



www.chinatag.com

CHINATAG

Microsoft **70-222**

Microsoft Windows NT 4.0 to
Microsoft Windows 2000

Study Guide
DEMO Version

Copyright (c) 2003 Chinatag LLC. All rights reserved.

Important Note Please Read Carefully

For demonstration purpose only, this free version Chinatag study guide contains **10** full length questions selected from our full version products which have more than **200** questions each.

This Study guide has been carefully written and compiled by Chinatag certification experts. It is designed to help you learn the concepts behind the questions rather than be a strict memorization tool. Repeated readings will increase your comprehension.

For promotion purposes, all PDF files are **not** encrypted. Feel free to distribute copies among your friends and let them know Chinatag website. Our IT certification products start at only **\$7.99**.

Study Tips

This product will provide you questions and answers along with detailed explanations carefully compiled and written by our experts. Try to understand the concepts behind the questions instead of cramming the questions. Go through the entire document at least twice so that you make sure that you are not missing anything.

Latest Version

We are constantly reviewing our products. New material is added and old material is revised. Free updates are available for 180 days after the purchase. You should check the products page on the <http://www.chinatag.com> website for an update 3-4 days before the scheduled exam date.

Please tell us what you think of our products. We appreciate both positive and critical comments as your feedback helps us improve future versions. Feedback on specific questions should be send to feedback@chinatag.com.

Thanks for purchasing our products and look forward to supplying you with all your Certification training needs.

Good studying!

Technical and Support Team
Chinatag LLC.

TABLE OF CONTENTS

List of Tables

List of Acronyms

Introduction

1. The Microsoft Windows 2000 Platform

1.1 Windows 2000 Professional

1.1.1 Ease of Use

1.1.1.1 User Interface Enhancements

1.1.1.2 Support for Mobile Users

1.1.1.3 Printing Support

1.1.2 Simplified Management

1.1.3 Increased Hardware Support

1.1.4 Enhanced File Management

1.1.5 Enhanced Security Features

1.2 Windows 2000 Server

1.2.1 Symmetric Multiprocessing

1.2.2 Simplified Management

1.2.2.1 Active Directory Directory Services

1.2.2.2 Management Capabilities

1.2.2.3 Network and System Management Features

1.2.2.4 Application Services

1.2.3 Enhanced File Management and Security

1.2.4 Improved Networking and Communications

1.2.5 Improved Printing Support

1.3 Windows 2000 Advanced Server and Windows 2000 Datacenter Server

1.3.1 Windows 2000 Advanced Server

1.3.2 Windows 2000 Datacenter Server

2. Installing and Deploying Windows 2000

2.1 System Requirements

2.2 Installing Windows 2000 from the CD-Rom

2.2.1 Booting from the CD-Rom

2.2.2. Booting from Boot Disks

2.3 Installing Windows 2000 over the Network

- 2.4 Upgrading to Windows 2000
 - 2.4.1 Upgrading to Windows 2000 Professional
 - 2.4.2 Upgrading to Windows 2000 Server
 - 2.4.2.1 Upgrading the Single Domain Model
 - 2.4.2.2 Upgrading the Single Master Domain Model
 - 2.4.2.3 Upgrading the Multiple Master Domain Model
 - 2.4.2.4 Upgrading the Complete Trust Domain Model
 - 2.4.2.5 Upgrading the Operating System
 - 2.4.2.6 Upgrading the Network Domain
 - 2.4.2.7 Upgrading the Primary Domain Controller
 - 2.4.2.8 Upgrading the Backup Domain Controllers
- 2.5 The Windows 2000 Boot Process
 - 2.5.1 Files Used in the Boot Process
 - 2.5.1.1 The Preboot Sequence
 - 2.5.1.2 Boot Sequence
 - 2.5.1.3 Kernel Load
 - 2.5.1.4 Kernel Initialization
 - 2.5.1.5 Logon
- 2.6 The Boot.ini File
 - 2.6.1 Components of the Boot.ini File
 - 2.6.2 ARC Paths
 - 2.6.3 Boot.ini Switches
- 2.7 Advanced Boot Options
 - 2.7.1 The Recovery Console
 - 2.7.1.1 Installing and Starting the Recovery Console
 - 2.7.1.2 Using the Recovery Console
- 2.8 The Backup Utility
 - 2.8.1 Backup Types
 - 2.8.2 Backing Up System State Data
 - 2.8.3 Restoring Files and Folders
 - 2.8.4 Restoring Active Directory Directory Services
 - 2.8.4.1 Failed Domain Controllers
 - 2.8.4.2 Damaged Active Directory Databases
 - 2.8.4.3 Authoritative Restores
 - 2.8.5 The Emergency Repair Disk
 - 2.8.5.1 Creating the Emergency Repair Disk
 - 2.8.5.2 Repairing a Damaged Windows 2000 Installation

