Features for Users Who Are Hearing-Impaired 292
ShowSounds 292
SoundSentry 292
Support for Alternative Input Devices 292
SerialKeys 292
Support for Multiple Pointing Devices 292
Features for Software Developers 293
Accessibility Guidelines for Software Developers 293
Methods for Simulating Input 293
Chaining Display Drivers 293
New Common Controls 293

Chapter 20 Applications and Utilities 295
The Quick Viewers 295
WordPad 298
Paint 299
Backup 300
HyperTerminal 301
The New MS-DOS–Based Editor 302
The WinPad Organizer 303
Disk Utilities 304
The Disk Defragmenter 304
ScanDisk 304

Chapter 21 What Makes a Great Windows 95 Application? 307
The Win32 Application Programming Interface 307
OLE Functionality 308
The Features of OLE 309
The *Windows 95 User Interface Design Guidelines* 312
Support for Handling Plug and Play Events 315
Support for Quickly Identifying Files 316
Consistent Setup Guidelines 317

Chapter 22 The Windows 95 Logo Program 319
The Availability of Windows 95–Based Products 320
Licensing Criteria for the Windows 95 Logo 320
For More Information 320

Chapter 23 Questions and Answers About Windows 95 321
General Questions 321
Upgrading to Windows 95 323
Ship Dates and Packaging Plans 326
User Interface 327
Architecture 328
Plug and Play 329
Application Support 330
Networking 330
Systems Management 331
Messaging and Mail 332
The Microsoft Network 332
Mobile Computing 333
For More Information 334

Samsung - Exhibit 1023 - Page 12

Microsoft WinNews—Get the Latest Information on Microsoft Windows

Windows 95 is continuing to evolve as we get closer to the release of the product. To help keep you informed of the latest information on Windows, Microsoft has created the WinNews information forum, an easily accessible electronic distribution point for new white papers, press releases, and other pertinent documentation. If you have a modem or access to the Internet, you can always get up-to-the-minute information on Windows 95 directly from Microsoft on WinNews. Use the following electronic addresses to access further information:

CompuServe	GO WINNEWS
Internet	ftp.microsoft.com/peropsys/win_news
Worldwide Web	http://www.microsoft.com
GEnie	WINNEWS Download area in Windows RTC
Prodigy	Jumpword WINNEWS
AOL	Keyword WINNEWS

To subscribe to Microsoft's WINNEWS Electronic Newsletter, send e-mail to enews@microsoft.nwnet.com with the words SUBSCRIBE WINNEWS in your message.

This document is provided for informational purposes only. The information contained in this document represents the current view of Microsoft Corporation on the issues discussed as of the date of publication. Because Microsoft must respond to change in market conditions, it should not be interpreted to be a commitment on the part of Microsoft and Microsoft cannot guarantee the accuracy of any information presented after the date of publication.

INFORMATION PROVIDED IN THIS DOCUMENT IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND FREEDOM FROM INFRINGEMENT. The user assumes the entire risk as to the accuracy and the use of this document. This document may be copied and distributed subject to the following conditions: 1) All text must be copied without modification and all pages must be included; 2) All copies must contain Microsoft's copyright notice and any other notices provided therein; and 3) This document may not be distributed for profit.

Copyright © 1994 Microsoft Corporation. All Rights Reserved.

Acknowledgments

Special thanks to the contributors to this book, including (but not limited to):

Russ Arun
Richard Barton
Joe Belfiore
Andreas Berglund
Eric Bidstrup
Jeff Camp
Ina Chang
Brad Chase
Joyce Cox
Deborah Epstein-Celis
Dhiren Fonseca
Pat Fox
Richard Freedman
Andy Hill
Jean Kaiser
Bill Koszewski
Keith Laepple
Greg Lowney
Peggy McCauley
Yusuf Mehdi
George Moore
Doralee Moynihan
John Parkey
Dave Pollon
Rob Price
Victor Raisys
Jim Reitz
Brad Silverberg
Bob Taniguchi
Jeff Thiel
Mike Tuchen
Bill Veghte
Rogers Weed
Christian Wildfeuer

Dedicated to the Windows 95 Project Team—
for the development of one really cool operating system!

Samsung - Exhibit 1023 - Page 13

- **Compatibility with existing hardware.** The wide range of hardware available for Windows 3.1—from scanners to plotters to fax modems to video capture boards—is enormously valuable to users. While providing support for new, easier-to-use peripherals through Plug and Play, Windows 95 preserves the huge investment of users and manufacturers by maintaining compatibility with existing peripherals and their associated device drivers.

- **Performance equal to or better than that of Windows 3.1.** In keeping with the goal of adding value to existing PCs without requiring additional hardware and software, Windows 95 matches or exceeds the performance of Windows 3.1 on today's average PC (386DX with 4 MB of RAM). As more memory is added to the PC, performance scales faster than Windows 3.1. As a result, access to all the new features in Windows 95 should not incur any performance penalty.

- **Safe, hassle-free upgrade and migration.** Windows 95 makes the upgrade process as easy as possible by providing a Setup program that installs cleanly over Windows 3.*x*. Windows 95 includes the Windows 3.1 Program Manager and File Manager so that users can migrate to the new user interface at their own pace.

The mission of Windows 95 is to go beyond making PCs easier to use and make them truly usable. A truly usable PC is more intuitive and automatic, integrates the latest technologies, offers superior responsiveness and stability, and is compatible with today's existing software and hardware. Windows 95 also aims to make the upgrade and transition easy, without pain and without loss of performance or capability. This book details the specific benefits of the many Windows 95 innovations, underscoring improvements over Windows 3.1. You'll see as you read through the chapters that the size and scope of Windows 95 is awesome, and that its features are worthy of its mission.

CHAPTER 1

The Microsoft Windows Operating System Family

The Microsoft Windows operating system family provides users and developers with a rich set of services that take full advantage of the broad range of available hardware platforms, from small form-factor portable systems to multiprocessor servers. Windows 95 is for users of Intel–based desktop and laptop PCs. Windows NT Workstation and Windows NT Server are advanced operating systems for workstations and network servers, respectively, and support both Intel and reduced instruction set computing (RISC) microprocessors, as well as symmetric multiprocessing (SMP).

