Summary of Improvements over Windows 3.1

Improvements made to the base architecture of Windows 95 result in many benefits to users. A summary of some of the key improvements include:

- Fully integrated 32-bit protected-mode operating system, eliminating the need for a separate copy of MS-DOS
- Preemptive multitasking, and multithreading support—improving system responsiveness and smooth background processing
- 32-bit installable file systems including VFAT, CDFS, and network redirectors providing better performance, use of long filenames, and an open architecture supporting future growth
- 32-bit device drivers available throughout the system, delivering improved performance and intelligent memory use
- Complete 32-bit kernel, including memory management, scheduler, and process management
- Improved system-wide robustness and cleanup after an application ends or crashes, delivering a more stable and reliable operating environment
- More dynamic environment configuration reducing the need for users to tweak their system
- Improved system capacity, including better system resource limits to address issues Windows 3.1 users encountered when running multiple applications

Fully-Integrated Operating System

The first thing that users of Windows 3.1 and MS-DOS will see when they turn their computer on (or perhaps won't see) is the lack of an MS-DOS command prompt from which they would need to invoke Windows. Windows 95 is a tightly integrated operating system that features a preemptive multitasking kernel that boots directly into the graphical user interface, yet provides full compatibility with the MS-DOS operating system.

Many of components in Windows 95 overcome limitations inherent in MS-DOS and Windows 3.1, moreover, the improvements do not come at the cost of compatibility with existing software, hardware, or computing environment.

No Need for CONFIG.SYS or AUTOEXEC.BAT

Windows 95 no longer needs a separate CONFIG.SYS or AUTOEXEC.BAT file as MS-DOS and Windows 3.1 require. Instead, Windows 95 is intelligent about the drivers and settings it needs to use and automatically will load the appropriate driver files or set the appropriate configuration settings during its boot process. If a CONFIG.SYS or AUTOEXEC.BAT file are present, the settings in these files will be used to set the global environment. For example, the default search path or the default appearance of the command prompt can be defined by using the appropriate entries in the AUTOEXEC.BAT file. While Windows 95 itself does not need a CONFIG.SYS or AUTOEXEC.BAT file, compatibility is maintained with existing software or environments that may require one or both of these files.

MS-DOS Not Really There?

Unlike Windows 3.1, Windows 95 is not built on top of real-mode operating system components for its interaction with the file system. This being said, the Windows 95 boot sequence does begin by loading real-mode operating system components that are compatible with MS-DOS. During the boot sequence, support for loading real-mode drivers and TSRs that may be identified in CONFIG.SYS or AUTOEXEC.BAT are processed. Since these drivers have been written to explicitly look for or use MS-DOS application support, the real-mode operating system components of Windows 95 help to maintain compatibility with software that users already have on their system. Once the real-mode drivers have been loaded, Windows 95 begins loading the protect-mode operating system components, and in some cases where a protect-mode Windows–based driver is provided, and will actually remove real-mode drivers from memory. More on this subject is discussed later in this guide.

32-Bit Versus 16-Bit Components

Windows 95 uses a combination of 32-bit and 16-bit code in order to provide a good balance between delivering compatibility with existing applications and drivers, decreasing the size of the operating system working set, and offering improved system performance over Windows 3.1. System reliability is also improved without the cost of compatibility or increased size.

Windows 95 is a 32-bit preemptive multitasking operating system that implements some 16-bit code to provide compatibility with existing applications. In general, 3: bit code is provided in Windows 95 to maximize the performance of the system, while 16-bit code balances the requirements for reducing the size of the system an maintaining compatibility with existing applications and drivers.