3. DNS, WINS and Name Resolution

- 3.1 Domain Name Space
- 3.2 DNS Zones

- 3.2.1 Zone Files
 - 3.2.1.1 Resource Records
 - 3.2.1.2 File Types
 - 3.2.2 Zone Types

3.3 Name Servers

- 3.3.1 Name Server Roles
- 3.3.2 Zone Transfers
- 3.3.3 Zone Transfer Security
- 3.3.3 Active Directory Integrated Zones

3.4 Resolving Names

- 3.4.1 Forward Lookup Query
- 3.4.2 Reverse Lookup Query

3.5 Installing the DNS Service

3.6 Configuring the DNS Service

- 3.6.1 Configuring a DNS Name Server
- 3.6.2 Creating Forward Lookup Zones and Reverse Lookup Zones
- 3.6.3 Configuring Dynamic DNS
- 3.6.4 Configuring a DNS Client

3.7 Troubleshooting the DNS Service

- 3.7.1 Monitoring the DNS Service
- 3.7.2 Setting Logging Options
- 3.7.3 Using Nslookup

3.8 Configuring automatic IP Addressing

- 3.8.1 DHCP Addressing
 - 3.8.1.1 The DHCP Lease Process
 - 3.8.1.2 Automatic Lease Renewal
 - 3.8.1.3 Manual Lease Renewal
- 3.8.2 Automatic Private IP Addressing

4. Implementing Active Directory

4.1 Directory Service Functionality

- 4.1.1 Simplified Administration
- 4.1.2 Scalability
- 4.1.3 Open Standards Support

4.2 Active Directory Support for Client Computers

4.3 Active Directory Structure

4.4 Installing Active Directory Directory Services

- 4.4.1 The Database and Shared System Volume
- 4.4.2 Domain Modes

- 4.5 Active Directory Replication
 - 4.5.1 Multimaster Replication
 - 4.5.2 Replication Latency
 - 4.5.3 Resolving Replication Conflicts
 - 4.5.4 Single Master Operations
 - 4.5.5 Using Sites for Active Directory Replication
 - 4.5.5.1 Creating a New Site
 - 4.5.5.2 Site Link Attributes
 - 4.5.5.3 Site Link Bridges
 - 4.5.5.4 Replication Within Sites
 - 4.5.5.5 Replication Between Sites

- 4.6 Establishing a Root Domain
 - 4.6.1 Migrating an Existing Domain to a New Root Domain
 - 4.6.1.1 Upgrading the Master Domain
 - 4.6.1.2 Migrating Objects to Active Directory Directory Services
 - 4.6.1.3 Creating Organizational Units
 - 4.6.2 Creating a New Root Domain

- 4.7 Administering Active Directory
 - 4.7.1 Active Directory Objects
 - 4.7.1.1 Controlling Access to Active Directory Objects
 - 4.7.1.2 Moving Active Directory Objects
 - 4.7.1.3 LostAndFound Objects

- 4.8 Managing Network Resources
 - 4.8.1 Delegating Administrative Control
 - 4.8.2 Publishing Resources
 - 4.8.3 Setting Up and Managing Published Printers
 - 4.8.3.1 Maintaining Printer Resources
 - 4.8.3.2 Installing Printer Drivers
 - 4.8.4 Setting Up and Managing Published Shared Folders
 - 4.8.5 Monitoring User Access to Shared Folders
 - 4.8.5.1 Monitoring User Sessions
 - 4.8.5.2 Sending Administrative Messages to Users

5. Administering User Accounts

- 5.1 Types of User Accounts
 - 5.1.1 Local User Accounts
 - 5.1.2 Domain User Accounts
 - 5.1.3 Built-In User Accounts

- 5.2 Creating User Accounts

- 5.2.1 Creating Local User Accounts
- 5.2.2 Creating Domain User Accounts
- 5.2.3 Copying Domain User Accounts

5.3 Configuring Account Policies

- 5.3.1 Configuring Password Policy
- 5.3.2 Configuring Account Lockout Policy

5.4 Managing Users and User Accounts

- 5.4.1 Managing User Data
- 5.4.2 Using User Profiles
 - 5.4.2.1 Mandatory User Profiles
 - 5.4.2.2 Roaming User Profiles
 - 5.4.2.3 Specifying Home Directories

5.5 Managing Users by Using Groups

- 5.5.1 Group Scopes
 - 5.5.1.1 Local Groups
 - 5.5.1.2 Global Groups
 - 5.5.1.3 Domain Local Groups
 - 5.5.1.4 Universal Groups
 - 5.5.1.5 Special Identity Groups