The scaleable architecture of the Windows operating system family supports the same user interface, applications, and development tools across an ever-expanding range of hardware. At the same time, the Windows operating systems meet the spectrum of customer requirements, from productivity applications to powerful, secure, mission-critical applications.

Windows 95 and Windows NT Workstation

Because it is not currently possible to have one operating system that fully exploits the broad range of available hardware, the Microsoft Windows operating system family, shown in Figure 1, has two distinct design points: one centered on mainstream systems, and the other centered on leading-edge systems.

Samsung - Exhibit 1023 - Page 14

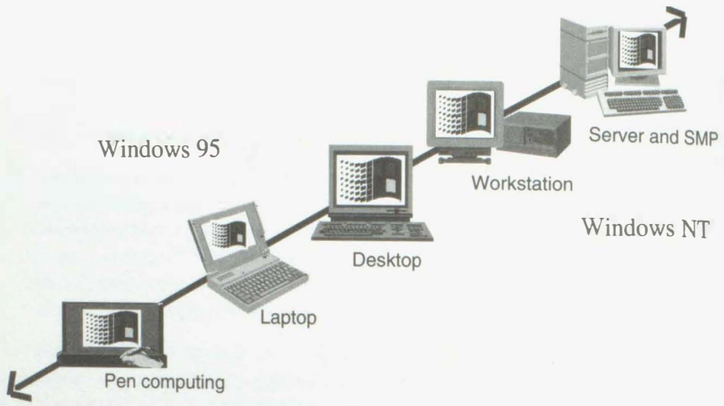


Figure 1. A consistent platform for development, deployment, and training

For mainstream systems (currently represented by products such as subnotebook and entry-level desktop machines), Windows 95 delivers responsive performance for a broad range of applications while conserving the amount of system resources used. Windows 95 is designed for use on Intel–based PCs and supports the Intel 80386DX, 80486, and Pentium processors used in mainstream desktop and portable PCs.

For leading-edge systems, Windows NT fully exploits the capabilities of the hardware and provides the most advanced services for the most demanding applications. Windows NT is designed for use on Intel–based and workstation PCs—for example, a MIPS R4400 or Digital Alpha AXP–based system, a dual-processor workstation, or a multiprocessor RISC server.

Because of the requirements placed on new enterprise solutions, all major operating system developers—including Microsoft, IBM, Sun (and most UNIX vendors), and Novell—have recognized the necessity of moving to a micro-kernel architecture for their leading-edge operating systems. Microsoft made this commitment over five years ago and began shipping Windows NT to developers in July 1992 with general availability in July 1993. This architecture allows vendors to enhance systems to respond to the rapidly changing requirements of evolving business solutions while maintaining the flexibility needed to exploit new hardware and peripherals.

Both Windows 95 and Windows NT Workstation provide a common base of functionality that is required by all customers, including ease of use, power, connectivity and manageability. Microsoft is committed to and will deliver parity in basic functionality (such as the user interface) to each platform as quickly as possible.

The differences between the two platforms are a result of their different design goals. Windows 95 is focused on making computing easier for anyone using a wide range of personal and business applications on desktop and portable computers. To protect their

current investment, these users require the highest level of compatibility with today's applications and device drivers. Windows NT Workstation is focused on providing the most powerful desktop operating system for solving complex business needs. For developers; technical/engineering/financial users; and business operations application users, Windows NT Workstation delivers the highest level of performance to support the most demanding business applications. It also provides the highest levels of reliability, protection, and security for critical applications while exploiting the latest hardware innovations, such as RISC processors and multiprocessor configurations. This focus on solving business needs is also reflected in the emphasis on maintenance and regular system updates.

Over time, as mainstream systems become more powerful, technologies implemented first in the leading-edge Windows operating system will migrate to the mainstream operating system. Sometimes technical innovations will appear first in the mainstream operating system because of timing of releases or because some features improve ease of use for general users. However, the guiding principle for product planning is that the leading-edge operating system will provide a superset of the functionality of the mainstream operating system.

For application developers, Microsoft provides only one Windows programming platform, defined by Win32—the 32-bit Windows application programming interface—and OLE. By following a few simple guidelines, developers can write a single application that runs across the Microsoft Windows operating system family. Optionally, developers can target a specific operating system whose functionality is important to a particular application, but targeting is not a requirement.

Which Operating System?

The decision about which of the Microsoft Windows operating systems to deploy should be based on the tasks to be accomplished. The two operating systems provide a complementary set of capabilities that can accommodate a broad range of usage scenarios.

Windows 95 Usage Scenarios

The following examples illustrate scenarios where Windows 95 is the best choice.

- Most office environments require people to perform a variety of general tasks, such as word processing, database queries, or spreadsheet analyses, using productivity applications, such as the Microsoft Office suite. These people may also be using applications that are specific to their particular business. Their companies have an installed base of personal computers, peripheral devices and applications, and Windows 95 allows them to maximize their investment in that computing infrastructure.

Samsung - Exhibit 1023 - Page 15

- Many companies have employees who spend a high percentage of their working hours away from the office—for example, at customer sites, in hotels, or out in the field—and rely on personal computers to help them perform their jobs. Windows 95 meets the requirements of these mobile computer users for the same application and device compatibility as their office-based colleagues, but also places lower demands on their hardware, including amount of memory, battery power, and use of disk space.
- Most users of computers in the home find them both challenging and unfriendly. However, they want to be able to take advantage of new capabilities, such as multimedia, and to easily access online information services. Windows 95 is easy for all family members to use, yet has the power to do what they want to do. Built into the operating system are rich multimedia capabilities; the highest levels of compatibility for running MS-DOS–based applications, such as games; and connectivity to information services, such as the Internet or other online services. In addition, technology such as Plug and Play allow some users to effortlessly add new components, such as printers, modems, and other peripherals, to their systems.

Windows NT Workstation Usage Scenarios

The following examples illustrate scenarios where Windows NT Workstation is the best choice.

