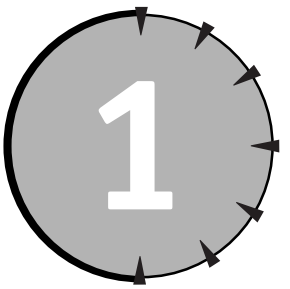
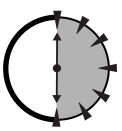
SESSION



Windows Server 2003 Basics

Session Checklist

- ✔ Windows Server 2003 editions
- ✔ Windows memory and processing
- ✔ Windows technology foundations



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Windows Server 2003 is the latest version of Microsoft's enterprise server operating system. The Windows Server 2003 family is the successor to the Windows 2000 Server family, which in turn built upon Windows NT Server. Windows Server 2003 introduces many new features and offers significant improvements to many features found in earlier Windows Server operating systems.

Before you can begin using Windows Server 2003, though, you need to understand the family of products that carry the Server name and how they differ from one another. You also have to understand their common memory and processor architecture, and some of the basic technologies that Windows Server 2003 is built upon.

The Windows Server Family

When Microsoft introduced Windows 2000 Server, they created a *family,* or series, of server operating systems. That family continues in Windows Server 2003 and consists of four separate products:

- Windows Server 2003 — Standard Edition
- Windows Server 2003 — Web Edition
- Windows Server 2003 — Enterprise Edition
- Windows Server 2003 — Datacenter Edition

Microsoft has also announced a 64-bit version of Windows Server 2003, which will be available on server computers utilizing Intel's Itanium processor or compatible processors from other companies. 64-bit editions of both Windows Server 2003 — Standard Edition and Windows Server 2003 — Enterprise Edition will be available.

The name "Windows Server 2003" is used to refer to the entire family of server operating systems. In this book, I use the name "Windows Server 2003" when discussing features that apply to all editions, and I refer to a specific edition by name when discussing features supported only by that edition.

Each of the three Windows Server 2003 editions has specific capabilities designed to meet specific business needs, and they build upon one another. In other words, Windows Enterprise Server can do everything the standard edition can do, and more.

Microsoft also produces a line of application servers that are collectively referred to as the "Enterprise Servers." This line includes Commerce Server, SQL Server, and Exchange Server. Don't confuse the "Enterprise Server" brand with Windows Server 2003, which is the operating system that all of the application servers run on.

Windows Server 2003 — Standard Edition

The standard edition of Windows Server 2003 provides all of the basic functionality a server operating system needs. The standard edition is intended to support

small- to medium-sized businesses as a file server, application server platform, or domain controller.

SYNTAX

A *file server* stores files, like Microsoft Office documents and enables users to access these files over a network. An *application server* runs application server software, such as a Web server or database server. A *domain controller* is a special type of server that centralizes security and user accounts for a business. You'll learn more about domain controllers in Session 3.

Windows Server 2003 has the following limitations:

- A maximum of four microprocessors may be used.
- No more than 4GB of memory is allowed. Of that 4GB, the operating system always reserves 2GB for its own use, allowing applications on the server to share the remaining 2GB.

Windows Server 2003 — Web Edition

Specially designed for use as a Web server, Windows Web Server provides a subset of the overall Windows Server 2003 functionality. The Web Server edition is optimized for Microsoft's Internet Information Services (IIS) Web server platform. The Web Server edition does not support some advanced services, including:

- Advanced network security features like Internet Authorization Server
- Fax services
- Terminal services

As the name implies, Windows Web Server is ideal for servers used as Internet or intranet Web servers.

Windows Server 2003 — Enteprise Edition

Windows Enterprise Server builds upon the Windows Server 2003 standard edition. It provides all of the same features and capabilities as the standard edition and adds the following:

- Support for up to eight microprocessors in a server.
- Expanded memory support that reserves only 1GB of memory for the operating system, allowing applications on the server to share the remaining 3GB.

- The ability to create clusters of two servers. You'll learn more about clustering in Session 27.

Some software applications are specifically designed to take advantage of these additional features. For example, Microsoft SQL Server 2000 is available in an "Enterprise Edition" that enables you to create clustered SQL Servers. The Enterprise Edition cannot be installed on the standard edition of Windows Server 2003 because cluster support isn't included in that edition.

Any Microsoft application server product with "Enterprise Edition" in the name may list the Enterprise Server edition of the operating system as a minimum requirement to take advantage of advanced features like clustering.

