

**Chapter
1**

**WINDOWS 2000
PLATFORM AND
ARCHITECTURE**

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Objectives

You will learn:

- C Windows 2000 product family.
- C New features/facilities of Windows 2000 Server.
- C Windows architecture.
- C Changes to the kernel and kernel architecture.
- C New features/facilities.
- C Kernel - new facilities.
- C Clustering.
- C Implementing domain organization.
- C Upgrading the remaining backup domain controllers.
- C Completing upgrade of the domain.
- C Terminal Services - function and purpose.
- C Windows 2000 Active Directory Service.
- C Joining a Windows XP computer to a domain or workgroup.

1 Windows 2000 Product Family

Windows 2000 is built on NT Technology. It scales from one or two servers with a few dozen clients to hundreds of servers and thousands of clients.

	Windows Professional	Windows Server	Windows Advanced Server	Windows Datacenter Server
Target Audiences	Business desktops, notebooks	File, print, intranet, networking	Line of business, e-commerce	Large critical applications: OLTP, data warehouses, ASPs and ISPs
CPUs Supported	2	4	8	32
Memory Supported	4 GB	4 GB	8 GB	64 GB
Clustering	None	None	Two-node failover, 32-node network load balancing	Cascading fail-over among four nodes, 32-node network load balancing
Minimum System Requirements	133 MHz Pentium-compatible CPU, 64 MB RAM, 1 GB disk space	133 MHz Pentium-compatible CPU, 256 MB RAM, 1 GB disk space	133 MHz Pentium-compatible CPU, 256 MB RAM, 1 GB disk space	Pentium III Xeon processors or higher, 256 MB RAM, 1 GB free space

1.1 Windows 2000 Server Family

The Windows 2000 Server family has two members:

Standard	Offers core functionality for essential services (including file, print, communications, infrastructure, and Web servers) appropriate to small- and medium-sized organizations with numerous workgroups and branch offices.
Advanced	The Advanced edition is designed to meet mission-critical needs, such as large data warehouses, e-commerce, or Web hosting services for medium-sized and large-sized organizations and Internet service providers (ISPs).

1.2 Windows 2000 Advanced Server

Windows 2000 Advanced Server provides a comprehensive clustering infrastructure for high availability and scalability of applications and services, including main memory support of up to 8 gigabytes (GB) on Page Address Extension (PAE) systems.

Designed for demanding enterprise applications, Advanced Server supports new systems by using up to eight-way symmetric multiprocessing (SMP). SMP enables any one of the multiple processors in a computer to run any operating system or application thread simultaneously with other processors in the system.

Windows 2000 Advanced Server is well suited to database-intensive work, and provides high-availability server clustering and load balancing for high system and application availability.

Windows 2000 Advanced Server includes the full feature set of Windows 2000 Server and adds the high availability and scalability required for enterprise and larger departmental solutions.

Key features of Advanced Server include:

- C All Windows 2000 Server features.
- C Network (TCP/IP) load balancing.
- C Enhanced two-node server clusters based on the Microsoft Windows Cluster Server (MSCS) in the Windows NT Server 4.0 Enterprise Edition.
- C The Windows 2000 platform.

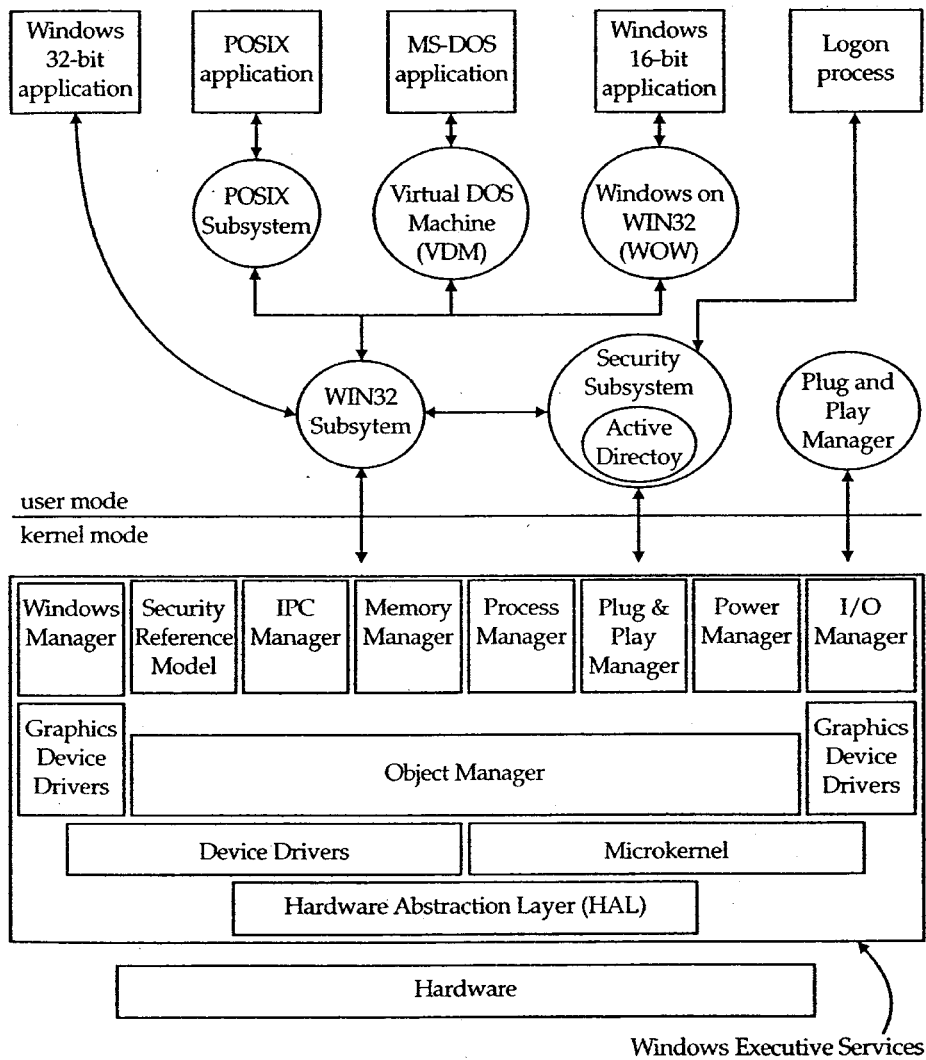
2 New Features/Facilities

The following features/facilities have been added to Windows 2000:

- C Active Directory, provides for searches to be initiated which will locate all of the people or software and hardware resources in the enterprise.
 - The same search dialog box can be used to search the computer's hard drive, network, or the Internet. All of the search results are displayed with a thumbnail view of the file, the file type and size, and the date the file was last modified.
 - Content indexing uses keywords to index files on every drive. This results in faster search results.
- C When Personalized Menus is turned on, Windows 2000 keeps track of which programs are used, and hides the programs that have not been used recently, while still keeping all of the programs easily accessible.
- C The desktop environment can be modified with customized toolbars by adding, removing, or arranging buttons.
- C Active Desktop provides a means for customizing the desktop, making it easy to start programs and use the Internet or intranet.
- C Enhanced Accessibility features.
- C Built-in support for multiple languages.
- C Enhanced Add/Remove Programs feature.
- C IntelliMirror, allows users to work from any workstation on the network and have their own documents, programs, and settings available to them, just as they are on their own computer.
- C Enhanced remote network management.
- C Microsoft Management Console (MMC) provides a common framework for all administrative tools, such as Event Viewer, Service Manager, and Disk Administrator.
- C Improved driver support.
- C Increased support for new-generation hardware and multimedia technologies.
- C Integration of the new Euro currency symbol.

3 Architecture

3.1 Windows 2000



4 Kernel Architecture

The core of Windows 2000 Server is the kernel. The kernel is based on the same basic architecture as Windows NT Advanced Server 3.1 but has evolved to meet the changing needs of modern networks.

Microsoft Windows 2000 is composed of many different layers that all interact to present the user with a complete operating system. At the core of this architecture lies the kernel which has special rights over the hardware of the system.

The kernel is responsible for:

- C Allocating memory to applications.
- C Communicating with device drivers.
- C Determining which processes run at any given time.

The kernel allows the operating system to scale higher, supporting up to 32 processors and 32 GB of RAM. It allows database applications like Microsoft SQL Server to take advantage of that larger hardware, and increases their performance by moving pieces of functionality into the kernel itself.

Applications depend on the kernel to allocate memory, processor time, and hardware resources.

Microsoft has changed several aspects of the kernel:

- C Windows 2000 Server scales much higher than was possible with Windows NT.
- C Network applications are more reliable and will run more efficiently.
- C Users in other countries will have an easier time using the operating system and its applications in their environments.

Features such as processor quotas and process accounting make Windows 2000 Server an extremely attractive platform for web hosting environments.

Clustering features are now built into the kernel, allowing for greatly improved uptime in networks where redundancy is available.

Process and Sessions

Windows 2000 launches a separate Win32 process is launched for each user session. This ensures that applications do not communicate between user sessions, eliminating potential violations of a user's privacy. These kernel changes will not affect administrators who choose not to use Terminal Services.

Windows 2000 Win32 Architecture

The Windows 2000 Win32 subsystem is capable of handling multiple user sessions.

5 Kernel - New Facilities

5.1 Processor Quotas and Accounting

It is common practice for Internet Service Providers (ISPs) to share a single Web server between many customers.

Two new features make multiuser environments more effective:

- C Processor accounting.
- C CPU throttling.

Processor accounting is used by IIS to record the number of processor cycles consumed by individual Web requests. This allows ISPs to bill based on processor usage, and enables developers to determine which pages can most benefit from optimization.

CPU throttling stops a Web site's out-of-process applications from stealing so much processor time that the other Web sites cannot function correctly.

The job object is the underlying technology that enables processor accounting and CPU throttling. Services such as IIS spawn many processes so that multiple tasks can be accomplished at the same time. While multiple processes improve performance, they make it complicated to track which processes are associated with which tasks. Because IIS 4 supported many virtual servers sharing the same application space, it was impossible to audit or control how much processor resources each virtual server consumed.

Job objects allow the operating system to manage groups of processes as a single unit. This makes it much easier for applications to monitor and throttle the amount of processor time that separate tasks consume. This feature is critical for environments where multiple customers share the same server.

One or more processes can work together to complete a single job, which is represented by a job object.

5.2 Spin Count

Spin count is a method for improving performance on multiprocessor systems when multiple programs need access to the same resources simultaneously.

Spin count controls how many times a process will attempt to access a resource before waiting.

On a single processor system, the different processes will have to wait for each other to execute anyway, in which case repeated attempts to access the resource will not be successful until the other process has a chance to execute.

Applications that use spin count on single processor systems will not hurt their performance; they just will not benefit.

5.3 Scatter/Gather I/O

Scatter/Gather I/O is a new feature in Windows 2000 Server that improves the performance of application servers on a network. Its use is entirely transparent to system administrators, because applications can make use of it without any special configuration.

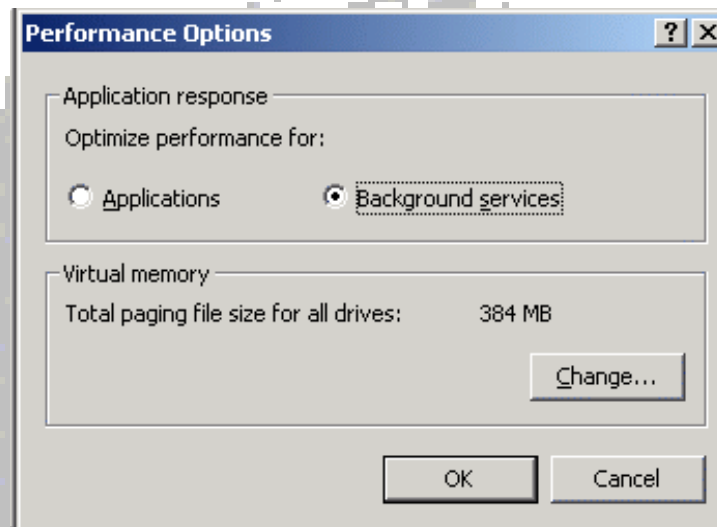
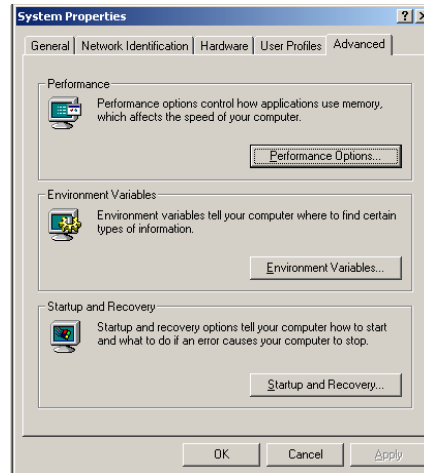
The technology streamlines the process of moving data from discontinuous sections of the system's RAM to a contiguous space on the disk drive. Applications must be written specifically to take advantage of it. Therefore, existing services will not realize any benefit.