- Engineers, scientific researchers, statisticians, and other technical users often need to use processing-intensive applications for data analysis and large design activities. Windows NT Workstation, with its support for SMP and its portability to high-performance platforms, such as those based on Pentium, Alpha, or MIPS CPUs, can provide the performance of a leading-edge workstation or minicomputer at a fraction of the cost. Moreover, with Windows NT Workstation, users can also run personal productivity applications on their systems.
- For industries that need to protect sensitive data or application files, such as banking and defense, Windows NT Workstation provides a secure desktop. The NTFS file system, combined with appropriate security procedures, helps prevent unauthorized access to systems and data, and the security model in Windows NT Workstation is designed to be compliant with C2-level certification. With these features, a single Windows NT system can be shared by multiple users and still maintain security for all files on the system.
- Many companies require high levels of availability and performance and cannot afford downtime, regardless of which application is running. Often these types of systems are being "right-sized" from mini and mainframe systems. For example, many manufacturing companies use 16-bit applications to manage their production lines. With Windows NT Workstation, these Win16–based applications can be run in separate address spaces (often referred to as separate virtual machines). Then even if one application fails, the other applications continue to run. Windows NT Workstation also provides complete protection for 32-bit applications and automatic recovery (reboot, if necessary) if the system goes down.

Evaluating Windows 95

As you compare Windows 95 with other operating system products on the market, including Windows 3.1, you should examine the following areas to help identify the operating system that best meets your needs and the needs of your system's users:

- Ease of use
- Performance
- Compatibility of device and application support
- Support for networking and connectivity
- Support for manageability and administration
- Support for communications and messaging
- Support for mobile services and remote access

In the following sections, we briefly discuss these evaluation criteria. The remaining chapters in this book show how Windows 95 provides the best desktop operating system for mainstream platforms in each of these areas.

Ease of Use

It is important to look at the ease-of-use aspects of an operating system from the perspectives of both a novice and an experienced user. Novice users include both people who have never used a PC and people who have used one infrequently, often because they find PCs intimidating. Novices might have trouble moving around the user interface and might need more information or coaching—for example, from an online Help system. Experienced users generally interact with more areas of the operating system than novice users, and they demand flexibility, speed, and power.

As you evaluate the ease of use of an operating system, it's helpful to answer these questions:

- Is the operating system easy to learn and use and efficient for the widest range of users?
- Can users discover new features and new, more efficient ways of performing tasks as they become more experienced?
- Does the operating system make it easy for novice users to complete common tasks, such as starting new applications, switching between two or more active applications, or manipulating files?
- Is the operating system flexible enough that experienced users can customize it to reflect the way they interact with the computer?

Samsung - Exhibit 1023 - Page 16

Performance

The term *system performance* refers to how the operating system performs overall while performing a set of broad tasks—for example, running a group of applications and programs that are normally run simultaneously. The term *performance* also refers to the ability of individual system components or subsystems to perform a more narrow set of tasks—for example, file input/output (I/O) operations.

Several available suites of benchmarks test the ability of operating systems to complete a set of tasks that are designed to mimic real-world use of a particular PC/operating system combination. These benchmark suites produce numbers that represent the responsiveness of the operating system for a given set of commercially available applications. You can run the same set of applications in your environment and use the benchmark information to determine the relative performance of various operating systems.

However, benchmark suites don't tell the whole story. In addition to running application benchmark suites, you should isolate and separately test various components and subsystems of the operating system to obtain low-level results that indicate how well the operating system can support the services used by applications. Areas commonly isolated and benchmarked on standalone PCs include the performance of the local file system for disk and file I/O, the performance of the graphics subsystem and video display drivers for graphics and text I/O, and the performance of the printing subsystem for printing I/O. In addition, you should test desktop operating systems in networked environments for their ability to support network I/O throughput for the supported network clients, as well as server functionality responsiveness (if supported by the operating system).

All operating systems perform at their best on a PC that has the maximum amount of RAM. However, most users' PCs have less than the maximum amount. You should run performance tests against different hardware configurations, including memory ranges from 4 MB to 16 MB and PCs containing Intel 80386DX, 80486, and Intel Pentium–based CPUs. Because different hardware resources deliver different performance testing results, it's important to test not only on more than one PC configuration, but also on hardware that is currently mainstream in the industry.

As you evaluate the performance of an operating system, it's helpful to answer these questions:

- Does the operating system perform well on a wide variety of hardware and software?
- How well does the operating system complete benchmark tests on a suite of applications on a given hardware platform?
- How well does the operating system complete benchmark tests on individual components and device drivers provided as part of the system?

- Does the operating system perform well as far as network connectivity for supported network clients or provided network server functionality is concerned?

Compatibility of Device and Application Support

When it's time to replace an old operating system, a key question to consider is "Can my company still use its existing hardware and software with the new operating system?" Your company has probably invested a large amount of money in applications, printers, modems, and other PC-related peripheral devices. It's important to find out whether the replacement operating system can run with the existing hardware and software.

It's also important to know how broad a range of devices is supported by the operating system you choose. No doubt, as your company grows, your hardware needs will grow too. Your choice of an operating system should not unreasonably restrict the peripheral devices your company can buy later. The operating system you choose should include ample device drivers, not only to support the devices you currently own, but also those you will buy in the future.

When examining device support of an operating system, consider the number of devices supported, the industry standards that the operating system supports, and compatibility with existing device drivers shipped with earlier operating systems or with the devices themselves.

As you evaluate the device and application support of an operating system, it's helpful to answer these questions:

- Does the operating system provide broad support for your company's existing hardware and the associated MS-DOS–based and Windows–based device drivers?
- Are devices easily recognized, installed, and configured by the operating system?
- Does the operating system allow you to run your existing MS-DOS–based or Windows–based applications as well as MS-DOS 6.*x* or Windows 3.1?
- Does the operating system allow the easy exchange of information among applications, or does it support advanced interapplication communication mechanisms?
- Does the operating system provide services for new types of applications, such as multimedia, remote access, and communications-related applications?

Support for Networking and Connectivity

In a corporate environment, an operating system must be able to provide network support for a broad base of clients. You should compare each operating system's ability to support connectivity in a heterogeneous environment, as well as how successfully network functionality and other areas of the system, such as the user

Samsung - Exhibit 1023 - Page 17

interface, are integrated in each operating system. Bear in mind that, in general, companies are not looking for the incorporation of proprietary network functionality in an operating system. They want the operating system to support industry-wide standards so that they don't have to rely on a single vendor to support a multivendor environment.

