Domain Services. [11]

The Active Directory consists of several network services which include:

- LDAP-likedirectory services
- Kerberos-based authentication
- DNS-based naming and other network information
- Central location for network administration and delegation of authority
- Information security and single sign-on for user access to networked based resources
- The ability to scale up or down easily
- Central storage location for application data
- Synchronization of directory updates amongst several servers

Using the same database, for use primarily in Windows environments, Active Directory also allows administrators to assign policies, deploy software, and apply critical updates to an organization. Active Directory stores information and settings in a central database. Active Directory networks can vary from a small installation with a few computers, users and printers to tens of thousands of users, many different domains and large server farms spanning many geographical locations.



Picture 6-18 Active Directory Domain Services, www.microsoft.com

It's better to choose eDirectory when the company plans to: Supply company users with non-Windows desktops;

- Implement and/or use a vast amount of non-Windows servers;
- Consider opensource to be the best thing since sliced bread;
- Use software that has specific eDirectory requirements. (think about: GroupWise, Bordermanager etc.)

It's better to choose Active Directory when the company plans to:

- Implement a really large directory

- Implement and/or use Microsoft Windows-only servers and desktops.
- Use software that has specific Active Directory requirements. (think about: Citrix, Exchange Server, ISA Server, etc.)

If the company goal is a flexible solution to address a specific (application) problem choose Active Directory Application Mode (ADAM).

6.4.3. External communication

External communications are in all three cases handled by software connected and implemented together with the rest of the complex solution.

Microsoft handles the external as well the internal communication with the use of two software solutions. Both of them are connected through the active directory. One of the solutions is Microsoft Exchange Server. In SBS and EBS 2008 the version 2007 is used. It is presumed that Microsoft will implement 2010 version into next version of SBS and EBS. Second used software for communication are the Sharepoint Services 3.0.

The Exchange server is used for handling the email and unified messaging whereas Sharepoint services are used as a portal server for sharing documents, materials and providing external connection to a remote desktop.

Apple is handling the communication through four services joind by CalDAV protocol. These four services are[21]:

- iCal Server 2 with improved CalDAV support, a new web calendaring application, push notifications and the ability to send email invitations to non-iCal users.

- Address Book Server provides a central location for users to store and access personal contacts across multiple Macs and synchronized iPhones. Based on the CardDAV protocol standard.
- A new Mail Server engine that supports push email so users receive immediate access to new messages. However, Apple's implementation of push email is not supported for Apple's iPhone.
- Mobile Access Server enables iPhone and Mac users to access secured network services, including corporate websites, online business applications, email, calendars and contacts. Without requiring additional software, Mobile Access Server acts as a reverse proxy server and provides SSL encryption and authentication between the user's iPhone or Mac and a private network.

As for the Novell Open Enterprise Server, the solution does not have a mail, contact and calendar solution included as default but a GroupWise can be used if needed.

GroupWise is a messaging and collaborative software platform from Novell that supports email, calendaring, personal information management, instant messaging, and document management. The platform consists of the client software, which is available for Windows, Mac OS X, and Linux, and the server software, which is supported on Windows Server, Netware, and Linux. The latest generation of the platform is GroupWise 8, which was launched in 2008.

6.4.4. Additional features

Additional features are software applications implemented into the server that grant the server another funcionalities. Print services, file sharing services and such are not considered as they are a part of any modern server operating systems.

Additional features implemented into **Mac OS X 10.6 server** are[17]:

- Wiki Server is a set of services which ships with Mac OS X Server v10.5 and v10.6. Mac OS X Server includes web-based Wiki, Weblog, Calendaring, and Contact services. Additionally, it includes a Cocoa application called Directory which allows directory viewing as well as enabling of group services. Users can create collaborative web pages, called wikis, complete with group calendar, blog, and mailing list archive. With the wiki server members can create blog entries, tag and cross-reference material, upload files and images, add comments, and perform keyword searches. Wiki server maintains the complete history, so IT can always revert to a previous version of any page.
- Podcast Producer 2 with dual-source video support. Also includes a new Podcast Composer application to automate the production process, making it simple to create podcasts with a customized, consistent look and feel. Podcast Composer creates a workflow to add titles, transitions and effects, save to a desired format and share to wikis, blogs, iTunes, iTunes U, Final Cut Server or Podcast Library.
- Spotlight Server. Designed for workgroups with shared documents, projects, and file archives. It works with Mac OS X Leopard clients to search content stored on shared volumes across

the entire network. Spotlight Server works with the Quick Look and Cover Flow features in Leopard to scan though files—without needing to open them.