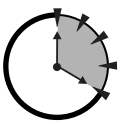
Enterprise Server is targeted toward medium to large businesses that need to run extremely powerful servers, use clustering, or run especially powerful application server software.

Windows Server 2003 — Datacenter Edition

Windows' Datacenter Server edition is the most powerful version of the operating system. Like the Enterprise Server edition, Datacenter Server builds upon the standard Windows Server 2003 edition and adds the following features and capabilities:

- Support for up to 32 processors in a single server
- Support for up to 64GB of memory
- Support for clusters of up to four servers

Microsoft designed Datacenter Server to be the most stable, reliable, and powerful version of Windows Server 2003. As such, it is also one of the most expensive. Also, Datacenter Server is the only version of Windows Server 2003 that you cannot purchase and install yourself (see the sidebar, "Where Do I Get Datacenter?")



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Datacenter Server is targeted to large businesses that need the most powerful servers possible, and who also require extremely reliable servers that rarely crash and rarely need to be rebooted (aside from scheduled maintenance operations).

Where Do I Get Datacenter?

One major concern that Windows administrators have is reliability. Windows NT and, to a lesser extent, Windows 2000, have a reputation for occasionally crashing, needing to be frequently rebooted, and so forth. Microsoft has conducted numerous studies over the years to discover the reasons behind these reliability problems. Those studies determined that most operating system failures were due to hardware and device driver problems.

A *device driver* is a small software program that allows Windows to interact with a server's hardware, including its disk drives, video display circuits, modems, and so forth. Because the operating system must work closely with device drivers, they must be programmed very carefully. A small bug in a device driver can easily crash the entire operating system.

When Microsoft decided to create Windows 2000 Datacenter Server, they decided to try to eliminate all hardware and device driver problems. To do so, they created a special certification program with the industry's major manufacturers of server hardware. As a result of that program, Datacenter Server can be purchased only along with a hardware server that has been certified by Microsoft as being compatible with the operating system. So the only way to purchase Datacenter Server is to buy it preloaded on a Compaq, IBM, Dell, or other brand of server. Datacenter Server is only available on specific server models that have been rigorously tested to ensure hardware and device driver compatibility.

What's more, any future upgrades to a server running Datacenter Server must be performed by the original server manufacturer, to ensure continued operating system compatibility. If you perform your own unauthorized upgrades to a Datacenter Server, Microsoft's Product Support Services will not help you with any problems that may arise.

Windows Architecture

Like its predecessors, Windows Server 2003 is a multithreaded, multiprocessing, multitasking operating system. It has a rich set of built-in services that make it easy for software developers to create powerful applications in a relatively short period of time. Unlike older operating systems, such as Windows 3.0 and Microsoft

MS-DOS, Windows Server 2003 offers built-in memory management, task scheduling, and much more. Windows Server 2003 also offers compatibility with an enormous array of hardware devices, allowing the operating system to interact with storage devices, scanners, networks, and many other types of peripherals. All of these features fall under two categories: operating system architecture components and application architecture components.

Operating system architecture

Windows uses a layered operating system architecture, allowing different layers to handle specific functions. This approach makes Windows very flexible, allowing the operating system to run in a variety of circumstances while requiring very few changes. The three major layers of Windows' architecture are shown in Figure 1-1 and include the *HAL,* the *kernel,* and the *applications* that run under Windows.