5.6 Implementing Organizational Units

6. Implementing Group Policy

6.1 The Structure of Group Policy Objects

- 6.1.1 Physical Structure
- 6.1.2 Logical Structure

6.2 Local and Active Directory Group Policy

- 6.2.1 Local Group Policy
- 6.2.2 Active Directory Group Policy

6.3 Linking Group Policy Objects

6.4 Group Policy Inheritance

- 6.4.1 Group Policy Application Order
- 6.4.2 Filtering Group Policy Application
- 6.4.3 Managing GPO Permissions

6.5 Delegating Group Policy Management

6.6 Managing Users Environment

- 6.6.1 Administrative Templates
- 6.6.2 Desktop Security Settings

6.6.3 Group Policy Script Settings

6.7 Software Installation And Maintenance Technology

6.7.1 Acquiring and Modifying Software Packages

6.7.2 Deploying Software Packages

6.7.2.1 Assigning Software Packages

6.7.2.2 Publishing Software Packages

6.7.2.3 Deploying .zap Files

6.7.3 Upgrading Software

6.7.3.1 Mandatory Upgrades

6.7.3.2 Optional Upgrades

6.7.4 Redeploying Software

6.7.5 Removing or Disabling Software

6.8 Troubleshooting Group Policy Application

7. Managing Access to Files and Folders

7.1 Creating Shared Folders

7.2 Managing Shared Folders

7.2.1 Shared Folder Permissions

7.3 NTFS Permissions

7.3.1 NTFS Folder Permissions

7.3.2 NTFS File Permissions

7.3.3 Multiple NTFS Permissions

7.3.4 NTFS Permissions Inheritance

7.3.5 Assigning Special Access Permissions

7.3.5.1 Changing Permissions

7.3.5.2 Taking Ownership

7.3.6 Combining Shared Folder Permissions and NTFS Permissions

7.3.7 Copying and Moving Files and Folders

7.3.8 Troubleshooting Permission Problems

7.4 Administering Shared Folders Using Dfs

7.4.1 Setting Up Dfs

7.4.2 File Replication Service (FRS) and Domain Dfs Root Replication

7.5 Disk Quotas

7.6 Encrypting File System (EFS)

8. Routing and Remote Access Service (RRAS)

8.1 Combining Routing and Remote Access

- 8.2 Installing and Configuring RRAS
 - 8.2.1 Routing and Remote Access Service Features
 - 8.2.2 Remote Access Client
 - 8.2.3 Remote Access Protocols
 - 8.2.4 Remote Access Security
 - 8.2.4.1 Secure User Authentication
 - 8.2.4.2 Mutual Authentication
 - 8.2.4.3 Data Encryption
 - 8.2.4.4 Callback
 - 8.2.4.5 Caller ID
 - 8.2.4.6 Remote Access Account Lockout
- 8.3 Remote Access Authentication
 - 8.3.1 Windows Authentication
 - 8.3.2 RADIUS Authentication
 - 8.3.3 Virtual Private Networks (VNP)
 - 8.3.3.1 VPN Protocols
 - 8.3.4 Tunnelling
 - 8.3.5 RRAS Tools

LIST OF TABLES

- TABLE 1.1: The Windows 2000 Platform
- TABLE 1.2: Windows 2000 Symmetric Multiprocessing Support
- TABLE 2.1: Windows 2000 System Requirements
- TABLE 2.2: Windows 2000 Professional Upgrade Paths
- TABLE 2.3: WINNT32 Switches
- TABLE 2.4: WINNT Switches
- TABLE 2.5: Windows 2000 Server Upgrade Paths
- TABLE 2.6: Upgrading Windows NT Server Roles
- TABLE 2.7: Files Used in the Windows 2000 Boot Process
- TABLE 2.8: ARC Path Naming Conventions

TABLE 2.9:	Boot.ini Switches
TABLE 2.10:	Recovery Console Commands
TABLE 3.1:	Top-Level Domains
TABLE 3.2:	Zone Types
TABLE 4.1:	Common Active Directory Objects
TABLE 4.2:	Find Dialog Box Options
TABLE 4.3:	Standard Active Directory Object Permissions
TABLE 4.4:	MOVETREE Command-Line Switches
TABLE 5.1:	Password Policy Options
TABLE 5.2:	Account Lockout Policy Options
TABLE 6.1:	Default Permissions for a GPO
TABLE 6.2:	The Administrative Templates
TABLE 6.3:	The Desktop Security Settings
TABLE 6.4:	Group Policy Settings to Control the Network Environment
TABLE 6.5:	Group Policy Settings to Control Access to the Administrative Tools
TABLE 7.1:	Shared Folder Permissions
TABLE 7.2:	NTFS Folder Permissions
TABLE 7.3:	NTFS File Permissions
TABLE 7.4:	Permission Inheritance Options
TABLE 7.5:	Troubleshooting Permission Problems
TABLE 7.6:	Creating a New Dfs Child Node
TABLE 7.7:	Command-line Switches for the Cipher Command
TABLE 8.1:	Netsh Command-line Options
TABLE 8.2:	Netsh Global CommandsSome Useful Performance Console Counters