The design of Windows 95 deploys 32-bit code wherever it significantly improves performance without sacrificing application compatibility. Existing 16-bit code is retained where it is required to maintain compatibility, or where 32-bit code would increase memory requirements without significantly improving performance. All of the I/O subsystems and device drivers in Windows 95, such as networking and file systems, are fully 32-bit, as are all the memory management and scheduling components (the kernel and virtual memory manager). Figure 1 depicts the relative distribution of 32-bit versus 16-bit code present in Windows 95 for system-level services. As can be seen from the figure, the lowest-level services provided by the operating system kernel are provided as 32-bit code. Most of the remaining 16-bit code consists of hand-tuned assembly language, delivering performance that rivals some 32-bit code used by other operating systems available on the market today.

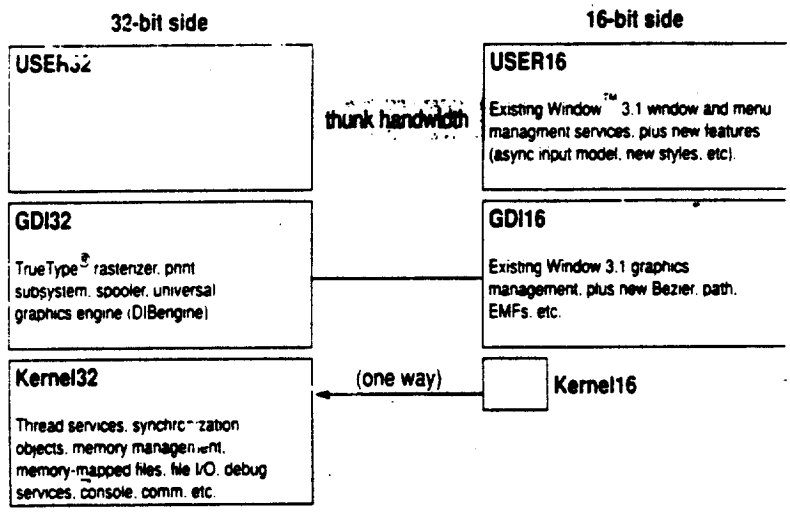

Figure 1. Relative Code Distribution in Windows 95

Many functions provided by the Graphics Device Interface (GDI) have been moved to 32-bit code, including the spooler and printing subsystem, the font rasterizer, and the drawing operations performed by the graphics "DIB engine." Much of the window management code (User) remains 16-bit to retain application compatibility.

In addition, Windows 95 improves upon the MS-DOS and Windows 3.1 environment by implementing many device drivers as 32-bit protected-mode code. Virtual device drivers in Windows 95 assume the functionality provided by many real-mode MS-DOS–based device drivers eliminating the need to load them in MS-DOS. This results in a minimal conventional memory footprint, improved performance, and improved reliability and stability of the system over MS-DOS–based device drivers.

Virtual Device Drivers—What is a VxD?

A virtual device driver (VxD) is a 32-bit, protected-mode driver that manages a system resource, such as a hardware device or installed software, so that more than one application can use the resource at the same time. To understand the improvements available in Windows 95 over the combination of MS-DOS and Windows 3.1, it is good to have a basic understanding of what a VxD is and the role virtual device drivers play in the Windows 95 environment.

The term *VxD* is used to refer to a general virtual device driver—the *x* represents the type of device driver. For example, a virtual device driver for a display device is known as a VDD, a virtual device driver for a timer device is a VTD, a virtual device driver for a printer device is a VPD, and so forth. Windows uses virtual devices to support multitasking for MS-DOS-based applications, virtualizing the different hardware components on the system to make it appear to each MS-DOS VM that it is executing on its own computer. Virtual devices work in conjunction with Windows to process interrupts and carry out I/O operations for a given application without disrupting how other applications run.

Virtual device drivers support all hardware devices for a typical computer, including the programmable interrupt controller (PIC), timer, direct-memory-access (DMA) device, disk controller, serial ports, parallel ports, keyboard device, math coprocessor, and display adapter. A virtual device driver can contain the device-specific code needed to carry out operations on the device. A virtual device driver is required for any hardware device that has settable operating modes or retains data over any period of time. In other words, if the state of the hardware device can be disrupted by switching between multiple applications, the device must have a corresponding virtual device. The virtual device keeps track of the state of the device for each application and ensures that the device is in the correct state whenever an application continues.