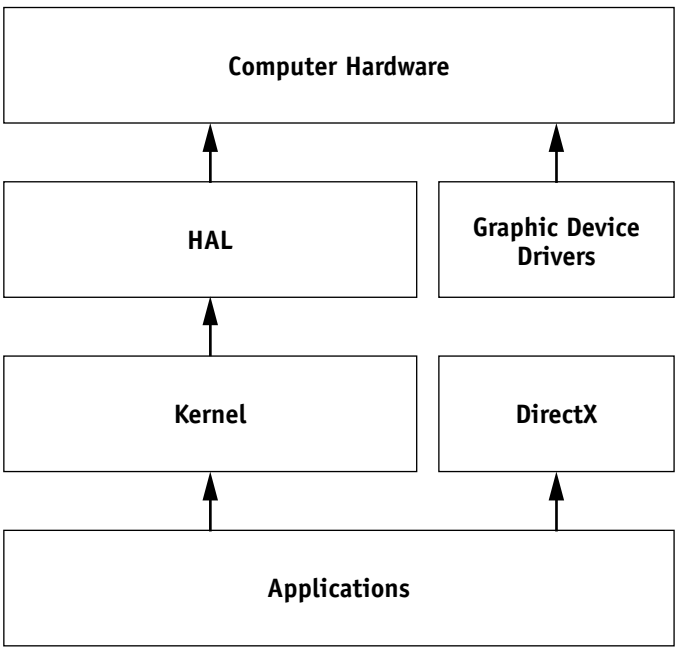

Figure 1-1 *The Windows operating system architecture*

The HAL

The Windows operating system architecture starts with the HAL, or *Hardware Abstraction Layer*. The HAL is a special piece of software that interacts directly with the hardware of a computer, including the computer's memory, processor, and various data communication devices.

The HAL can be replaced when Windows needs to run on a different type of computer. For example, Microsoft includes two HALs with Windows. One is designed for computers with only a single processor, and that HAL is fine-tuned to run best on one processor. Microsoft also provides a multiprocessor HAL, which is designed to take advantage of computers with two or more processors.

As shown in Figure 1-1, the HAL is bypassed for operations that work with the computer's graphics display. Separate drivers are provided for graphics cards; these drivers interact directly with the cards, providing faster graphics output.

The Kernel

The Windows kernel is the core of the operating system. The kernel runs on top of the HAL and uses device drivers to communicate with specific types of hardware. The kernel is responsible for running applications, drawing windows, buttons, and other elements of the graphical user interface (GUI), and so forth. In many respects, the kernel is what you think of as Windows itself.

Microsoft introduced a special set of software services called *DirectX* that communicates directly with graphics drivers. DirectX allows game programs to bypass the kernel and the HAL for very fast graphics output.

Applications

Applications are the things *you* use a server for, such as Web server software, database server software, or even Microsoft Office. Applications must be written to the Windows 32-bit API, or Application Programming Interface. This API is a special set of rules that programmers must follow in order for their applications to run on Windows. Essentially, an application uses the API to ask the kernel to perform various tasks, such as load files from disk or display graphics on a monitor. The kernel accepts applications' requests and passes them on to the HAL, which in turn translates them into the instructions understood by the computer's hardware.

Application architecture

Windows' application architecture allows the operating system to run multiple applications at the same time. Generally, each application is run in a separate *memory space,* meaning each application believes it is the only one running on the computer. If an application encounters an error and crashes, Windows can simply terminate that application's memory space. Other applications running on the server are unaffected.

Multitasking

In Windows terminology, a *task* usually represents a single software application. On a workstation computer, Microsoft Word is a task. On a server computer, an application server like Internet Information Services or Commerce Server might be a task.

10 Min. To Go

Multitasking refers to Windows' ability to run multiple tasks at the same time. In reality, though, a computer's processor can't run multiple tasks at once. To enable multitasking, the Windows kernel includes a *task scheduler.* This scheduler keeps tracks of all the applications currently running on the computer and assigns each of them a *time slice.* The scheduler then instructs the computer's processor to spend a short amount of time on each task. The amount of time the processor spends on a task is determined by the task's time slice: A larger time slice means the processor works on that task longer before switching to another one.

Because modern processors are so fast, they can switch between dozens of tasks in just a few *milliseconds.* Although the computer works on only one task at a time, it switches between them so quickly and so frequently that it *seems* to be working on them all at once.

You can see the tasks the computer is working on from within Windows. Just right-click on the Task Bar and select Task Manager from the pop-up menu. As shown in Figure 1-2, the Task Manager's Processes tab shows you all the tasks the computer is running and the percentage of the processor's time that is being spent on each task.

Multithreading

Each task running under Windows is capable of running multiple *threads.* You can think of a thread as a minitask that runs within the main task. For example, Microsoft Word enables you to type a document while it prints another one and spell-checks a third. All of these operations take place in separate threads within the main Word task.