LIST OF ACRONYMS

ACL	Access Control List
ACPI	Advanced Configuration And Power Interface
AD	Active Directory
APM	Advanced Power Management
APIPA	Automatic Private Internet Protocol Addressing
CA	Certificate Authority
CAL	Client Access License
DHCP	Dynamic Host Control Protocol
DNS	Domain Name System
EAP	Extensible Authentication Protocol
EFS	Encrypting File System
FEK	File Encryption Key
GPO	Group Policy Object
GPT	Group Police Template
HCL	Hardware Compatibility List
IAS	Internet Authentication Services
ICS	Internet Connection Sharing
IPSec	Internet Protocol Security
L2TP	Layer Two Tunnelling Protocol
LDAP	Lightweight Directory Access Protocol
LPD	Line Printer Daemon
MMC	Microsoft Management Console
NAT	Network Address Translation
NTFS	NT File System
ODBC	Open Database Connectivity
OSI	Open Systems Interconnection (Model)
OU	Organizational Unit
PCMCIA	Personal Computer Memory Card Interface Adapter
PnP	Plug and Play
PPP	Point To Point Protocol
PPTP	Point To Point Tunnelling Protocol

PXE	Preboot Execution Environment
RAS	Remote Access Service
RIPrep	Remote Installation Preparation
RIS	Remote Installation Services
RRAS	Routing And Remote Access Service
SAM	Security Accounts Manager
SMP	Symmetric Multiprocessing
SMS	Systems Management Server
Sysprep	System Preparation
TFTP	Trivial File Transfer Protocol
UDF	Unique Database File
UNC	Universal Naming Convention
VPN	Virtual Private Network
WDM	Windows32 Driver Model

Migrating from Microsoft Windows NT 4.0 to Microsoft Windows 2000

Exam Code: 070-222

Certifications:

Microsoft Certified Professional (MCP)
Microsoft Certified Systems Engineer (MCSE)

Elective

About This Study Guide

This Study Guide provides all the information required to pass the Microsoft 70-222 exam – Migrating from Microsoft Windows NT 4.0 to Microsoft Windows 2000. It however, does not represent a complete reference work but is organized around the specific skills that are tested in the exam. Thus, the information contained Study Guide is specific to the 70-222 exam and not to Migrating from Windows NT 4.0 to Windows 2000. It includes the information required to answer questions related to Windows 2000 Professional, Windows 2000 Server and Windows NT that may be asked during the exam. Topics covered in this Study Guide includes: Developing the Migration Strategy; Selecting the migration model; Upgrading the Domain; Developing an operating system upgrade path; Migrating to Active Directory; Installing the Windows 2000 DNS service; Configuring the existing DNS implementation; Developing and deploying a recovery plan; Planning and Deploying a Domain Upgrade; Upgrading the PDC, BDCs, application servers, DNS servers, and RRAS servers; Configuring networking protocols, DHCP, LAN Manager Replication, WINS, NetBIOS, Windows 2000 DNS Server service, and existing DNS service; Implementing group policies; Implementing file replication bridges; Converting domains to native mode; Implementing disaster recovery plans; Planning and Deploying an Intra-Forest Domain Restructure and an Inter-Forest Domain Restructure; Creating or configuring the Windows 2000 target domain or domains; Creating trusts; Creating organizational units (OUs); Configuring remote access functionality, networking protocols, DHCP, LAN Manager Replication, WINS, NetBIOS, Windows 2000 DNS Server service, and existing DNS service; Troubleshooting a failed domain upgrade; Resolving domain name issues; Troubleshooting account issues for all types of migrations; Resolving issues associated with user rights; Troubleshooting access issues for all types of migrations; Resolving permission issues involving NTFS; Resolving authentication issues; Resolving trust relationship and inappropriate access issues; Resolving name resolution issues; Resolving file and directory replication issues.

Intended Audience

This Study Guide is targeted specifically at people who wish to take the Microsoft MCSE exam 70-222 – Migrating from Microsoft Windows NT 4.0 to Microsoft Windows 2000. This information in this Study Guide is specific to the exam and is not a complete reference work. Although our Study Guides are aimed at new comers to the world of IT, the concepts dealt with in the exam, and consequently in this Study Guide are rather complex. We therefore suggest that a sound knowledge of CompTIA's A+, Network+ and Server+ course work material would be advantageous.