As you evaluate the networking support of an operating system, it's helpful to answer these questions:

- Is the operating system an open, layered networking architecture that lets you mix and match best-of-breed components at every layer?
- Does the operating system have built-in, native support for popular networks?
- Does the operating system natively support a wide range of network transports, such as TCP/IP and IPX/SPX; industry-wide communication protocols, such as RPC, NetBIOS, DCE, and named pipes; and existing network device standards, such as NDIS and ODI?
- Does the operating system provide a simple, consistent user interface for accessing the network and using network resources?
- Does the operating system support an open architecture that allows third-party and network operating system vendors to easily integrate or add network connectivity enhancements or application support?

Support for Manageability and Administration

PCs are now one of the largest expenses of an MIS organization. Medium and large businesses invest tens of thousands of dollars each year, not only on the hardware and software for new and existing computer systems, but also for setup and administration of these systems. Currently, the available tools for managing and administering PCs in a networked environment have little consistency and almost no integration.

Standards organizations are now working to simplify system administration by developing standard methods for managing PCs. These standards will mean better and more integrated management tools for the network administrator. For an administrator to reap any benefits, however, the operating system must support management mechanisms that adhere to existing standards or its infrastructure must be designed for adaptability to a new standard.

As you evaluate the support for manageability and administration of an operating system, it's helpful to answer the following questions:

- Does the operating system provide the tools and platform infrastructure for supporting management mechanisms that adhere to existing industry standards, such as SNMP, and is it flexible enough to support future standards, such as DMI?

- Does the operating system provide tools and mechanisms for MIS organizations and administrators to customize and control the functionality and capabilities on the desktop?
- Does the operating system provide support for managing desktop PCs remotely over a network?

Support for Communications and Messaging

With the explosive growth of services such as CompuServe, America Online, and the Internet, the increase in demand for an operating system that provides access to online and mail services has been dramatic. The support and services provided by an operating system can open the door to the Information Age, allowing users to discover new communications and messaging possibilities.

As you evaluate the communications and messaging support of an operating system, it's helpful to answer these questions:

- Does the operating system support high-speed communications and background multitasking capabilities?
- Does the operating system provide support for communication hardware; for new communication functionality, such as sharing communication ports; for unified device configuration; and for emerging communications technology?
- Does the operating system provide support for industry-standard messaging services?
- Does the operating system provide broad communication and messaging capabilities, such as faxing, dial-up access to resources, and access to online information services, and consolidated information access?

Support for Mobile Services and Remote Access

To realize seamless mobility, users must be able to easily communicate and remain productive, whether they are in the office, at a customer site, or at home. Users must be able to communicate with coworkers and clients regardless of their location. In addition, transitions from home computer to portable computer to office computer must not cause interruptions in workflow. Including support for mobility services as part of the operating system ensures tight integration and connectivity between portable computers and desktop PCs, allowing minimal work interruptions as users switch from one location and/or computer to another.

As you evaluate the support for mobile services of an operating system, it's helpful to answer these questions:

- Does the operating system support remote access to the key services or information you need on your corporate network?

Samsung - Exhibit 1023 - Page 18

- Does the operating system have robust support for the dynamic nature of mobile hardware, such as PCMCIA, power management, and docking stations?

CHAPTER 2

An Overview of Windows 95

Windows 95 is an extremely feature-rich operating system. Virtually every aspect of Windows 95 reflects improvements over Windows 3.1 and Windows for Workgroups. This book discusses the areas of technology that make up Windows 95, focusing on the following features, functionality, and components:

- The Windows 95 user interface
- Base system architecture
- Robustness
- Support for running MS-DOS–based applications
- Plug and Play
- Device support
- Networking
- Systems management
- Printing
- Communications
- Mobile computing services
- Microsoft Exchange: e-mail, fax, and more
- The Microsoft Network online information service
- Multimedia services
- Installation and setup of Windows 95
- International language support
- Accessibility
- Applications and utilities

Where appropriate, each discussion includes the following:

- **A summary of improvements in Windows 95 over Windows 3.1.** This section provides a quick overview of ways in which Windows 95 addresses Windows 3.1 problems or improves upon Windows 3.1 functionality. These discussions also apply to Windows for Workgroups even though Windows for Workgroups may not be explicitly identified.

Samsung - Exhibit 1023 - Page 19

- **A Try It! section.** You are encouraged to see for yourself that Windows 95 is a flexible, powerful, and robust operating system by following brief sets of instructions for performing specific tasks.

Key New Features

As you read this book, it's important to keep in mind the needs of the marketplace and how Windows 95 meets those needs. This section briefly outlines some of the key new features in Windows 95 and the problems they solve. Because the scope of the new features is broad and their appeal is wide, they are organized here in terms of improvements over Windows 3.1 in the following areas:

- Ease of use
- Speed and power
- Compatibility

The features are further organized by benefiting group:

- End-users
- MIS organizations

Ease of Use

For End-Users

For end-users and MIS organizations alike, improvements in ease of use in Windows 95 fix the problems identified in Windows 3.1. For example, less-experienced users found overlapping windows and tasks such as minimizing and maximizing windows too complex, while more experienced users craved greater efficiency. But the improvements go beyond simply solving these problems, by also encompassing hardware, connectivity, and applications. Windows 95 offers these solutions:

- **A new user interface (UI).** A shower of improvements greatly enhances ease of learning, usability, and efficiency for all users, no matter what their level of expertise. Novice users can get started more quickly, and experienced users can fully unlock the power of their PCs.
- **Plug and Play.** The goal of Plug and Play is simple: When a user installs a new hardware device, it works.
- **Long filenames.** Signaling the end of cryptic 8.3 filenames, long filenames are just one example of the many usability improvements in Windows 95.