5.4 Quantum

A quantum is a property of a thread that defines how long a thread will be allowed to execute before control is handed over to another thread.

Since it takes time to switch the CPU between multiple threads, some applications will benefit from increasing the thread quantum length. The trade-off with this action is that increasing a thread's time slice makes multitasking less smooth.

The quantum type can also be adjusted between fixed length and variable length. This can be configured from the Performance Options dialog box, which is accessed from the Advanced tab of the System Properties dialog box.



Administrators and developers have control over quantum type and length.

- C Giving priority to applications allocates short, variable quanta, providing smoother multitasking.
- C Giving priority to background services causes the operating system to use long, fixed quanta, which improves performance of network services.

By default, Windows 2000 Server gives priority to background services, and Windows 2000 Professional gives priority to applications.

5.5 Windows Driver Model

A driver is a piece of software that allows the operating system to communicate with a piece of hardware. All hardware accessories require drivers: network cards, SCSI cards, modems, scanners, and printers.

Previous versions of Windows required different drivers for each operating system. This was a burden to hardware vendors who created the drivers and to any administrators who managed multiple operating systems. Windows 2000 and Windows 98 systems can now use the same drivers.

The WDM Kernel Streaming architecture improves the performance of real-time streaming media. Previous versions of Windows required streaming media applications to do the bulk of processing in user mode. Many of these functions have been moved to kernel mode, where they execute much faster. However, applications must be specifically written to take advantage of the WDM Kernel Streaming, however, so legacy applications will not benefit.

The WDM Still Image Architecture provides operating system level support for scanners and digital cameras.

5.6 EMA: Enterprise Memory Architecture

Memory allocation can create bottlenecks for many large application servers and is particularly true for massive database servers that must handle hundreds of gigabytes of data.

Windows 2000 Server incorporates Enterprise Memory Architecture which allows up to 32 GB of memory to be addressed by servers with 64-bit processors. Although most servers will not require this level of RAM, data warehouses will benefit because data can be manipulated faster in memory than on hard disks. At the current time the Alpha and Pentium II Xeon chips can utilize the memory model.

Applications must be specifically coded to use the Very Large Memory APIs. Microsoft SQL Server is coded to use this, and other relational database services are in the process of being modified to use the new APIs. Most applications will not benefit from adding more than 4 GB of RAM.

5.7 Multiprocessor Capabilities

Windows 2000 Server offers improved multiprocessor support.

Multithreaded applications executing on multiprocessor systems will perform better; developers do not need to write special code to take advantage of the improved scalability.

Multiprocessor Utilization:

- C Windows 2000 Server supports two processors simultaneously. Existing users of Windows NT 4.0 Server who upgrade to Windows 2000 Server will be allowed to use four processors.
- C Windows 2000 Advanced Server supports four simultaneous processors. Existing users of Windows NT 4.0 Server Enterprise Edition who upgrade to Windows 2000 Advanced Server can continue to use eight processors.
- C Windows 2000 Advanced Server doubles the maximum number of processors from what was previously available - 16 processors can be used simultaneously.

Hardware vendors can extend this to support 32-way concurrent processing.

Processes can now be pinned to specific processors. Administrators can use the Task Manager to set the processor affinity of a process. This forces the process to use only that specific processor, which can improve performance by reducing the number of processor cache flushes as processes are swapped between processors. A potential drawback with this feature is that it can also reduce performance by not allowing the process to move to the least busy processor.

5.8 I2O Support

I2O (Intelligent I/O Architecture) is a new technology that reduces the load on a system's CPU and improves I/O performance. I2O works by adding a dedicated processor that is optimized for input and output operations.

This technology is designed to streamline bandwidth-intensive activities such as realtime audio and video.

5.9 Improved Sorting

Large-scale databases and warehousing applications will realize performance improvements by using the improved sorting capabilities of Windows 2000 Advanced Server.

Performance has been improved by moving these processor-intensive algorithms to the kernel. Applications will need to be written specifically to take advantage of the new APIs, and the newest version of Microsoft SQL Server already has been.

6 Clustering

Organizations that depend on their networks require extremely high uptime.

Downtime is caused by several different events:

- C Hardware failures.
- C Application failures.
- C Reboots as a result of configuration changes.
- C Upgrades and patches.

The clustering features of Windows 2000 Datacenter Server allow two servers to back each other up. When one server fails, a second server can automatically take over those services in less than a minute, in a process known as fail-over. The monitoring services will detect the failure and shift responsibility to the backup server.

For scheduled downtime events, one server can cover for the other server while it is taken offline. This process, called a rolling upgrade, reduces downtime to a minimum when applying patches.

Clustering is designed to allow better scalability by load-balancing requests between multiple machines. In addition to improving uptime by providing fail-over capabilities, many aspects of the operating system are capable of being load balanced. Requests can be automatically distributed between two or more systems, and clients will automatically select a different server in the event one server in a cluster fails.

Clustering services are built into the operating system itself. Cluster-aware administration tools can be used for changing settings to multiple servers simultaneously. Windows 2000 Server clustering capabilities can be utilized/implemented without purchasing any special equipment. Servers in the cluster can have different hardware configurations.

The following components have been improved to support fail-over between systems in a cluster:

WINS	Windows Internet Name Service
DHCP	Dynamic Host Configuration Protocol
Dfs	Distributed File System

7 Terminal Services

Terminal Services is built in to Windows 2000 Server. Terminal services allows clients to run interactive applications on a remote server. The client system accepts input from and displays output to the user. The network infrastructure is used to carry the data between the client system and the server. All processing is done on the server.