How To Use This Study Guide

To obtain maximum benefit from this Study Guide we recommend that you:

- Study each chapter carefully until you fully understand the information. This will require regular and disciplined work

Note: Remember to pay special attention to these note boxes as they contain important additional information that is specific to the exam.

- Be sure that you have studied and understand the entire Study Guide before you take the exam.

Good luck!

1. The Microsoft Windows 2000 Platform

Microsoft Windows 2000 is more reliable, more scalable, and easier to deploy, manage, and use than previous versions of the Windows operating system. The Windows 2000 platform reduces costs, enables a new generation of applications, and provides an organization with a sound infrastructure upon which to build their networks. The Windows 2000 platform consists of the four operating systems described in Table 1.1.

TABLE 1.1: *The Windows 2000 Platform*

Operating System	Description
Windows 2000 Professional	Replaces Microsoft Windows 95, Microsoft Windows 98, and Microsoft Windows NT Workstation 4.0 in the client operating system in the business environment.
Windows 2000 Server	Contains all of the features in Windows 2000 Professional, and provides services that simplify network management. Windows 2000 Server is an ideal platform for file and print servers, Web servers, and workgroups. It provides improved network access for branch offices.
Windows 2000 Advanced Server	Contains all of the features in Windows 2000 Server, and provides increased scalability and system availability. Windows 2000 Advanced Server is ideal for servers used in a large enterprise network and for database intensive work.
Windows 2000 Datacenter Server	Contains all of the features in Windows 2000 Advanced Server, and supports more memory and more CPUs per computer. Windows 2000 Datacenter Server is the most powerful Windows 2000 server operating system and is ideal for large data warehouses, online transaction processing (OLTP) and large-scale simulations, and server consolidation projects.

1.1 Windows 2000 Professional

Windows 2000 Professional improves the capabilities of previous versions of Windows in five areas: ease of use, simplified management, increased hardware support, enhanced file management, and enhanced security features.

1.1.1 Ease of Use

Windows 2000 Professional includes changes to the look and functionality of the desktop, windows, and the **Start** menu, making it easier to use than previous versions of Windows. Windows 2000 Professional also contains features that improve support for mobile users and make printing easier and more flexible.

1.1.1.1 User Interface Enhancements

The enhancements and features that improve the Windows 2000 Professional user interface include:

- **Personalized Menus**, which can be activated to keep track of the programs you use and to update the Programs menu so that it presents only the programs that you use most often. Applications that you use less frequently are hidden from normal view, making the **Start** menu easier to use;
- **Logon and shutdown dialog boxes**, which are easier to use with fewer, better organized choices; and
- An enhanced **Task Scheduler**, which allows you to schedule scripts and programs to run at specific times.

1.1.1.2 Support for Mobile Users

Windows 2000 Professional supports the latest laptop technologies based on the Advanced Configuration and Power Interface (ACPI), which allows you to change or remove devices without turning off the computer. ACPI also lengthens battery life with power management and suspend or resume capabilities. Windows 2000 Professional also includes the following features to provide support for mobile users:

- **Network Connections wizard**, which consolidates all of the processes for creating network connections. Users can use this wizard to set up the following networking features:
 - Dial-up connections
 - Virtual private networks (VPNs)
 - Incoming calls
 - Direct connections to another computer
- **Virtual private network (VPN) support**, which provides secure access to corporate networks from off-site locations by using a local Internet service provider (ISP) rather than using a long distance, dial-up connection.
- **Offline folders**, which allows you to copy documents from a network share to your local computer, providing you have the required permissions to the network share and the files it contains. Offline folders make it easier to access data when you are not connected to the network.
- **Synchronization Manager**, which compares items on the network to items that you opened or updated while working offline. Synchronization occurs when you log on, and any changes made offline to files and folders, Web pages, and e-mail messages are saved to the network.

1.1.1.3 Printing Support

Printing in Windows 2000 Professional has been improved to assist you in providing a more flexible network of printers. The printing features and enhancements that Windows 2000 Professional provides are:

- **Internet Printing Protocol (IPP)**, which allows users to send documents to any printer in a Windows 2000 network that is connected to the Internet. Internet printing allows users to:
 - **Print to a Uniform Resource Locator (URL)** over an intranet or the Internet;

- **View printer and job-related information** in Hypertext Markup Language (HTML) format from any browser; and
- **Download and install printer drivers** over the Internet.
- **Add Printer wizard**, which simplifies the process of connecting to local and network printers from within a program. You no longer need to open the Printers system folder or specify driver models, printer languages, or ports when you add printers.
- **Image Color Management (ICM) 2.0**, which allows you to send high-quality color documents to a printer or another computer with greater speed and reliability than ever before. ICM 2.0 is an operating system API that helps ensure that the colors you see on your monitor match those on your scanner and printer.