Additional features implemented in **Novell Open Enterprise Server**[15]:

- Novell iFolder® lets IT store, access, organize and manage company files from anywhere, anytime. This powerful, encrypted online file synchronization and online transfer tool gives IT worry-free security, ensuring that user files are always safe, secure and up to date. And Novell iFolder 3.7 makes it easier than ever to share information with colleagues and work with files from any machine with Web access.
- Novell iManager keeps IT on the alert through its browser-based monitoring tool and allows IT to centrally view and manage the demands of company network from a single location. Novell iManager provides a number of capabilities that advance company administrative capacity and flexibility.
- Novell Customer Center is an online interface that makes it easy to manage company business and technical interactions with Novell. From one location, IT can review the status of all company Novell products, subscriptions and services and obtain critical Linux updates and support. Novell Customer Center combines the innovative tools and automated services IT need to ensure licensing compliance and reduce systems-management costs.
- The Novell Clients help IT connect with the full range of Novell services on SUSE Linux Enterprise Desktop, Windows XP or Windows Vista. They enable users on Windows* or Linux* platforms to enjoy the added benefits of Novell eDirectory,

integrated messaging, single synchronized login and multiprotocol support.

- Give users secure access to files from anywhere. NetStorage provides secure Internet-based access to all files and folders stored on Novell Open Enterprise Server. NetStorage authentication relies on the power of Novell eDirectory™ to provide secure access, so Internet-based access is as secure as accessing files from within the network.

Additional features implemented into **Microsoft Windows Essential Business Server 2008**[7]:

- Microsoft Forefront Threat Management Gateway (Forefront TMG), formerly known as Microsoft Internet Security and Acceleration Server (ISA Server), is a network security and protection solution for Microsoft Windows, described by Microsoft as "enables businesses by allowing employees to safely and productively use the Internet for business without worrying about malware and other threats".
- The next generation of Forefront Security for Exchange Server provides fast and effective detection of malware and spam, blocks out-of-policy content, and integrates with Forefront Online Protection for Exchange to offer the defense-in-depth benefits of hosted and on-premise filtering in a single solution.
- SQL Server 2008 R2 adds certain features to SQL Server 2008 including master data management system branded as *Master Data Services*, a centralized console to manage multiple SQL Server instances, and support for more than 64 logical processors.

- Microsoft System Center is a set of server products aimed specifically at helping corporate IT administrators manage a network of Windows Server and client desktop systems. When first introduced, the "System Center" brand included products from the Windows Server System line, but has since evolved to include new products.

7. Implementation of EBS 2008

This chapter will briefly go through the preparation process of the Microsoft Windows Essential Business Server 2008 installation. This work is not a guide through the installation process and is simply showing the installation and implementation process.

7.1. Overview of the Installation Process[11]

Windows EBS automates many of the installation and configuration tasks that IT usually must perform manually when IT install servers.