Terminal services allows the use of thin clients. A thin client is a desktop system that has a bare minimum of hardware. Instead of requiring end-user systems to have fast processors, large amounts of RAM, and large hard drives, the network Terminal Services will do all the work. The thin client will forward requests to the server. The experience for the user is similar to that of having a fully equipped desktop system. While hardware requirements for the client are minimal, Terminal Services may be used with any type of desktop system.

The light requirements of the clients provide an added benefit to organizations with legacy hardware. Existing Windows for Workgroups 3.11 and Windows 95 systems can act as clients without upgrading the operating system. This allows an older piece of desktop hardware to run new 32-bit applications, increasing its lifetime. Terminal Services clients for Windows NT 4.0, Windows 95, Windows 98, and Windows 2000 Professional are included with Windows 2000 Server.

To allow multiple users to each have a session over the network, Windows 2000 incorporates a highly modified Win32 subsystem. The new Win32 subsystem can track different user sessions and keep them separate. Keyboard and mouse input are funneled not only to the proper application, but also to the proper session. Each user does work within his or her own security limitations.

A separate Win32 process is launched for each user session. This ensures that applications do not communicate between user sessions.

8 Upgrading Computers

The following upgrade paths for Windows 2000 are supported:

Previous Windows Version	Upgrade Windows Version
Windows NT 4.0 Server	Windows 2000 Server Retail (Full) Version Windows 2000 Server Upgrade Version Windows 2000 Advanced Server Retail (Full) Version
Windows NT 4.0 Terminal Server	Windows 2000 Server Retail (Full) Version Windows 2000 Server Upgrade Version Windows 2000 Advanced Server Retail (Full) Version
Windows NT 4.0 Enterprise Edition	Windows 2000 Advanced Server Retail (Full) Version Windows 2000 Advanced Server Upgrade Version
Windows 2000 Server	Windows 2000 Server Retail (Full) Version Windows 2000 Server Upgrade Version
Windows 2000 Advanced Server	Windows 2000 Advanced Server Retail (Full) Version Windows 2000 Advanced Server Upgrade Version

8.1 Preparing for an Upgrade

There are a number of basic steps to take in preparing a system for upgrading to Windows 2000 Advanced Server:

Backing up files	Before upgrading, it is recommended that the current files be backed up to disk, tape drive, or another network computer.
Uncompressing the drive	Uncompress any DriveSpace or DoubleSpace volumes before upgrading to Windows 2000. Do not upgrade to Windows 2000 on a compressed drive unless the drive was compressed with the NTFS file system compression feature.
Disabling disk mirroring	Before upgrading, if disk mirroring has been installed on the target computer, disable it before running Setup. Disk mirroring can be reenabled after completing the installation.
Disconnecting UPS devices	If an uninterruptible power supply (UPS) is connected to the target computer, disconnect the connecting serial cable before running Setup. Windows 2000 Setup attempts to automatically detect devices connected to serial ports, and UPS equipment can cause problems with the detection process.
Reviewing applications	Before starting the Windows 2000 Advanced Server Setup program, read the applications section of Readme.doc in the root directory of the Windows 2000 Advanced Server CD-ROM. Look for information regarding applications that need to be disabled or removed before running Setup.

9 Upgrading Windows NT Domain

Domains are an important feature of both Windows NT and Windows 2000. A domain is a grouping of accounts and network resources under a single domain name and security boundary. It is necessary to have one or more domains to support domain-based user accounts and other domain security features in Windows 2000 Advanced Server.

With Windows 2000, servers can have one of three roles in relation to domains:

Server Role	Explanation
Domain controllers	Contain matching copies of the user accounts and other Active Directory data in a given domain.
Member servers	Belong to a domain but do not contain a copy of the Active Directory data.
Stand-alone servers	Belong to a workgroup rather than a domain.

A domain must have at least one domain controller. For resilience, a domain should have multiple domain controllers to support the handling of logon requests and directory updates.

It is recommended that the roles that the servers will have within domains in Windows 2000 be planned before running Setup. However, adjustments to these roles are possible after Setup.

9.1 Upgrade Considerations

There are several important points to remember about upgrading an existing Windows NT domain to run with Windows 2000:

1. NTFS file system must be used on domain controllers. In addition, any servers that have any partition formatted with FAT or FAT32 will lack many security features.

For example, on FAT or FAT32 partitions, a shared folder can be protected only by the permissions set on the share, not on individual files, and there is no software protection against local access to the partition.

2. To upgrade a server and then use the same applications as before, application compatibility should be reviewed.

One important source of application compatibility information is Read1st.txt and the applications section of Readme.doc in the root directory of the Windows 2000 CD-ROM.

The most recent information on compatible and certified applications for Microsoft Windows 2000 is available at <http://www.microsoft.com>.

3. Member servers can be upgraded before or after upgrading domain controllers. However, when upgrading the domain controllers in a Windows NT domain to Windows 2000, the primary domain controller must be upgraded first.
4. When upgrading domain controllers, if there is a remote access server that is a member server, it is recommended that it is upgraded before the last domain controller is upgraded.

9.2 Role Names

The roles of the servers in a domain are named somewhat differently with Windows 2000 Advanced Server as compared to Windows NT. With Windows NT, the possible roles were primary domain controller (limited to one per domain), backup domain controller, member server, or stand-alone server. Windows 2000 has only one kind of domain controller, and also includes the roles of member server and stand-alone server. When upgrading, Windows 2000 Setup assigns server roles as follows:

Role in Windows NT domain	Role in Windows 2000 domain
Primary domain controller	Domain controller
Backup domain controller	Your choice of domain controller or member server
Member server	Member server
Stand-alone server	Stand-alone server

9.3 Order of Server Upgrades

When planning the order of server upgrades in a domain, there are two somewhat different approaches: upgrading the domain controllers first, or upgrading the member servers first. A mixture of these approaches can be used. However, when upgrading domain controllers, the primary domain controller should be upgraded first. If member servers are upgraded first, a variety of features become available, but none of that require Active Directory. One upgrading domain controllers is started, Active Directory features become available.