1.1.2 Simplified Management

Windows 2000 Professional includes many features that help reduce the overall cost of managing the computing environment. It simplifies the process of setting up a computer by allowing disk duplication, and allows you to use the Windows 2000 System Preparation tool to create an image of a computer's hard disk. You can then use a third-party tool to duplicate the hard disk on similarly configured computers.

In addition, the configuration management capabilities in Windows 2000 create a more consistent environment for the end user and help ensure that users have any data, applications, and operating system settings that they need. These configuration management enhancements include:

- **Add/Remove Programs wizard**, which simplifies the process of installing and removing programs. Users can install applications by pointing directly to a location on the corporate network or Internet. The user interface provides additional feedback and sort options to view installed or available applications by size, frequency of use, and time of last use.
- **Windows Installer service**, which manages application installation, modification, repairs, and removal. It provides a standard format for managing the components of a software package, and an application programming interface (API) for managing applications and tools.

Windows 2000 Professional includes diagnostic and troubleshooting tools that make it easier to support the operating system. These troubleshooting tools include:

- The **Upgrade Compatibility Verification tool**, which detects and warns the user if certain installed applications or components will cause an upgrade to fail or if the components will not work after an upgrade is complete. When you run the `winnt32` command with the `/checkupgradeonly` switch, the Report System Compatibility screen appears and lists any items found that are not compatible with Windows 2000.
- **Troubleshooting wizards**, which can be used to solve common computer problems. These troubleshooting wizards are included in Windows 2000's online Help.

1.1.3 Increased Hardware Support

Microsoft Windows 2000 Professional supports more than 7,000 hardware devices, including infrared devices, scanners, digital cameras, and advanced multimedia devices that Windows NT Workstation 4.0 did not support. Some of the enhancements to hardware support in Windows 2000 Professional include:

- The **Add/Remove Hardware wizard**, which you can use to add, remove, troubleshoot, and upgrade computer devices. When a device is not working properly, you can use the wizard to stop operation and safely remove the device.
- The **Win32 Driver Model (WDM)**, which provides a common model for device drivers across Windows 98 and Windows 2000, ensuring that the drivers that are written to the WDM will work in both Windows 98 and Windows 2000.
- **Enhanced Plug and Play** functionality that allows:
 - Automatic and dynamic reconfiguration of installed hardware;
 - Loading of appropriate drivers;
 - Registration for device notification events; and
 - Changeable and removable devices.
- **Power options**, which prevent unnecessary power drains on your system by directing power to devices as is required. The options available to you depend on your hardware and can include:
 - **Standby**, in which state your monitor and hard disks are turned off so that your computer uses less power.
 - **Hibernation**, which saves everything in memory to disk and turns off your computer. When you restart your computer, your desktop is restored exactly as you left it.

In addition to this increased hardware support, Windows 2000 Professional also provides **symmetric multiprocessing (SMP)** system capabilities and supports two processors. It assumes that all of the processors are equal and that they all have access to the same physical memory. Therefore, Windows 2000 can run any thread on any available processor regardless of which process, user or executive, owns the thread.

Windows 2000 also supports processor affinity, whereby a process or thread can specify that it is to run on a particular set of processors. As with previous versions of Windows NT, Windows 2000 includes **Application Programming Interfaces (APIs)** that a process can use for processor affinity. These APIs must be defined in the application to make use of processor affinity.

1.1.4 Enhanced File Management

Windows 2000 Professional provides enhancements to file management capabilities, including the following:

- **NTFS file system**, which supports file encryption and enables you to add disk space to an NTFS volume without having to restart the computer. It also supports distributed link tracking, and disk quotas.
- **FAT32 file system**, which is supported for compatibility with Windows 95 Operating System Release (OSR) 2 systems and later.
- **Disk Defragmenter utility**.
- **Backup utility**, which helps to protect data from accidental loss due to hardware or storage media failure.
- **Volume Mount Points**, which allows you to connect, or mount, a local drive at any empty folder on a local NTFS-formatted volume.

1.1.5 Enhanced Security Features

Windows 2000 Professional is the most secure Windows desktop operating system for either a stand-alone computer or any type of public or private network. The security features and enhancements in Windows 2000 Professional include:

- **Kerberos 5**, which is the primary security protocol for Windows 2000 domains, and supports single logon, allowing faster authentication and faster network response.
- **Encrypting File System (EFS)**, which strengthens security by encrypting files on your hard disk so that no one can access them without using the correct password.
- **Internet Protocol Security (IPSec)**, which encrypts Transmission Control Protocol/Internet Protocol (TCP/IP) traffic to secure communications within an intranet and provides the highest levels of security for virtual private network (VPN) traffic across the Internet.
- **Smart card support**, which enables portability of credentials and other private information between computers at work, home, or on the road. This eliminates the need to transmit sensitive information, such as authentication tickets and private keys, over networks.