For MIS Organizations

MIS organizations find their jobs increasing in difficulty as the number of PCs in a given corporation grows more rapidly than their support staff. In addition, the introduction of Windows 3.1 led to a series of security, reliability, and management issues because of its lack of integrated connectivity and lack of management infrastructure. The following features of Windows 95 attack these problems:

- **Built-in networking.** Whether a company is running NetWare or Microsoft networks; IPX/SPX, TCP/IP or NetBEUI; NDIS or ODI, Windows 95 has native, integrated support for its network. And additional LANs are easily supported.
- **The Registry.** By holding all pertinent information about the system—installed hardware, installed software, and user preferences and rights—and by exposing its contents remotely through a wide variety of industry standard interfaces—SNMP, DMI, Win32 plus RPC—the Registry provides the foundation for a highly manageable PC.
- **User Profiles and System Policies.** Windows 95 can provide different operating system and UI functionality depending on who has logged onto a PC. For example, a network administrator can prevent a particular user from deleting program items no matter which PC that user logs onto, or the administrator can enforce a policy that requires everyone in a particular group to have passwords of at least six characters.
- **Pass-through user-level security.** A PC running Windows 95 can be configured to require that remote users and their passwords be passed through to and validated by a NetWare server or Windows NT Advanced Server before those users are allowed to carry out certain tasks, such as changing the PC's Registry or accessing its files, either over the network or remotely. This user-level security allows the existing network-based namespace to be leveraged.
- **Network backup agents**. Windows 95 includes agents that support industry-leading server backup products, making it easier to back up information stored on PCs throughout the network.

Speed and Power

For End-Users

A major area of concern for end-users is improving the efficiency and power with which they use Windows. Users want to get their work done faster. They want to be able to run more than one application or computer process at a time instead of waiting for their PCs to finish one task before starting another. They want to be more effective without sacrificing system stability or performance. And perhaps most important of all, they want to escape the feeling that they take advantage of only a small fraction of their PCs' capabilities.

Samsung - Exhibit 1023 - Page 20

Windows 95 is designed to anticipate and exploit key emerging trends and technologies. For example, the need for seamless mobile computing is becoming more important as more hardware power is packed into smaller and lighter designs and more users work at home or on the road. The explosion of the home market has increased the demand for more powerful multimedia applications, which necessitates better multimedia support from the operating system.

The following features of Windows 95 bring more power and speed to users:

- **True preemptive multitasking.** Windows 95 can preemptively multitask 32-bit applications smoothly and efficiently.
- **Scaleable performance.** As the amount of RAM increases, the performance of Windows 95 increases more rapidly than that of Windows 3.1 because of the high-performance, 32-bit architecture of Windows 95.
- **Support for 32-bit applications.** Support for the Win32 API in Windows 95 means that users can look forward to a new generation of easier, more powerful multithreaded 32-bit applications.
- **Increased robustness.** New features mean greater robustness and protection for existing MS-DOS and Windows–based applications, and the highest level of protection for new 32-bit Windows–based applications.
- **Mobile computing anywhere.** Windows 95 provides both a remote networking client that allows dial-up access to any network (including the Internet) running IPX/SPX, TCP/IP or NetBEUI over PPP, and a dial-in server that lets any PC running Windows 95 act as a secure, single-line dial-in gateway to a network.
- **Faster printing.** The new 32-bit printing subsystem in Windows 95 means users spend less time waiting for print jobs to spool and finish.
- **High-performance multimedia components.** Both the video playback engine (Video for Windows) and CD-ROM file system (CDFS) are new 32-bit components that deliver smoother video and sound reproduction.
- **More memory for MS-DOS–based applications.** The use of protected-mode device drivers and file systems in Windows 95 means users will routinely have 600 KB or more of free conventional memory available in each MS-DOS session, even if they are connected to a network, using a CD-ROM drive, a mouse, and so on.

For MIS Organizations

Because MS-DOS and Windows were not designed for networked environments, their use in those environments can result in a string of problems well known to MIS professionals. These problems include not having enough real-mode memory to run mission-critical MS-DOS–based applications, and instability under Windows 3.1—for example, turning off a Novell NetWare server completely hangs all connected machines running Windows.

The following features of Windows 95 are just some of the solutions that will make the job of MIS organizations easier:

- **32-bit NetWare connectivity**. Windows 95 includes a 32-bit network client for NetWare that is fast and reliable and has a zero footprint in conventional memory. Windows 95 also includes a similar client for Microsoft Networks.
- **Multiple network support**. A PC running Windows 95 can have multiple network clients (to connect concurrently to a Novell NetWare server, a Windows NT Server, and so on) and multiple transports (including IPX/SPX, TCP/IP, and NetBEUI) loaded and running simultaneously, providing connectivity in a heterogeneous environment.
- **Universal information client**. Microsoft Exchange, the universal information client provided with Windows 95, is integrated seamlessly into the user interface and provides a wide range of plug-in services, such as e-mail, online services, group applications, and so on. Thus the user has a single interface with the outside world of information, and the MIS administrator has a single client that supports multiple e-mail and other systems. Windows 95 includes support for services such as Microsoft Mail for e-mail, Microsoft At Work fax software for faxing, and Internet mail.

Compatibility

For End-Users

If an operating system upgrade requires new software, more memory, or new hardware, then the upgrade's cost is far higher than just its purchase price. Currently, users often have to wait a substantial amount of time—usually until their next PC purchase—before they can benefit from new technology. One of the biggest goals of Windows 95 was to make it possible for everyone to stay up to date with the latest version of Windows.

The following features were included in Windows 95 with this goal in mind:

- **Compatibility with existing MS-DOS–based and Windows–based applications.** Windows 95 works with and even improves today's software.
- **The same or better performance.** Windows 95 runs PCs with at least a 386DX processor and 4 MB of RAM at least as fast as Windows 3.1 does—faster in many cases. Windows 95 requires no additional RAM to maintain performance.
- **Backwards compatibility with existing hardware devices.** Windows 95 supports existing hardware and device drivers while enabling next generation, easier-to-use hardware through Plug and Play.

Samsung - Exhibit 1023 - Page 21

For MIS Organizations

In terms of cost, MIS organizations also have problems upgrading to a new operating system. However, maintaining compatibility with existing hardware and software is even more important, not only because of the larger scale of the upgrade, but also because different operating systems might be used by different groups within the organization. Having to support more than one operating system multiplies the problems MIS organizations face. MIS professionals also worry about the need to migrate users to a new operating system quickly, easily, and in an orderly way and about retraining users.