The following table shows the advantages and disadvantages of the two approaches to server upgrades:

Order of server upgrades	Advantages	Disadvantages
Domain controllers first (must start with primary domain controller)	Provides all the features of Active Directory as well as the other features of Windows 2000 Advanced Server.	Requires you to organize Active Directory structures at time of upgrade. With a small domain, organizing Active Directory structures will take little effort.
Member servers first	Provides protocol support and other features, whether or not domain controller upgrades and the organizing of Active Directory structures have been carried out.	Does not provide features that are part of Active Directory.

9.4 Upgrading a Domain by Upgrading Domain Controllers First

If Windows NT domain is upgraded by upgrading the domain controllers first, the upgrade has the following three stages:

1. Carrying out backups and other preparations so that the previous installation can be restored if necessary.
2. Upgrading the primary domain controller. This must be done before upgrading any backup domain controllers.
3. Upgrading other servers in the domain.

The first domain controller to be upgraded in a Windows NT domain must be the primary domain controller. As this server is upgraded, there will be the choices of creating a new domain or a child domain, and creating a new forest or a domain tree in an existing forest. For the upgrading of a domain of two to five servers, a new domain and a new forest should be created.

During the upgrade, the location of three important items: the database containing user accounts and other Active Directory data, the log file, and the system volume (Sysvol) folder can be specified. The database and the log file can be on any kind of partition (FAT, FAT32, or NTFS); the database can expand by as much as a factor of ten from the size it had with Windows NT. So, plenty of room should be allowed for it. The system volume directory must be on an NTFS partition.

After the primary domain controller is upgraded to a Windows 2000 domain controller, it will be fully backward-compatible. This means that the domain controller appears as a Windows 2000 domain controller to Windows 2000 servers and clients, but emulates a Windows NT 4.0 primary domain controller to other servers and clients.

After upgrading the primary domain controller and ensuring that it is functioning satisfactorily, any backup domain controllers should be upgraded next. If possible, it is best to begin the upgrades soon, rather than allowing a long delay. Also, if there is a remote access server that is a member server, it is recommended that it be upgraded before the last backup domain controller is upgraded. A remote-access member server is dependent on domain controllers for user information, and therefore should not be "left behind" when domain controllers are upgraded.

10 Windows 2000 Active Directory Service

The Active Directory directory service is compatible with Windows NT and supports a mixed-mode of operation using both Windows 2000 Server domain controllers and Windows NT Server 4.0 domain controllers. Because Active Directory supports mixed-mode, domains and computers can be upgraded at a pace suitable to the organization.

Active Directory supports the NTLM protocol used by Windows NT. This enables authorized users and computers from a Windows NT domain to log on and access resources in Windows 2000 domains. To Windows NT clients and Windows 95 or Windows 98 clients that are not running Active Directory client software, a Windows 2000 domain appears to be a Windows NT Server 4.0 domain.

The upgrade to Active Directory can be gradual and performed without interrupting operations. If you domain upgrade recommendations are followed, it should never be necessary to take a domain offline to upgrade domain controllers, member servers, or workstations.

Active Directory allows upgrading from any Windows NT 4.0 domain model and supports both centralized and decentralized models. The typical master or multiple-master domain model can be easily upgraded to an Active Directory forest.

10.1 Planning and Implementing a Namespace and DNS Infrastructure

Because the Domain Name System (DNS) is required for Active Directory, a DNS and Active Directory namespace must be designed. The DNS server should be either configured manually or it may be configured using the Active Directory Installation wizard automatically.

The first Windows NT server upgraded must be the Windows NT primary domain controller (PDC). Upgrading the Windows NT PDC is required for successful upgrade of a Windows NT domain to a Windows 2000 domain.

10.2 Installing Active Directory on the Windows NT PDC

During the Windows 2000 Server upgrade, the Active Directory Installation wizard requires that the server joins an existing domain tree or forest, or starts a new domain tree or forest. To join an existing domain tree, a reference to the desired parent domain must be provided.

Running the Active Directory Installation wizard installs all necessary components on the domain controller, such as the directory data store and the Kerberos V5 protocol authentication software.

The existing Security Account Manager (SAM) objects will be copied from the registry to the new data store. These objects are the security principals (user accounts, local and global groups and computer accounts).

Once the Kerberos V5 protocol is installed, the installation process starts the authentication service and the ticket granting service, and if this is a new child domain, establishes a transitive trust relationship to the parent domain. Eventually, the domain controller from the parent domain copies all schema and configuration information to the new child domain controller.

The upgraded domain controller is a fully functional member of the Active Directory forest. The new domain is added to the domain and site structure, and all domain controllers receive the notification that a new domain has joined the forest.

Computers running Active Directory client software can use Active Directory features, such as authentication, for access to resources in the domain tree or forest, and for directory queries. Clients benefit from the transitive trust relationships that exist within the forest, enabling authorized users to access resources in any domain.

Once the Windows NT PDC is upgraded, one can proceed to either:

- C Upgrade all other servers to Windows 2000 Server.
During the upgrade process, a BDC running the your current version of Windows NT Server should exist to guarantee a backup if any problems develop.
- C Install Windows 2000 Server on only one domain controller, leaving all other domain controllers configured with Windows NT Server.

10.3 Computers Running Previous Versions of Windows

Computers running previous versions of Windows access the domain as if it were a Windows NT domain, finding only those resources available through Windows NT one-way trusts. While the domain is in mixed-mode, the domain controller exposes to clients using previous versions of Windows only resources in domains that have older, established Windows NT explicit trusts. This creates a consistent environment in that the previous version clients can access only resources in domains with explicit trusts, regardless of whether the client is using a Windows 2000 domain controller or a Windows NT back-up domain controller.

After the PDC upgrade, the Windows 2000 domain controller uses the Active Directory data store, which is compatible with any remaining Windows NT backup domain controllers(BDCs).

The upgraded Windows 2000 domain controller can synchronize security principal changes to remaining Windows NT Server 4.0 BDCs. It is recognized as the domain master by the Windows NT Server 4.0 BDCs.

If the Windows 2000 domain controller goes offline or otherwise becomes unavailable and no other Windows 2000 domain controllers exist in the domain, a BDC running Windows NT Server can be promoted to be a Windows 2000 domain controller.