1.2 Windows 2000 Server

Windows 2000 Server builds on Windows NT Server 4.0 to prove a faster, more reliable platform that is easier to manage and lowers your total cost of ownership (TCO) by integrating with existing systems. Windows 2000 Server supports new systems that dramatically increase system performance, and provides the following benefits: enhanced SMP support, simplified management, enhanced file management and security, improved networking and communications, and improved printing support.

1.2.1 Symmetric Multiprocessing

Previous versions of Windows NT required an **Original Equipment Manufacturer (OEM) Hardware Access Layer (HAL)** if more than two processors were to be used on a computer. If you installed an OEM HAL to increase the supported number of processors in a computer, and then upgrade to Windows 2000, Windows 2000 provides the same level of support. Therefore, upgrading from Windows NT 4.0 Server to Windows 2000 Server or from Windows NT 4.0 Enterprise Edition to Windows 2000 Advanced Server or Windows 2000 Datacenter Server exceeds SMP support in fresh installs as shown in Table 1.2.

TABLE 1.2: *Windows 2000 Symmetric Multiprocessing Support*

Operating System	Clean Installation	Upgrade
Windows 2000 Professional	2 Processors	2 Processors
Windows 2000 Server	2 Processors	4 Processors
Windows 2000 Advanced Server	4 Processors	8 Processors
Windows 2000 Datacenter Server	16 Processors	32 Processors

Thus, if you need to reinstall Windows 2000 on a computer and the number of processors in the computer exceeds the number supported by a clean installation of Windows 2000, you can install the OEM version of Windows NT 4 first, and then upgrade to Windows 2000.

1.2.2 Simplified Management

Windows 2000 Server allows administrators to manage their networks from a central location, dramatically decreasing the TCO. It offers several features and enhancements to accomplish this, including Active Directory directory service; configuration management; network and system management; and application services.

1.2.2.1 Active Directory Directory Services

Active Directory directory services in Windows 2000 Server extend the features of previous Windows-based directory services and are designed to work well in any size installation, from a single server with hundreds of objects to thousands of servers with millions of objects. Active Directory directory services provide a single, consistent, open set of interfaces for performing common administrative tasks, such as adding new users or managing printers. Active Directory directory services also make it easier for users to locate and access resources anywhere on the network.

1.2.2.2 Management Capabilities

Windows 2000 Server contains all of the same configuration management capabilities as Windows 2000 Professional. Additional configuration management capabilities in Windows 2000 Server include:

- **Microsoft Management Console (MMC)**, which provides a common console for monitoring network functions and accessing administrative tools. The MMC is customizable, allowing administrators to create consoles that include only the administrative tools that they need.
- **Group Policy**, which provides administrators with more control over which users have access to specific workstations, data, and applications, allowing administrators to define and control the state of computers and users in an organization.
- **Windows Scripting Host**, which allows administrators and users to save time by automating many actions, such as connecting to or disconnecting from a network server, creating multiple user accounts, or creating a large number of groups. Scripts can be run directly on the desktop or from the command prompt.

1.2.2.3 Network and System Management Features

Windows 2000 Server contains several tools that help you install, configure, and administer your Windows 2000 network. These tools include:

- **Remote Installation Services (RIS)**, which allows administrators to install Windows 2000 Professional on client computers throughout a network from a central location. RIS can dramatically decrease the cost of deploying new operating systems by reducing the amount of time an administrator spends moving from one client location to another.
- **Windows Management Instrumentation (WMI)**, which improves administrative control by allowing administrators to correlate data and events from multiple sources and vendors on a local or enterprise basis.
- **Dynamic DNS Updates**, which reduces network administration costs by reducing the need for manual editing and replication of the Domain Name System (DNS) database each time that a change occurs in a DNS client's configuration.

- **Remote Storage**, which can be used to monitor the amount of available space on a local hard disk. When the free space on the primary hard disk drops below the necessary level, Remote Storage automatically removes local data that has been copied to remote storage, providing the required free disk space.

1.2.2.4 Application Services

Windows 2000 Server is the first platform to provide an integrated set of services for building and deploying scalable, reliable applications. Application services in Windows 2000 Server include the following:

- **Indexing Service**, which automatically builds an index of your Web server that can be easily searched from any Web browser.
- **Terminal Services**, which allows clients to access Windows-based applications running entirely on the server and supports multiple client sessions on the server. The server manages all computing resources for each client that is connected to the server and provides all users who are logged on with their own environment. Users can log on to multiple-terminal servers or a single-terminal server multiple times.