Windows 95 addresses these needs through the following features:

- **Network compatibility.** In addition to its 32-bit Microsoft Client for Novell NetWare networks, Windows 95 is compatible with existing real-mode network clients and existing logon procedures, such as the scripts used by NetWare.
- **A self-paced guided tour and Windows 3.1 help.** Windows 95 offers a guided tour to help novice users and users new to Windows 95 find their way around. In addition, an online help system that eases the transition of Windows 3.1 users to Windows 95 is only a mouse-click away.
- **Inclusion of the Windows 3.1 Program Manager and File Manager.** An explicit Windows 95 goal is to allow MIS organizations and users to switch to the new user interface at their own pace. In keeping with this goal, Windows 3.1 users can opt to continue working with Program Manager and File Manager until they feel comfortable with the new interface.

CHAPTER 3

The Windows 95 User Interface

When you first boot Microsoft Windows 95, you know immediately that the old world of Windows running on top of MS-DOS is no more. Gone are the character-mode boot messages that held meaning only for a very small minority of computer users. Instead, you are graphically carried to the desktop of the new Windows 95 user interface (UI).

More than any other part of the operating system, the UI defines the user's overall experience. The easier, more powerful, and more compelling the UI, the better the user feels about computing and the more productive the user is likely to be. A great UI helps the computer industry grow because it makes computing easier and more natural for *all* people, from the novice user to the power user.

This chapter discusses the design process that produced the UI in Windows 95 and then introduces the components of the UI, organized into the following categories:

- **Easy.** Outlines UI features that make Windows 95 easy to learn and use, especially for those new to Windows.
- **Powerful.** Outlines UI features that make Windows 95 more powerful, efficient, and customizable for the experienced Windows user.
- **Compatible.** Outlines UI features that make Windows 95 easy to learn and to use for those familiar with Windows 3.1.

Designing the Windows 95 User Interface

The overarching goal of the UI in Windows 95 is to make PCs even easier to use for *all* people. Fulfilling this goal is a challenge because different people work in very different ways. Novices want learning how to perform a task to be easy, even at the expense of efficiency. However, experienced users want to do more with their PCs, and they want efficiency and flexibility. In addition, users upgrading from Windows 3.1 want to make the transition without throwing out everything they have already learned.

Samsung - Exhibit 1023 - Page 22

Windows 95 meets these disparate needs by being scaleable—that is, by being able to fit the proficiency and preferences of the individual user. For novices, the most common and essential features of Windows 95, such as launching an application, task switching, and finding a file, are easily "discoverable" via the Taskbar, with its Start button and push-button task switching. For experienced users, Windows 95 promotes efficiency, customizability, and control via such power-user capabilities as the Windows Explorer, rich secondary mouse-button clicking, properties sheets, and shortcuts.

Design Methodology

The UI in Windows 95 was not constructed from a blueprint drawn from a master specification. It started with clear objectives, guiding design principles, and a skilled team. The design process started with the basic question, "How can the UI in Windows 3.1 be improved?" That question launched a continuous cycle of discarding old ideas, conceiving new ideas, and learning—a constantly iterating design-usability test-redesign loop like the one shown in Figure 2.

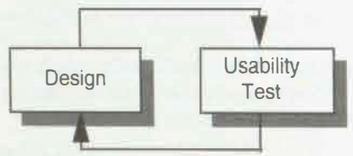


Figure 2. The design loop of Windows 95

Improving the Windows 3.1 User Interface

There was no shortage of information about how the Windows 3.1 UI might be improved. The table on the following page summarizes key findings.

The following mechanisms were used to compile this feedback data:

- **Usability tests.** The Microsoft Usability Lab, described on the following page, is primarily used for testing usability of new designs. However, to better understand how people use Windows 3.1 and to establish a baseline, several phases of testing were dedicated to Windows 3.1.
- **Focus groups.** Several focus groups were conducted with different levels of users to identify the problems people have with Windows 3.1.
- **Educator feedback program.** A team of UI designers and testers visited 12 independent software education companies. More than any other group of users, software educators understand the everyday usage challenges faced by novice and intermediate users. The educators were asked questions such as, "What are the five hardest tasks for students to learn in Windows?" and "What five changes would you make to Windows to make it easier to learn?" The educators also tested prototypes of the UI in Windows 95.
- **Suggestion database.** Thousands of UI suggestions from Windows 3.1 users and corporate customers were compiled and analyzed, along with beta-tester UI feedback.

How Can the Windows 3.1 UI Be Improved?

Make It ...	Problem Areas
Easier to learn for novices	• Window management (overlapping and minimized windows) is confusing. • Hierarchical views (like those in File Manager) are confusing. • Double-clicking to launch applications is not discoverable. • Task switching is not discoverable. As a result, many users never run multiple applications.
More efficient and customizable for experienced users	• There is too much "middle management," with confusing and overlapping functionality between Program Manager, File Manager, Print Manager, Windows Setup, and Control Panel. • 8.3 filenames are restrictive. • The UI is not customizable. • Network and connectivity integration is poor.

Putting New Designs to the Test

Conducting extensive live tests in a variety of settings with a variety of subjects has been key to engineering a state-of-the-art UI. A large portion of the total development budget of Windows 95 has been expended on this critical activity, and Windows 95 is probably the most usability-tested product ever. The following methods have been used to test the UI in Windows 95:

- **Formative testing in the Usability Lab.** Conducted primarily in the groundbreaking Microsoft Usability Lab, formative testing collects data as test subjects perform specific tasks, such as launching a program, finding a file, and

Samsung - Exhibit 1023 - Page 23

installing a printer. The Usability Lab has nine testing suites, each with a one-way mirror, cameras, and other equipment for observing and recording users as they work. Central to the Lab's operations is online data-collection software that helps specialists collect cognitive and quantitative process data as subjects work through the sets of tasks.

Usability tests are observed firsthand by the design team and are essential in future designs. At the time this book was being written, more than 1000 hours of usability testing in 48 phases with more than 400 participants had been conducted. The experience of test subjects has ranged from novice users to intermediate/advanced users, so the test results focus on new computer users as well as users familiar with Windows.

- **Summative testing.** Conducted at customer sites and in the Usability Lab, summative testing involves testing the UI as a whole with real users over longer periods of time.
- **UI-expert and industry-expert review.** In the fall of 1993, a panel of UI experts and industry experts was assembled to review and critique the UI in Windows 95. In addition, four independent consultants each spent large blocks of time with Windows 95 and gave extensive feedback.

Easy to Learn

This section describes the features of the UI that are designed to make learning Windows 95 easy for novices.