Although most virtual devices manage hardware, some manage only installed software, such as an MS-DOS device driver or a terminate-and-stay-resident (TSR) program. Such virtual devices often contain code that either emulates the software or ensures that the software uses data that applies only to the currently running application. ROM BIOS, MS-DOS, MS-DOS device drivers, and TSRs provide device-specific routines and operating system functions that applications use to indirectly access the hardware devices. Virtual device drivers are sometimes used to improve the performance of installed software; the 80386 and compatible microprocessors can run the 32-bit protected-mode code of a virtual device more efficiently than the 16-bit real-mode code of an MS-DOS device driver or TSR. In addition, performance is also enhanced by eliminating ring transitions that result in executing 32-bit applications that access 16-bit real-mode services—with virtual device drivers, the system can stay in protected-mode.

Windows 95 benefits from providing more device driver support implemented as a series of VxDs in the Windows environment, over the use of device drivers previously available as real-mode MS-DOS device drivers. Functionality that was previously supported as MS-DOS device drivers, but are now supported as VxDs in Windows 95 includes components such as:

- MS-DOS FAT file system
- SmartDrive
- CD-ROM file system
- Network card drivers and network transport protocols
- Network client redirector, and network peer server
- Mouse driver
- MS-DOS file sharing and locking support (SHARE.EXE TSR)
- Disk device drivers including support for SCSI devices
- DriveSpace (and DoubleSpace) disk compression

In Windows 95, VxDs provide improved performance due to a 32-bit code path and eliminating or reducing the need to mode switch between real and protected-mode, reduced conventional memory footprint by providing device driver and TSR functionality as protected-mode components that reside in extended memory, and improved system stability and reliability over using the MS-DOS device driver counterparts. Virtual device drivers can be identified by the use of a .VXD extension in Windows 95, or a .386 extension as a virtual device driver from Windows 3.1.

CHAPTER 5

Improved Support for Running MS-DOS–based Applications

Support for MS-DOS–based applications, device drivers, and terminate-and-stay-resident programs (TSRs) does not go away in Windows 95. In fact, Windows 95 offers better compatibility for running MS-DOS–based applications than Windows 3.1 does, including applications that are hardware-intensive, such as games.

As with Windows 3.1, Windows 95 provides the ability for a user to launch an MS-DOS command prompt as an MS-DOS virtual machine (VM). The functionality supported in an MS-DOS VM, is the same functionality that is available under the latest version of MS-DOS, allowing users to run the same intrinsic commands and utilities.

Windows 95 delivers great support for running MS-DOS–based applications, allowing even applications that would not run under Windows 3.1 to run properly. This allows MS-DOS–based applications to coexist peacefully with the rest of the Windows 95 environment.

Summary of Improvements over Windows 3.1

Improvements made in the system provide the following benefits for running MS-DOS–based applications in the Windows 95 environment:

- Zero conventional memory footprint for protected-mode components
- Improved compatibility for running MS-DOS-based applications
- Improved robustness for MS-DOS–based applications
- Better support for running MS-DOS–based games, including in a window
- Support for running existing MS-DOS–based applications without exiting Windows 95 or running MS-DOS externally
- Consolidated attributes for customizing properties of MS-DOS–based applications
- Toolbar availability when running an MS-DOS-based application in a window providing quick access to features and functionality to manipulate the window environment
- User-scaleable MS-DOS window through the use of TrueType fonts
- Ability to gracefully end MS-DOS–based application without exiting the application
- Ability to specify local VM environment settings on a per-application basis through the use of a separate batch file
- Support for new MS-DOS commands providing tighter integration between the MS-DOS command line and the Windows environment

Zero Conventional Footprint Components

Windows 95 helps to provide the maximum amount of conventional memory available for running existing MS-DOS–based applications. Some MS-DOS–base applications do not run under Windows 3.1 because by the time MS-DOS–based device drivers, MS-DOS–based TSRs, MS-DOS–based networking components, and Windows 3.1 were loaded, there was not enough conventional memory available. Windows 95 provides 32-bit protected-mode components that replace many of the 16-bit real-mode counterparts, providing the same functionality while improving overall system performance and using no conventional memory.