1.2.3 Enhanced File Management and Security

Windows 2000 Server file management features improve resource availability and make it easier to manage your network storage requirements. Security features in Windows 2000 Server provide the highest levels of data protection and simplify administrative tasks.

To accomplish this, Windows 2000 Server provides all enhancements to file management capabilities and security features available in Windows 2000 Professional, plus:

- **Distributed file system (Dfs)**, which simplifies the process of creating a single directory tree that includes multiple file servers and file shares in a group, division, or enterprise. This makes it easier for users to find and manage data on a network.
- **Active Directory directory services security**, which allows administrators to create group accounts to more efficiently manage system security by allowing access to objects in Active Directory directory services based on group membership.
- **Security Templates**, which organizes all existing security attributes into one place, making it easier to administer security on a local computer.
- **Security Configuration and Analysis**, which allows you to import one or more saved configurations to a security database. Importing configurations builds a computer-specific security database that stores a composite configuration.

1.2.4 Improved Networking and Communications

Windows 2000 Server includes technologies that provide greater bandwidth control, secure network access from offsite locations, and support a new generation of communications solutions. These include:

- **MultiProtocol Routing**, which enables routing over multiple protocols, such as IP, Internetwork Packet Exchange (IPX), and AppleTalk on a local area network (LAN) or a wide area network (WAN). It also provides support for Open Shortest Path First (OSPF) and Routing Information Protocol version 2 (RIP v2).

- **Asynchronous Transfer Mode (ATM) support**, which allows a network to simultaneously transport a wide variety of network traffic, including voice, data, images, and video.
- **Remote Authentication Dial-in User Service (RADIUS)**, which provides authentication and accounting services for distributed dial-up networking. Windows 2000 can act as a RADIUS client, a RADIUS server, or both.

1.2.5 Improved Printing Support

Windows 2000 Server contains all of the same printing support features as Windows 2000 Professional and also provides support for more than 2,500 different printers. This makes it easier for organizations to use the printing services in Windows 2000 Server with existing printers, new printers, and shared printer pools.

In addition, Active Directory directory services integration with Windows 2000 Server, Advanced Server, and Datacenter Server make all shared printers in your domain available as objects in Active Directory directory services. Publishing printers in Active Directory directory services allows users to quickly locate the most convenient printing resources through an improved user interface. Locating printers in a timely manner can dramatically improve productivity, particularly for users who travel or change offices frequently.

1.3 Windows 2000 Advanced Server and Windows 2000 Datacenter Server

Windows 2000 Advanced Server includes all of the same features as Windows 2000 Server and additional features that provide a highly scalable, interoperable, available, and manageable operating system. Windows 2000 Datacenter Server builds upon Windows 2000 Advanced Server.

1.3.1 Windows 2000 Advanced Server

In addition to providing the features in Windows 2000 Server, Windows 2000 Advanced Server includes:

- **Enterprise Memory Architecture**, which allows applications that perform transaction processing or decision support on large data sets to keep more data in memory for greatly improved performance.
- **Increased SMP scalability**, which supports up to 4 processors on a clean install and up to 8 processors on an upgrade.
- **Windows Clustering**, which allows you to connect multiple servers to form a cluster of servers that work together as a single system. Windows Clustering provides the following benefits:
- **High-availability**, which provides high availability for mission-critical applications, including the ability to automatically detect the failure of an application and quickly restart it on a different server. When one server in the cluster fails, another server in the cluster can be used to restore service to users.
- **Network load balancing**, which provides high availability and scalability for network-based services, such as TCP/IP and Web services.
- **Component load balancing clusters**, which allow you to create a cluster that does class load balancing across COM+ application server computers creating application clusters that allow organizations to scale applications by simply plugging in additional nodes.

1.3.2 Windows 2000 Datacenter Server

Windows 2000 Datacenter Server builds upon the features in Windows 2000 Advanced Server, making it the most powerful and functional server operating system ever offered by Microsoft. The key benefits of Windows 2000 Datacenter Server include:

- Support for up to 16 processors, or up to 32 processors through OEMs
- Support for up to 64 GB of memory on Intel-based systems and up to 32 GB on Alpha-based systems

Like Windows 2000 Advanced Server, Windows 2000 Datacenter Server provides both clustering and load balancing services as standard features. In addition, Windows 2000 Datacenter Server is optimized for:

- Large data warehouses
- Econometric analysis
- Large-scale simulations in science and engineering
- Online transaction processing
- Server consolidation projects
- Large-scale ISPs and Web-site hosting