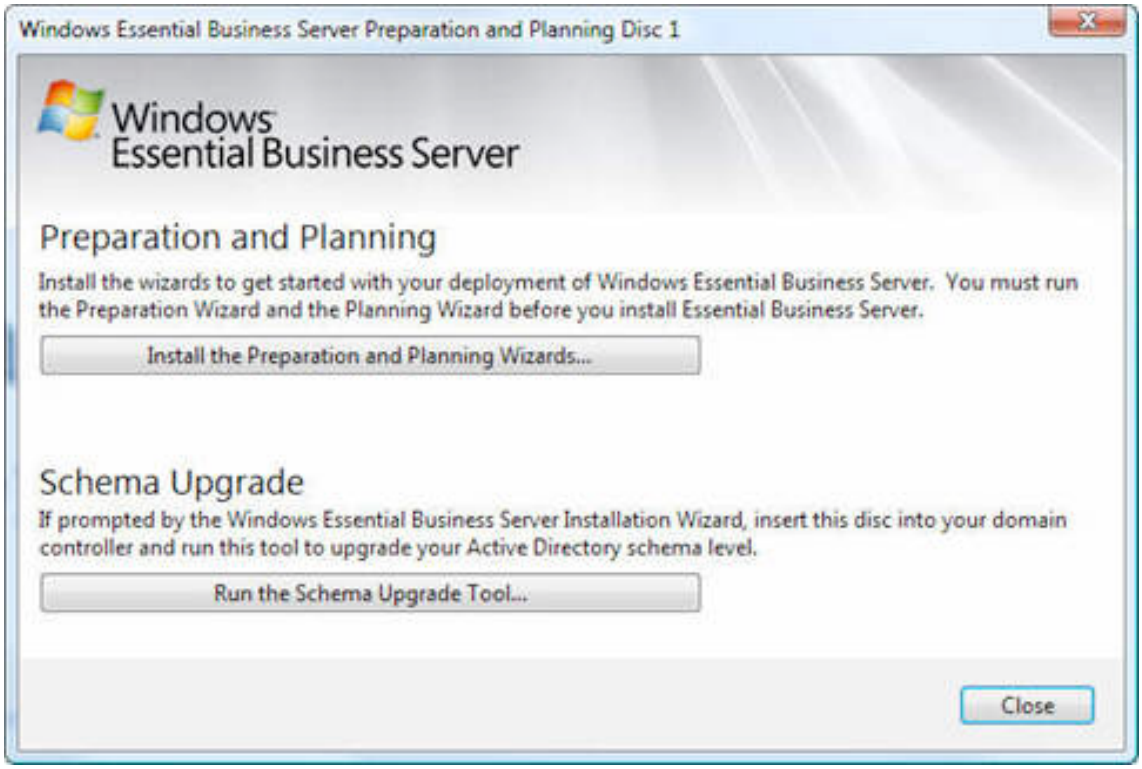
- Before installing Windows EBS, IT must run the following tools:
- Run these tools from Windows EBS Disc 1 - Prerequisite Planning Tools. Additional information for running these tools is available in the Windows EBS Preparation and Planning Guide at the Microsoft Web site.

After running the Preparation Wizard and the Planning Wizard, IT install and configure Windows EBS by following these steps:

1. Make physical connections for power and network connectivity and prepare company existing environment to meet Windows EBS prerequisites.

2. Install Windows EBS software on three servers: the Windows EBS Management Server, Security Server, and Messaging Server. This process includes a procedure to integrate the servers running Windows EBS into company existing environment.
    - The procedures for installing Windows EBS instruct IT to install the software from the Windows EBS installation discs and to create a partition on each server to install the operating system. If IT bought company servers for Windows EBS from an original equipment manufacturer (OEM), company installation media may differ and some components of Windows EBS may be preinstalled. For more information, refer to the documentation supplied with the hardware from company OEM.
    - IT can use Windows Deployment Services to deploy Windows EBS to company new servers. To deploy Windows EBS from a server that is running Windows Deployment Services, IT must add the images for the Management Server, Messaging Server, and Security Server to the server that is running Windows Deployment Services. For more information about using Windows Deployment Services, see “Windows Deployment Services Step-by-Step Guide” at the Microsoft Web site. IT must finish the installation process on all three Windows EBS servers after IT deploy the images.
3. Set the time zone on each server to the local time zone in company area. For more information, see Set the time zone on each computer.

4. Finish configuration and migration tasks to start using company servers. These tasks are finished by using tools and guidance in the Configuration and Migration Tasks page, which IT open in the Windows EBS Administration Console after the Windows EBS software is installed.