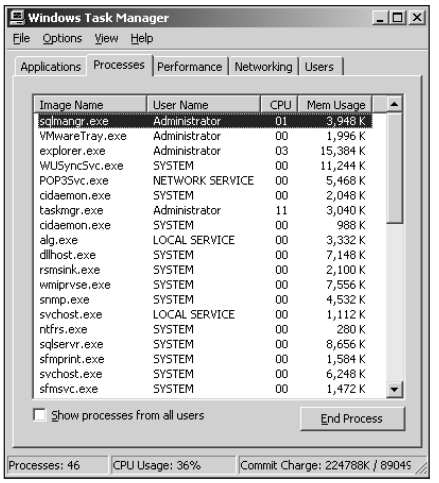

Figure 1-2 *The Windows Task Manager*

The Windows task scheduler breaks down the time slice assigned to each task and assigns the pieces to that task's threads. Each thread is then scheduled to run on the processor for the designated amount of time. Again, the processor is capable of working on only one thing at a time, but it is able to switch so fast that the computer appears to be working on multiple tasks and threads at once.

Multiprocessing

On a computer with more than one processor, Windows is truly capable of working on more than one thing at a time. The kernel's task scheduler is capable of assigning tasks and threads to a particular processor. The scheduler keeps track of how much work each processor is performing and tries to assign threads and tasks evenly, so that all processors in the computer are working at about the same rate.

As an administrator, you usually have no control over which tasks run on specific processors. Windows uses each processor in the computer as an available resource, and the scheduler makes complex decisions to determine which threads to assign to which processors. Software developers have a great deal of control over how well their applications can run on multiple processors. Some applications are written in such a way that they cannot effectively run on more than one processor. For example, an application that uses a single thread can run on only one processor because individual threads cannot be broken up between processors.

If you have an application that does not take advantage of the multiple processors in your server, contact the application's developer or manufacturer to see if a version is available that takes advantage of multiple processors.

Underlying Technologies

No operating system as large and complex as Windows Server 2003 is created entirely by one manufacturer's technologies and techniques. To create Windows Server 2003, Microsoft relied on many industry-standard technologies and used many industry techniques. Understanding these underlying technologies can help you better understand how Windows Server 2003 works "under the hood." Windows' most important underlying technologies fall into four categories: networking, security, services, and GUIs.

Networking

Windows Server 2003 provides a powerful set of networking services, allowing the operating system — and applications running on it — to communicate with other servers and applications across various types of electronic computer networks. Windows' primary networking *protocol,* or language, is TCP/IP. You have probably worked with TCP/IP before since it is also the native networking protocol used on the Internet and the World Wide Web.

You'll learn about Windows Server 2003's use of TCP/IP in Session 13.

By building Windows Server 2003 upon TCP/IP, Microsoft ensured that the operating system would be able to interact with and participate in the worldwide Internet. But, because many organizations who use Windows Server 2003 also use networking protocols other than TCP/IP, Microsoft made sure that Windows Server 2003 came with flexible networking options. In addition to TCP/IP, Windows Server 2003 can understand a variety of other network protocols, including

- IPX/SPX networks, which are common in environments that use Novell NetWare
- SNA networks, which are primarily used in conjunction with IBM midrange computers like the AS/400

- Legacy networks using DECnet, Banyan Vines, and other older network protocols

In the past, Windows included separate protocols for talking to computers like Apple Macintoshes. Today, most computers — including Macs — are capable of working with TCP/IP, so Windows no longer needs special, dedicated network protocols.

Security

While Windows Server 2003 uses an industry-standard security protocol named Kerberos (which is built upon TCP/IP), it's more important that you understand the security *concepts* the operating system uses. These concepts are built on many years of experience, and drawn from a variety of enterprise-class operating systems, including VAX and UNIX.

In Windows Server 2003, every object — such as a file, user account, printer, or other types of information — can be secured with an *Access Control List,* or ACL. The ACL lists the users who are allowed to work with the object and what actions they are allowed to perform. For example, a Word document including a list of company phone extensions might allow all of the company's users to read the file but permit only the company's receptionist to modify the file. An Excel spreadsheet containing payroll information might be visible only to members of the payroll and human resources departments. Windows uses the Kerberos protocol to determine who a user really is and then uses ACLs to determine what objects and information that user has access to.

This system of ACLs provides Windows administrators a great deal of flexibility. By carefully configuring ACLs, you can easily enable users to access the information they need to do their jobs, while protecting information that is private or confidential.

I'll introduce you to Windows security in Sessions 3 and 4.