The Desktop: Neat, Clean, and Logical

After users start their computers, they are presented with the Windows 95 desktop shown in Figure 3. It's neat and clean and displays only a few graphical objects.

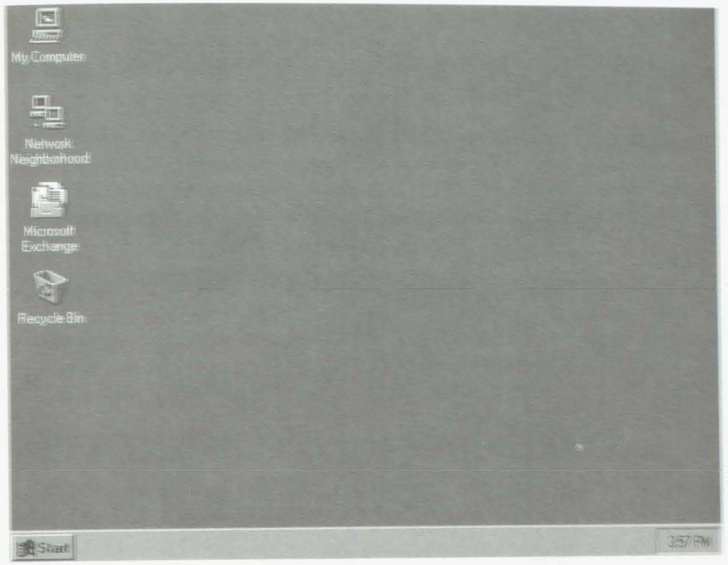


Figure 3. The desktop

The simplicity of the desktop appeals to all users' sense of organization, but it also serves to focus the novice user on the following essential elements:

- **The Taskbar.** Users can quickly start a program or open a document by clicking the Start button. And they can easily switch between tasks.
- **My Computer.** Browsing a PC is now logical and easy.
- **The Network Neighborhood.** In the world of mapped drives and complex interfaces, users can't browse their network. With the Network Neighborhood, they can easily browse the network, regardless of which network provider (such as Windows NT Server, a NetWare server, or Windows 95 itself) is being used.
- **The Recycle Bin.** The Recycle Bin allows users to recover deleted files and easily return them to their original location on the local system.

Samsung - Exhibit 1023 - Page 24

The Taskbar: Home Base

More than any other feature, the Taskbar, which is shown in Figure 4, exemplifies the order-of-magnitude improvement in ease of use and ease of learning of the UI in Windows 95. It is the UI's anchor. Its mission is to make 95 percent of what a typical user wants to do with the operating system easy to accomplish at all times. The Taskbar started out specifically as a program launcher and task switcher for novices. However, because of its simplicity and power, the Taskbar is also popular with experienced users, who can take advantage of its many other capabilities.



Figure 4. The Taskbar

The two key features of the Taskbar are the Start button and push-button task switching, which are examined in the next two sections.

The Start Button: Up and Running in Seconds

Usability tests on Windows 3.1 have shown that launching Write takes a new Windows user an average of nine minutes. With Windows 95, launching WordPad takes a new user an average of three minutes. If only the users that launch WordPad via the Start button (rather than by another means) are counted, the average launch time drops below one minute!

The main reason for this dramatic 3x–9x speed improvement is the Start button, which is shown in Figure 5. Without knowing about double clicking or complex hierarchies, a novice user of Windows 95 can quickly launch a program and get to work.

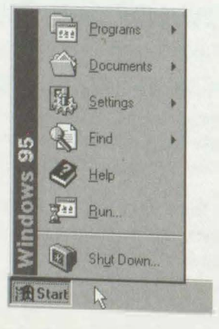


Figure 5. The Start button and its menu

However, the Start button is much more than a super-efficient program launcher. Its capabilities include the following:

- **Programs.** The Start button's Programs menu allows users to quickly launch programs. This menu is the equivalent of Program Manager in Windows 3.1, and in fact, when a PC running Windows 3.1 is upgraded to Windows 95, the contents of the program groups in Program Manager are transferred to the Programs menu.
- **Documents.** The Start button's Documents menu contains a list of the last 15 documents opened. This menu provides very quick access to the information most recently worked with and helps prevent time-consuming and frustrating browsing. It also helps users think of their work in terms of documents (a concept known as *document-centricity*), rather than applications.
- **Settings.** The Start button's Settings menu allows users to quickly change or view the PC's settings and options, including the Control Panel (for computer settings), the Start menu, and the Printers folder. It also allows users to customize the Taskbar to suit personal working preferences—for example, to specify which programs should be included on the Start button's Programs menu.
- **Find.** The Find item in Windows 95 goes far beyond the Search feature of File Manager in Windows 3.1. Searches do need not conform to the *.* searching syntax, and criteria such as last modification date, size of file, and actual text within a document can be used to find information.
- **Help.** Help has been overhauled in Windows 95 and is easily accessible via the Start button.
- **Run.** The Start button's Run item provides enhanced command-line type functionality.
- **Shutdown.** The Shutdown item provides easily accessible and safe shutdown, restart, and logoff.

Task Buttons: Task Switching Made Simple

Novices need to have powerful features presented to them in a simple and compelling way; otherwise they won't use these features. Research conducted with active Windows users indicates that fewer than 50 percent frequently use more than one application at a time and only 20 percent frequently use ALT+TAB task switching. These powerful features of Windows 3.1 are simply not discoverable.

The objective of the Taskbar is to make switching among multiple applications as simple as changing channels on a television set. Every open window has a button on the Taskbar, allowing the user to see which documents and applications are currently open. Switching applications is a simple matter of selecting the desired "channel" on the Taskbar. No more minimized program icons; no more disappearing windows. The user can see all the active tasks simply by looking at the Taskbar, the *TV Guide* of Windows 95. When a task is minimized into the Taskbar or maximized from the Taskbar, animation helps new users understand "where" the task goes.

Samsung - Exhibit 1023 - Page 25

Task buttons resize themselves automatically depending on the number of active tasks. If the buttons get too small to be useful, the user can customize the Taskbar. In fact, a host of other Taskbar configuration options allow the user to customize it in other ways, including the following:

- **Reposition.** The Taskbar can be dragged to any perimeter position on the screen.
- **Resize.** The width of the Taskbar can be widened by dragging its inside edge.
- **Auto Hide.** The Taskbar can be hidden and made to appear on the screen only when the mouse hits the screen edge, by selecting Settings and then Taskbar from the Start menu.