Better Display Adapter and Monitor Support

Video display adapter and monitor support in Windows 95 is another area that has received a lot of attention during the design phases of Windows 95.

Summary of Improvements Over Windows 3.1

Windows 95 addresses many of the problems inherent in Windows 3.1 display drivers and provides enhanced functionality and easier setup and configuration. Benefits of the new display driver support in Windows 95 includes:

- More stable and reliable video display adapter drivers
- Many more video cards supported by drivers in the box
- A mini-driver architecture that makes it easier for IHVs to write video display drivers
- Support for new features including the ability to change video resolution on-the-fly without needing to restart Windows 95 (important for hot/warm docking support)
- Video driver support for mobile computing docking/undocking providing functionality to autoswitch between video card in laptop and video card in a base unit
- Consistent and unified installation and configuration of display drivers and display properties such as colors, wallpaper patterns, and screen saver
- Image Color Matching support for device-independent color usage, which Microsoft worked in conjunction with Kodak to offer
- Support for new generation of hardware and device functionality such as Energy Star Monitors conforming to the VESA Display Power Management Signaling (DPMS) specification, and detection of monitor properties such as maximum resolution supported when used in conjunction with monitors that support the VESA Display Data Channel (DDC) specification

Windows 95 Puts Information on the Internet Just a Mouse-Click Away

With Windows 95, you have easy access to the Internet, whether you dial into a commercial Internet provider or you have access to the Internet via your corporate network over TCP/IP. Windows 95 provides all the plumbing you need to access information on the world-wide Internet network. Built-in support for TCP/IP, Windows Socket services, and dial-up protocols such as Point to Point Protocol (PPP) and SLIP, make connecting to the Internet and the information highway just a mouse-click away with Windows 95. TCP/IP, the protocol used on the Internet, is implemented in Windows 95 as a fast, robust, 32-bit Windows–based TCP/IP stack—this Windows–based TCP/IP implementation also does not have the conventional memory footprint commonly found in MS-DOS–based drivers or TSRs. Dial-up protocol support such as PPP and SLIP in Windows 95 give users flexibility in choosing the Internet access provider they want to use to dial into using a standard asynchronous modem or ISDN connection.

Support for Windows Socket services in Windows 95 allows users to use any of the large collection of third-party and public domain Internet utilities such as Mosaic, WinWAIS, and WinGopher, to easily connect to the Internet and access the thousands of world-wide information servers. Additionally, Windows 95 includes telnet and FTP to help you take advantage of the Internet. Windows 95 also supports sending and receiving electronic mail messages over the Internet through the use of a provided mail driver that integrates with the universal inbox in Windows 95, the Microsoft Exchange client. For more information on Internet mail support in Windows 95, see the Microsof Exchange section of this guide.

Windows 95 Makes Using the Network as Easy as "Point and Click"

For users, running one network client can be confusing and multiple network support is nearly unmanageable. Each server has its own set of unique client-side utilities and commands that are often difficult to remember and use. When the desktop PC has multiple network support loaded, the user is now faced with minimally twice the number of commands and utilities to remember and may now have to remember multiple passwords to access network resources. The easy to use Network Neighborhood user interface in Windows 95 makes it easier for users to perform common network operations on disparate servers. First, it's now possible for network manager to establish one password to log the user into the Windows 95 PC and any network resources or services that they are entitled access to. These services could include email, group scheduling applications, dial in support or database access.

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