10.4 Implementing Domain Organization

After upgrading to Windows 2000 and configuring the domain controller using the Active Directory Installation wizard, the Active Directory administration tools can be used to create the new directory objects, such as, organizational units and Group Policy objects needed to implement the organization.

10.5 Upgrading the Remaining Backup Domain Controllers

The next stage of the upgrade process is to upgrade any remaining Windows NT backup domain controllers to Windows 2000 Server and Active Directory.

When upgrading Windows NT domains only one Windows 2000 domain controller can create security principals (users, groups, and computer accounts). This single domain controller is configured as a PDC emulator operations master. The PDC operations master emulates a Windows NT PDC.

The domain controller emulating the Windows NT PDC controls unique resource identifiers assigned to security principals. Resource identifiers are used to create the Windows 2000 security identifier that identifies User and Group objects.

The domain controller that is emulating the Windows NT PDC supports two authentication protocols:

- C Kerberos V5 protocol
- C NTLM protocol

10.6 Completing Upgrade of the Domain

After all existing Windows NT primary and back-up domain controllers have been upgraded to Windows 2000 Server and Active Directory and have no plans to use Windows NT domain controllers, the domain can be switched from a mixed-mode to native-mode. The change from mixed-mode to native-mode is manually done by an administrator using the Active Directory Domains and Trusts snap-in.

Several things happen when changing to native mode:

- C Domain controllers no longer support NTLM replication.
- C The domain controller that is emulating the PDC operations master can not synchronize data with a Windows NT BDC.
- C Windows NT domain controllers can not be added to the domain.
- C Users and computers using previous versions of Windows begin to benefit from the transitive trusts of Active Directory and, with the proper authorization, can access resources anywhere in the forest.

Other than the enhanced access to any other domains in the forest, clients will not be aware of any changes in the domain.

10.7 Upgrading Active Directory

When a Windows NT PDC or BDC is upgraded to Windows 2000 the upgrade process creates domain and site objects used by Active Directory, as well as creating user and computer accounts and groups from the Windows NT directory (also referred to as the Security Accounts Manager database).

During upgrade, objects are created to contain the accounts and groups from the Windows NT PDC or BDC. These Container objects are named Users, Computers and Builtin, and are displayed as folder in the Active Directory Users and Computers console. These objects contain the users, computers, and groups from the Windows NT directory. User accounts and pre-defined groups are placed in the Users folder. Computer accounts are placed in the Computers folder. Built-in groups are placed in the Builtin folder.

During upgrade the existing Windows NT groups are placed into different containers depending on the nature of the group. Windows NT built-in local groups (such as Administrators and Server Operators) are put into the Builtin container. Windows NT global groups (such as Domain Admins) and any user-created local groups and global groups are placed in the Users container.

10.8 Models for Conservative Upgrade

Two other models exist to allow upgrade flexibility. Both models require upgrading the primary domain controller first.

<p>Model 1: Save a pre-Windows 2000 backup domain controller (BDC)</p>	<p>For this model, either a new BDC that runs the current version of Windows NT Server is installed, or, if there are more than one BDC, one of them is used. This BDC will store a secure copy of the current domain database. The BDC is removed from the network before beginning the process.</p> <p>If any problems arise during migration, all Windows 2000 computers can be removed from the production environment, then the BDC is brought back into the network and used as the new PDC. This new PDC then replicates its data to all BDCs, and the domain is returned to its previous state.</p>
<p>Model 2: Remove the primary domain controller (PDC) from the network first</p>	<p>In this model, the PDC is removed from the network before starting the migration. If multiple domains need to be created, all PDCs are brought into an environment that is not part of the production network. The PDCs are upgraded and domain tree or trees are formed while disconnected from the production environment. The result is the creation of a fully functional forest, without affecting production.</p> <p>Once a forest is formed, workstations and BDCs are added to it. If the migration continues smoothly, the PDCs can be returned to the production environment and turned on. The forest continues to work, and the rest of the servers can be updated to Windows 2000 Server; or the new client access software can be installed on the pre-Windows 2000 clients.</p>

11 Upgrading to Windows 2000 on Cluster Nodes

Two factors complicate the process of upgrading to Windows 2000 Advanced Server on cluster nodes.

1. Although the nodes are physically distinct, they cooperate to provide services to clients. Upgrade plans cannot be made for one node without considering the impact on the other node.
2. Clustering is used because the cluster nodes provide critical services to the enterprise. Taking those services offline during an operating system upgrade temporarily prevents client access to important information.

Rolling upgrade can be used to eliminate downtime of the cluster services and minimize administrative complexity by performing. In a rolling upgrade, the operating system is sequentially upgraded on each node, making sure that one node is always available to handle client requests.

Before upgrading to Windows 2000 Advanced Server from Windows NT 4.0 Enterprise Edition, Service Pack 4 or later must be applied. The Service Pack must be reapplied after installing clustering. The Service Pack makes important changes to the clustering software that prepare it for an upgrade.

11.1 Rolling Upgrades

A rolling upgrade has four phases. There must be at least two nodes in the cluster to perform a rolling upgrade. In this example, they are named Node 1 and Node 2:

Phase 1: preliminary	<p>Each node runs Windows NT 4.0 Enterprise Edition with the following software:</p> <ul style="list-style-type: none"> C Microsoft Cluster Server. C If the cluster has an Internet Information Services (IIS) resource, IIS version 4. C Service Pack 4 or greater for Windows NT 4.0 Enterprise Edition. The Service Pack must be applied after installing IIS and Microsoft Cluster Server, even if it was also applied earlier.
Phase 2: upgrade node 1	Node 1 is paused, and Node 2 handles all cluster resource groups while you upgrade the operating system of Node 1 to Windows 2000 Advanced Server.
Phase 3: upgrade node 2	Node 1 rejoins the cluster. Node 2 is paused and Node 1 handles all cluster resource groups while you upgrade the operating system on Node 2.
Phase 4: final	Node 2 rejoins the cluster, and you redistribute the resource groups back to the active/active cluster configuration.

11.2 Performing Rolling Upgrade

To perform a rolling upgrade:

1. In Cluster Administrator, click Node 1.
2. On the File menu, click Pause Node.
3. In the right pane, double-click Active Groups.
4. In the right pane, click a group, and then on the File menu, click Move Group. Repeat this step for each group listed.