Services

When network servers were first created, their primary task was to provide a place for users to store files that they wanted to share. As servers became more advanced, they gained the ability to run application server software, turning the

servers into database servers and Web servers. As a modern, advanced operating system, Windows Server 2003 not only includes all of these abilities, but also includes many application servers built right in. These are often referred to as *services,* and they include

- Internet Information Services, which allows Windows Server 2003 to be a Web server
- Certificate Services, which allows a server to issue and authenticate digital certificates for identity authentication and encryption
- Remote Access Services, which enables remote users with modems to dial in to a Windows Server 2003 as easily as they would dial in to an Internet Service Provider (ISP)
- Domain Name Services, which allows a server to translate friendly names like `www.microsoft.com` into the numeric TCP/IP addresses used on the Internet

These examples are just a few of the services included with every copy of Windows Server 2003. Because Windows Server 2003 includes so many services, it offers a great value to businesses. Rather than purchasing a separate server operating system and a variety of add-on services, they can simply purchase Windows Server 2003, which includes many commonly used services right in the box, at no extra charge.

You'll learn about Windows' built-in services throughout this book, especially in the Saturday Evening sessions.

Graphical user interfaces (GUIs)

Windows Server 2003 uses a GUI, built on Microsoft's experience with Windows 3.0, Windows 3.1, Windows 95, Windows NT, Windows 2000, and every other version of Windows that has ever existed. Many of the GUI elements — such as buttons, check boxes, option buttons, and so forth — used in Windows have become industry standards.

By default, Windows Server 2003 uses the same user "Windows Classic" interface found in Windows 2000 and is shown in Figure 1-3. The "classic" user interface offers the same capabilities and features, while at the same time preserving the GUI style that many administrators are already familiar with.

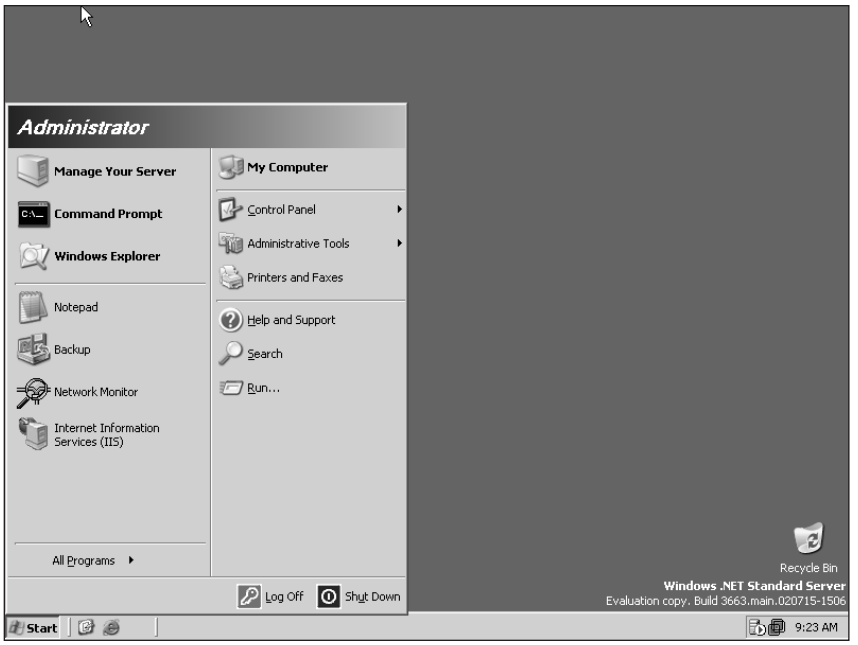

Figure 1-3 *The classic Windows GUI*

Done!

REVIEW

In this session, you learned about the four editions of the Windows Server 2003 family:

- Windows Server 2003 — Standard Edition
- Windows Server 2003 — Web Edition
- Windows Server 2003 — Enterprise Edition
- Windows Server 2003 — Datacenter Edition

You also learned about Windows' operating system and application architecture, including Windows' ability to perform multiprocessing, multitasking, and multithreading. Finally, you learned about many of the basic technologies that Windows is built on, including TCP/IP, Windows' security model, and its graphical user interface, or GUI.

QUIZ YOURSELF

1. Which edition of Windows Server 2003 introduces the ability to create server clusters? (See "The Windows Server Family.")
2. What is the main reason Datacenter Server is the most reliable edition of Windows Server 2003? (See "Where Do I Get Datacenter?")
3. What part of Windows is responsible for interacting with a computer's hardware? (See "Operating system architecture.")
4. What part of Windows decides which tasks and threads are executed by the computer's processors? (See "Multiprocessing.")
5. What is the native networking protocol for Windows Server 2003? (See "Networking.")