Picture 7-1 Windows EBS Preparation and Planning Wizard, www.microsoft.com

7.2. Installation sequence

Windows EBS installation is tightly integrated among the Preparation Wizard, the Planning Wizard, and the three servers. IT are guided to install Windows EBS on the servers in the following order:

1. The Management Server
2. The Security Server
3. The Messaging Server

After the installation is finished on each server, the Installation Wizard lists the components, server roles, and services that are installed. After Windows EBS is installed on the Messaging Server, IT can complete the configuration and migration tasks that are necessary to optimize use of the servers. Complete these tasks by using the Configuration and Migration Tasks page that starts when IT open the Windows EBS Administration Console on the Management Server.

7.3. Installation wizard

The Installation Wizard performs some verification checks, installs Windows EBS, and establishes the Windows EBS Security Server as a network firewall.

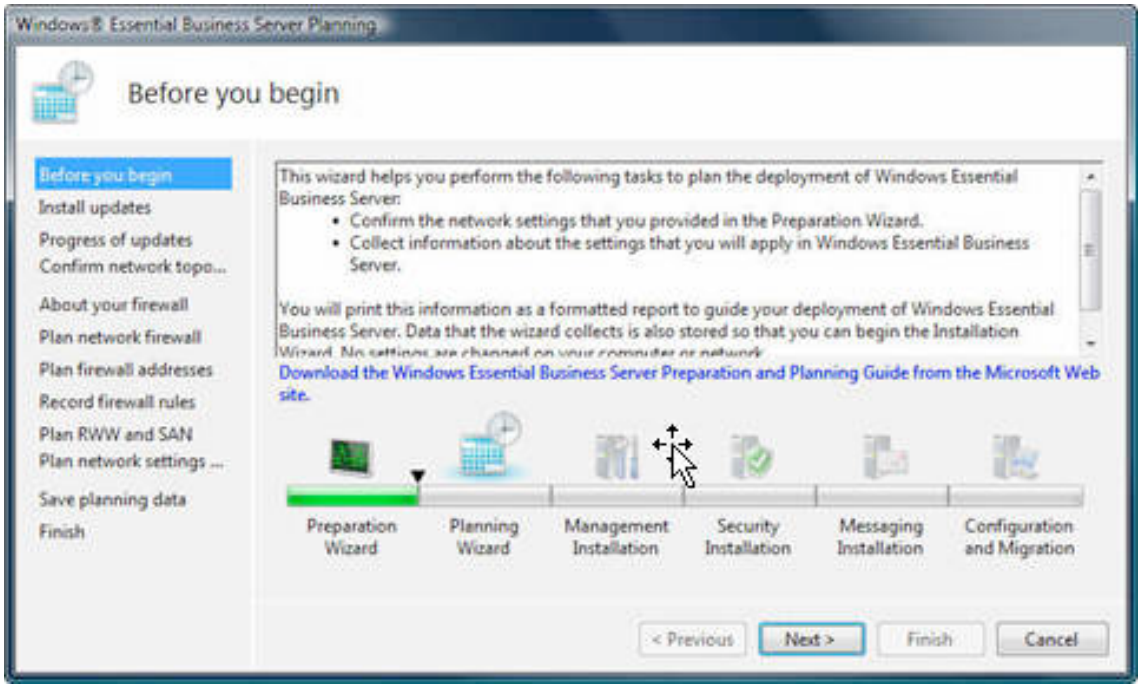
During installation, IT may be prompted to use additional tools to update company existing network so that it is compatible with company servers. These tools are supplied with Windows EBS.

The Installation Wizard completes several functions, including the following:

- Verifies that IT have run and finished the Preparation Wizard and the Planning Wizard
- Verifies the compatibility of company current network with Windows EBS, and then helps IT perform updates to ensure compatibility
- Connects to the Microsoft Update Web site to download and install critical updates
- Installs Windows Server® 2008
- Installs the product technologies, applications, and components of Windows EBS

- Performs initial configuration of network services, such as DHCP Server service and Active Directory® Domain Services
- Performs initial configuration of network security services on the Security Server.
- Guides IT through the steps to establish the Windows EBS Security Server as company external gateway and primary firewall during the Security Server installation
- Performs initial configuration of messaging services on the Messaging Server

After IT install all three of the servers for Windows EBS, the Installation Wizard prompts IT to complete a list of configuration and migration tasks on the Windows EBS Administration Console. These tasks complete company network configuration and move company primary workloads to the servers running Windows EBS.