The services will be interrupted during the time they are being moved and restarted on the other node. After the groups are moved, Node 2 handles all client requests, and Node 1 is idle.

5. Use Windows 2000 Advanced Server Setup to upgrade Node 1 from Windows NT 4.0 Enterprise Edition (after ensuring that the latest released Service Pack was applied and that it was applied after clustering was installed).

Setup detects the earlier version of clustering on Node 1 and automatically installs clustering for Windows 2000 Advanced Server. Node 1 automatically rejoins the cluster at the end of the upgrade process, but is still paused and does not handle any cluster-related work.

6. Perform validation tests on Node 1 to certify that the node is fully functional.
7. In Cluster Administrator, click Node 1 and then click Resume Node.
8. Repeat the preceding steps for Node 2 instead of Node 1.

12 Joining a Computer to a Domain or Workgroup

Joining a computer to a domain or workgroup allows a Windows NT, 2000, or XP computer to log on and access the network.

12.1 Joining a Windows XP Computer with an Existing Network Connection

During installation of the operating system a network connection typically has been defined for the computer.

To move a computer to a new domain or workgroup, perform the following steps:

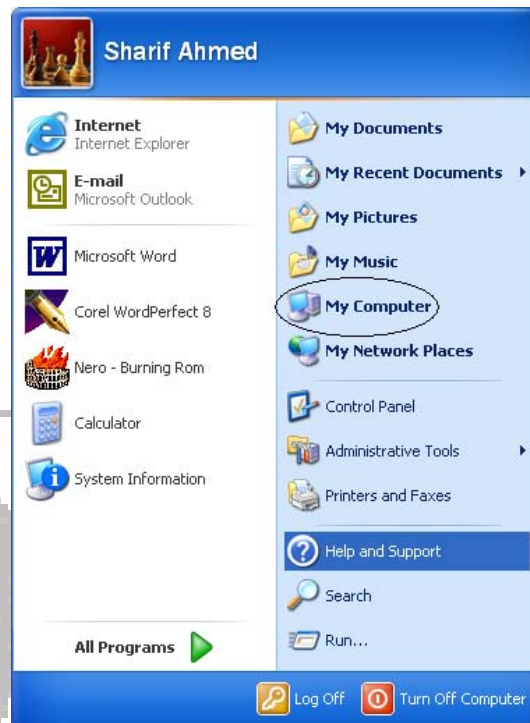
There will be questions for gathering information that is required for joining the domain.

The following information will be required:

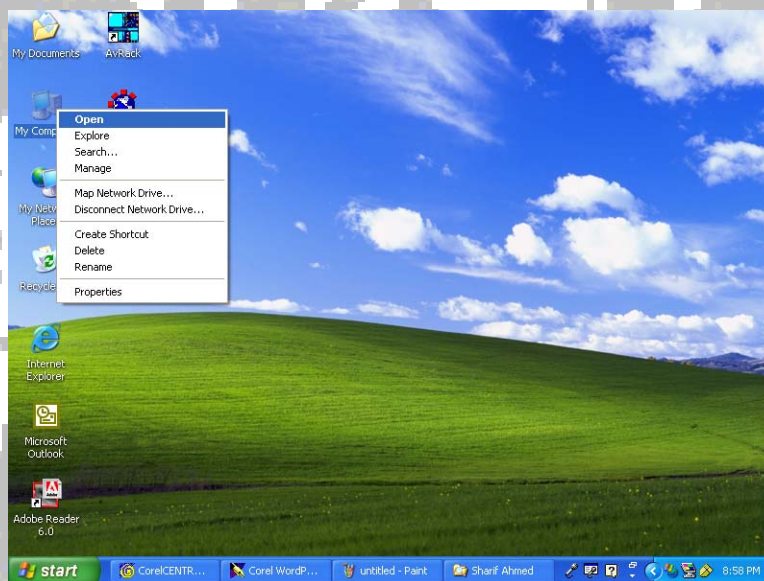
- C name
- C password
- C domain of a user account that can join the computer to the domain.
- C computer name
- C computer domain.

To join a domain:

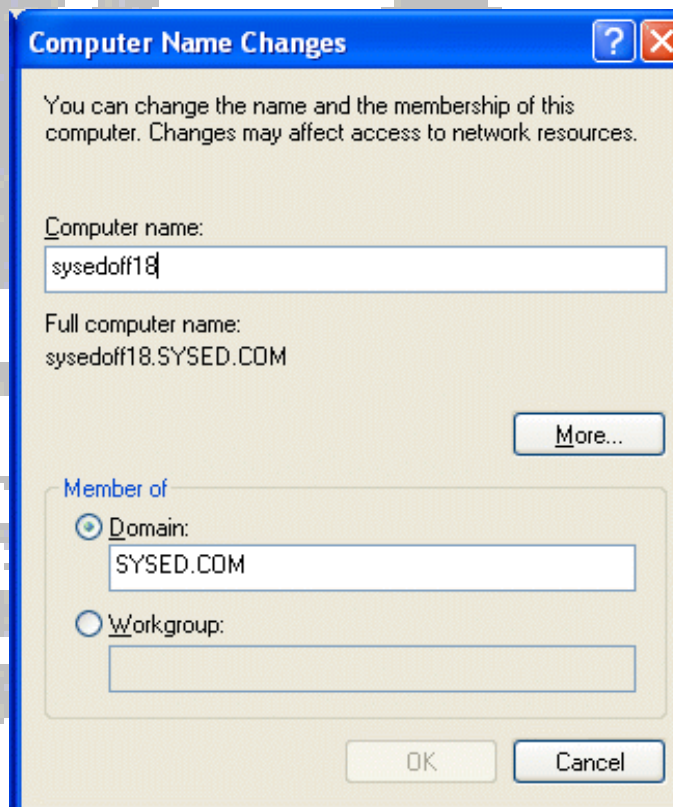
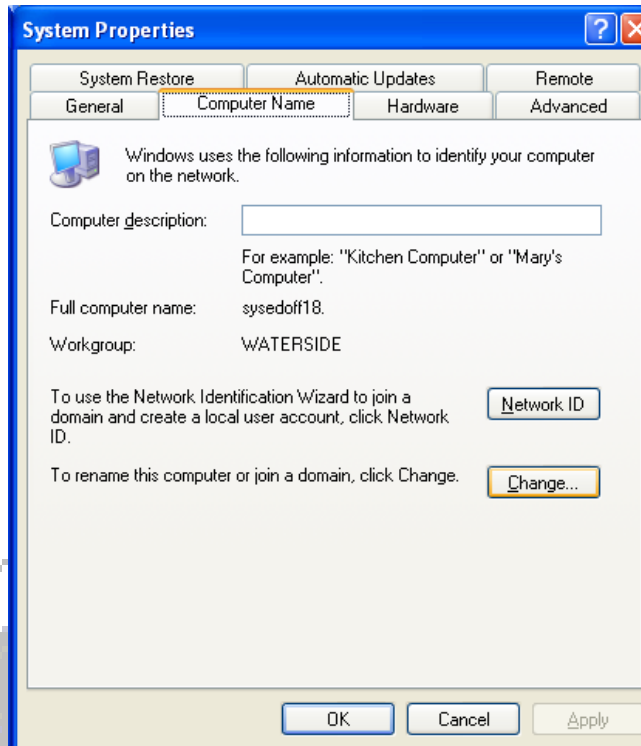
From the Start Menu go to My Computer and Select Properties:



Or with the Classic Menu turned on select, select the My Computer Properties and go to the Computer Name page.



From there either the Network ID button or Change button can be used for joining a domain.



1. To complete the joining of the new domain, in the Member Of panel select Domain and then type the domain name, such as sysed for sysed.com.
2. Type the user name and password that provide access to files and resources over the network.
Click Next.
3. If the computer name and domain have already been configured and a computer account exists for the computer in this domain, there will be a prompt asking if the computer should be joined to the domain.
Click Yes. Otherwise, type the computer name and computer domain. Then click Next.
4. If prompted for an authorized user account, type the user name, pass word, and domain of a user account that's authorized to join the computer to the domain.

It will now be necessary to log off and shut down the system. Upon rebooting the system there will be additional choices available on the Windows XP logon screen.

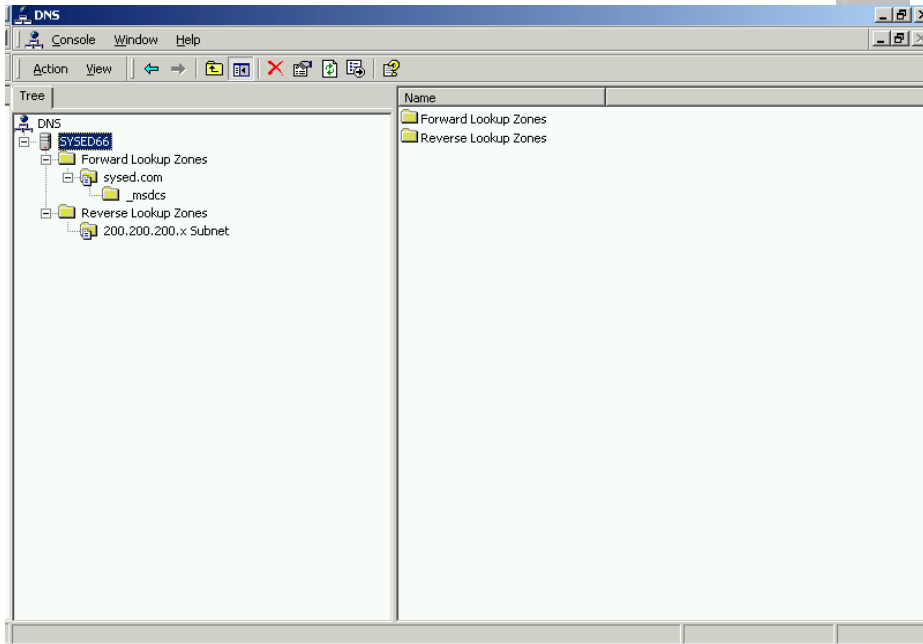
Windows XP Log on Screen

User name	<input type="text"/>
Password	<input type="password"/>
Logon to:	SYSED SYSEDOFF18(this computer)

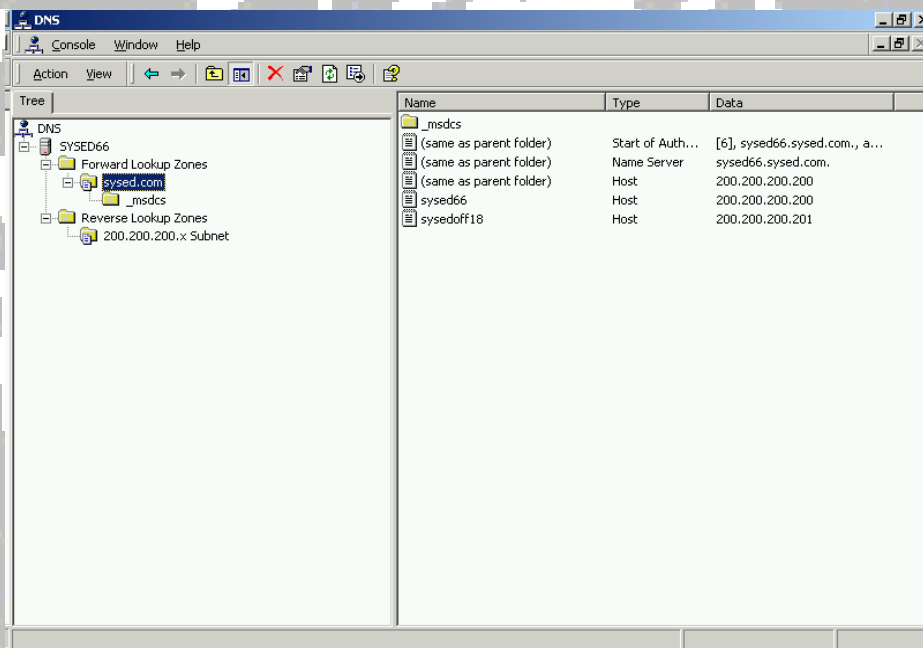
OK	Cancel	Shut Down...	Options <<
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12.2 Dynamic DNS and Active Directory

The following additions were made to Dynamic DNS within Microsoft Active Directory.



Forward Lookup Zones



Reverse Lookup Zones