Picture 7-2 Server Installation progress, www.microsoft.com

8. Results

The importance of having stable server operating system and network enviroment is the most important part of every business nowadays. Even though most of the managers do not consider IT more than just a support service for main line of the business, they do not comprehend the importance and their company dependency on the IT.

As this work can show there are three major players on the server operating systems market. Three major operating systems were considered. Namely the chosen representatives from Microsoft Windows family, The Microsoft Windows Essential Business Server 2008, from UNIX family, The Mac OS X 10.6 Snow Leopard Server and from Novell family, The Novell Open Enterprise Server 2.

All of these servers are front-end server solutions and are aimed at small and medium size businesses. Novell used to be the biggest software server producer in mid 90s however it started to loose its position after arrival of Windows Server solutions. The Apple Mac OS X servers were introduced in 2001 and from then they served as a server solution for mac network enviroments with almost no support for Windows clients. This situation has changed in recent years but the support for windows client is still limited.

Apple's biggest disadvantage, but probably also an advantage from different point of view, lies in the Apple's restriction, that every Apple operating system can be installed only on Apple branded hardware. This ofcourse limits the potential market for Apple operating system, but it also provides additional stability and performace as the system is optimized to run only on specified hardware and does not have to be prepared to accept the different hardware.

Microsoft solution is based on very good performance of Microsoft Windows Small Business Server 2003 R2, where the Microsoft company recognised a need for medium sized business to be able to purchase a server solution which will lower the cost for purchase of the server operating systems and additional software such as mail server, communication server and other. The Microsoft Windows Essential Business Server 2008 has been designed for medium size companies running up to 300 clients.

The recent progress on the market however shows that this solution was not very widely accepted and that the medium size and large size companies are moving more to the clustering systems and cloud computing therefore this solution is no longer needed.

Announcement from Microsoft on discontinuation of the development of this project was made on Friday 5 2010[16]:

Four years ago, we committed to building an infrastructure solution for the mid-market. Windows Essential Business Server (EBS) which was the first of its kind to meet the unique needs of mid-market IT pros. Since that time the market landscape has naturally changed.

Today, we announced the decision to streamline our server product portfolio and will discontinue future development of EBS, effective June 30th, 2010.

Since the launch of EBS, several changes have occurred that drove our decision to streamline our server product portfolio. First, midsize businesses are rapidly turning to technologies such as management, virtualization and cloud computing as a means to cut costs, improve efficiency, and increase competitiveness. Those capabilities are already available through other offerings, including Windows Server 2008 R2, Microsoft System Center and the Microsoft Business Productivity Online Suite (BPOS).

Secondly, Microsoft remains fully committed to small and medium-sized businesses. We recognize that ending future editions of EBS could result in additional cost and complexity for our EBS customers. Therefore, we are going to provide a limited offer for all EBS 2008 customers. Beginning on June 30, 2010 through December 31, 2010, current EBS 2008 customers can get the individual component software from the EBS 2008 suite for free (local taxes, shipping and handling charges may apply). To learn more about this offer, EBS customers can visit http://www.microsoft.com/ebs.

This decision not to ship future versions of EBS does not come lightly and will not impact any other Windows Server products and solutions, including the next version of Windows Small Business Server (SBS). As a matter of fact, we are working hard to build the next version of SBS and look forward to a second decade of success with this award winning small business offering.

There is a tremendous amount of talent and expertise on the EBS product development team and Microsoft is committed to transitioning members of the EBS product team to work on other projects within the Microsoft Server and Cloud division.

Finally, in building these products for midsize customers we've had the unique opportunity to work closely with customers and partners worldwide. We would like to sincerely thank those of IT who provided feedback, participated in the development, and used Windows Essential Business Server.

We look forward to continuing to provide world-class Microsoft solutions for the future!

More Information:

Current EBS customers can look forward to a support cycle that holds true to the Microsoft five-year mainstream and five-year extended support lifecycle.

All service packs will also be supported according to lifecycle support. For more detailed information, please visit http://support.microsoft.com/lifecycle.

For customers interested in transitioning off of EBS, we will offer a six-month promotion where customers can migrate to many of the stand-alone products included in EBS 2008. For more details on the offer, please go to http://www.microsoft.com/ebs.

Customers with Software Assurance will be offered an open agreement to receive the license for many stand-alone products that would have been included in EBS 2010. Customers who do not have Software Assurance will have the option to take advantage of the offer which begins on June 30, 2010 through December 31, 2010. For more details on the offer, go to http://www.microsoft.com/ebs.

As this announcement stays there will be only two solutions for small and medium size business after June 30 2010 and those are the Microsoft Windows Small Business Server and full featured Windows Server. The cloud computing with usae of Windows Azure will also be an option but the real usage of cloud computing, even though it is becoming more and more used, is still in its early stages.

Novell solution is a development from Novel Netware and it is a reaction to a decline in usage of Novell technologies. Open Enterprise Server is aimed at medium and large size market and it is based mostly on Linux operating system. The main disadvantage of the Novell Open Enterprise Server is that it needs an actuall running operating system and therefore a at least two people from which one understands perfectly the host operating system and another one who understands the Novell technologies. Also Open Enterprise

server does not have mail client preinstalled and it needs yet another software to have installed.

Most companies that report usage of Novell Open Entepreise server, and older Novell Netware, are doing so because of historical progress and that most of their processes and networks were built on Novell enviroment as even in the year 2006, the Novell solutions were considered as the best solutions for large scaled networks. This is now being rivaled by Microsoft solutions and cloud computing.

Also Novell is not very suitable enviroment for small and medium size business as it was always aimed at big companies and requires a quite a big manpower. Small and medium size businesses are now looking for easy set, but complex solutin, which would provide them with their needs and which, after the initial cost for licence and set up will not require huge numbers of money to be put into the server operations.

Therefore after considering all pros and cons the best solution nowadays for small and medium size business would be Microsot Windows Small Business Server or Windows Essential Business Server, even though there will be no new version of EBS. The market in five year will most likely progress from the need of proprietary server solutions to cloud enviroment and virtual services.

9. Bibliography

1. MICROSOFT CORPORATION: Microsoft Official Course 2395A Designing, Deploying, and Managing a Network Solution for the Small and Medium-Sized Business, Seattle, 2003, X10-11027
2. RUSSEL CH., CRAWFORD S.: Microsoft Windows Small Business Server 2003: Administrator's Companion. Microsoft Press, Redmond, 2006. ISBN 0-7356-2280-9
3. RATLIFF B., BALLARD J.: Microsoft Internet Security and Acceleration (ISA) Server 2004: Administrator's Pocket Consultant. Microsoft Press, Redmond,, 2006. ISBN 0-7356-2188-8
4. STANEK WILLIAM R.: Microsoft Exchange Server 2003: Administrator's Pocket Consultant. Microsoft Press, Redmond, 2004. ISBN 0-7356-1978-8
5. STANEK WILLIAM R.: Microsoft SQL Server 2005. Computer Press, a.s., Brno, 2006. ISBN 80-251-12211X
6. RIZZO J.: Mac OS X Snow Leopard Server FOR DUMMIES. Wiley Publishing, Inc., Hoboken, 2010. ISBN 978-0-470-45036-9
7. RUSSEL CH., CRAWFORD S.: Microsoft Windows Small Business Server 2008: Administrator's Companion. Microsoft Press, Redmond, 2009. ISBN 978-0-7356-2070-4
8. GRUMAN G., HATTERSLEY M., BUTLER T.R.: Mac OS X Snow Leopard Bible. Wiley Publishing, Inc, Indianapolis, 2009. ISBN 978-0-470-45363-6
9. MIKA J.: CHIP – Magazin of Information Technologies 12/09, Burda Praha, spol. s r.o., Prague, 2009. ISSN 1210-0684
10. HARRIS J., LATIMER M.: Novell Open Enterprise Administrator's Handbook, SUSE Linux Edition, Novell Press, Waltham, 2005. ISBN 978-0672327490

11. Microsoft Corporation [online]. 2007, www.microsoft.com
12. Microsoft Corporation [online]. 2007, www.microsoft.cz
13. Concentrix b.v. [online]. 2003-2007, www.smallbizserver.net
14. TechGenix Ltd. [online], 2007, www.isaserver.org
15. TechGenix Ltd. [online], 2007, www.msexchange.org
16. Novell Inc. [online], 2010, www.novell.com
17. Microsoft blog [online], 2010, blog.technet.com
18. Apple Inc., [online], 2010, www.apple.com
19. Gartner, Inc., [online], 2010, www.gartner.com
20. International Data Corporation, [online], 2010, www.idc.com
21. Market Share, [online], 2010, marketshare.hitslink.com
22. Wikipedia The Free Encyclopedia [online], 2008, www.wikipedia.org

10.Supplements

10.1. Picture list

Picture 3-5 Comparison of MS SBS 2008 and MS EBS 2008, www.microsoft.com 16
Picture 4-1 MS SBS 2008 Premium BOX, www.microsoft.com 17
Picture 4-2 Windows PowerShell, www.microsoft.com 24
Picture 4-3 Hyper-V technology, www.microsoft.com 26
Picture 4-4 Microsoft Forefront logo, www.microsoft.com 34
Picture 5-1 FrontPage of the Package MS BackOffice SBS 4.5, www.prodejit.com....40
Picture 5-2 MS SBS 2003 Premium Edition, www.alza.cz 41
Picture 5-3 MS SBS 2008 Server scenarios, www.microsoft.com 43
Picture 5-4 MS EBS 2008 Server scenarios, www.microsoft.com....45
Picture 6-1 Novell Open Enterprise Server BOX, www.novell.com....47
Picture 6-2 Novell NetWare console screen, printscreen 52
Picture 6-3 Mac OS X Server Boxes, www.aple.com....54
Picture 6-5 Inside of Apple XSERVE "XEON", rack photo....63
Picture 6-6 Rack with XSERVE G4 and XSERVE G5, rack photo....63
Picture 6-7 Client OS market share progress in one year's time, marketshare.hitslink.com 65
Picture 6-8 Client OS market share difference between February 2010 and March 2010, marketshare.hitslink.com 65
Picture 6-9 Server Unit Market share in Q3 2009, excel graph....67
Picture 6-10 Server Unit Market share in Q4 2009, excel graph 67
Picture 6-11 Server Sales Market share in Q3 2009, excel graph 68
Picture 6-12 Server Sales Market share in Q4 2009, excel graph 68

Picture 6-13 Windows Server 2008 R2 virtualization technology Hyper-V R2, www.microsoft.com....70
Picture 6-14 Mac OS X 10.4 – 10.6 OS Layers, www.apple.com....71
Picture 6-15 Open Enterprise Server services, www.novell.com....72
Picture 6-16 IPX Protocol Architecture Layers, www.wikipedia.com....73
Picture 6-17 TCP/IP Protocol Architecture Layers, www.wikipedia.com....74
Picture 6-18 Active Directory Domain Services, www.microsoft.com....77
Picture 7-1 Windows EBS Preparation and Planning Wizard, www.microsoft.com....85
Picture 7-2 Server Installation progress, www.microsoft.com....87

10.2. Table list

Table 6-1 Main differences between different Novell versions[15]....50
Table 6-2 Versions of the web technologies in various versions of Mac OS X 10.5 server....60
Table 6-3 IDC 2010 report on server HW sales....66
Table 6-4 Server Unit Market share in 2009....67
Table 6-5 Server SalesMarket share in 2009....68