In addition to making task switching dramatically easier and more accessible via the Taskbar, the UI in Windows 95 includes an updated version of the familiar ALT+TAB "cool switch." It now displays an iconic road map of all active tasks to prevent users from getting lost in an infinite ALT+TAB loop, as was common under Windows 3.1.

Try It!

Customize the Start Button

1. Click *Start*, and then *Settings*, and then *Taskbar*.
2. On the *Change Start Menu* property sheet, select the programs you want to appear either at the *Start* button's first level or on the *Programs* menu.
3. Close the property sheet and check your new configuration by clicking the *Start* button.

Hint: You can also add a program to the *Start* button by dragging a shortcut defined for the program to the button.

Test a Novice

1. Find a stopwatch and a friend or family member who is a computer novice.
2. Sit the novice down at a PC that is running Windows 95 with no programs loaded and a clean desktop.
3. Ask the novice to start an application that you know is listed on the *Programs* menu. Note the time taken to successfully start the application.
4. Try the same task on a PC running Windows 3.1.
5. Compare the times to complete the task. The time using Windows 95 should be the same or faster than the time using Windows 3.1.

Display the Start Menu

- Press CTRL+ESC, and the *Start* menu pops up.

My Computer: An Easier Model for File Management and Browsing

File management and browsing in Windows 3.1 are not intuitive. Fewer than 55 percent of Windows users regularly use File Manager, and File Manager is especially confusing and intimidating for novice users.

Designing a discoverable and comfortable model for browsing and file management for the novice user has been a priority for the UI design team because of the observed difficulties with Windows 3.1. Several significantly different designs have been tested and thrown out. In the course of this testing, the design team made the following discoveries about basic file management and browsing:

- Exposed hierarchies are intimidating and unintuitive.
- Dual-pane views—hierarchy on the left and contents on the right—are also intimidating and unintuitive. Novices have difficulty understanding the connection between the logical tree hierarchy pane and the contents pane.
- An object-oriented UI works well for basic tasks but not for complex ones. The general belief is that the more object oriented a UI is, the easier it is to use. However, this is not the case. Although the direct manipulation of screen objects to achieve logical results is important for basic tasks (such as dragging a file from a folder to the desktop), direct manipulation to carry out more advanced tasks (such as dragging a file to a printer icon) is not intuitive. On the other hand, selecting an object with the mouse and then browsing menus or buttons for actions to perform on that object is intuitive.
- Large icon views are much more comfortable than list views.
- Whether novice users can find what they are looking for and whether they feel comfortable and "grounded" along the way are the defining characteristics of a good browsing experience. Efficiency and speed are less important.

The My Computer default browsing model is the result of this testing. A folder or drive can be opened by double-clicking it, or by selecting it and choosing Open from the File menu. The default browsing model brings up a new window in large icon view, as shown in Figure 6 on the following page.

Samsung - Exhibit 1023 - Page 26

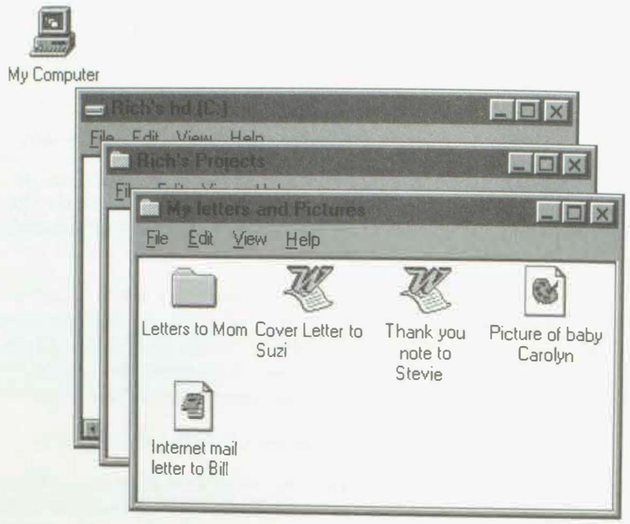


Figure 6. Browsing My Computer

To many advanced users this behavior seems cumbersome. "Why not open in list view?" they ask. "Why create a new window that just clutters up my screen?" "Why not open in a dual-pane view? It's much more efficient for me." "Why not turn the Toolbar on by default?" All of these possible default models and more were tested thoroughly and discarded because they caused confusion and stress for novices. Novices respond best when they are presented only with essential information and when they can easily "get back" to where they just were, so the default model was designed to meet these needs.

(Experienced users can select from multiple configuration options by choosing Options from the View menu. Also for experienced users, Windows 95 has a very powerful dual-pane browsing application called the Windows Explorer. In addition, File Manager from Windows 3.1 is still available and can be run for backward compatibility.)

The new capabilities of the default browsing model should not be overlooked in this discussion of simplicity. Folders can be created within folders. Files and folders respond logically to being dragged and dropped. Files and folders can be cut, copied, and pasted just like text and objects within applications can. Views can be customized, and each window "remembers" how it was last configured and opens automatically in that view. The best way to discover the capabilities of the default browsing model is to explore it, or better yet, watch a novice user explore it.

Try It!

Browse Folders with a Single Window

1. Double-click *My Computer*.
2. From the *View* menu, choose *Options*. On the *Folder* property sheet, select the *Browse folders with a single window that follows you as you open each folder* option.
3. Turn on the Toolbar by choosing *Toolbar* from the *View* menu.
4. Now double-click the icon for your hard drive. No new window opens.

Long Filenames: Greater Flexibility When Naming Files

By far the most-requested file system feature since Microsoft first released MS-DOS is support for long filenames, but until Windows 95 long filenames have not been possible. Windows 95 allows filenames of up to 255 characters. An example is shown in Figure 7. Eliminating the need to conform to the 8.3 naming convention results in obvious and large gains in usability. However, to ensure backward compatibility with existing MS-DOS and Win16–based applications, extensions have not been eliminated entirely; they are simply hidden from view by default.



Figure 7. A sample long filename

Files can be renamed in place in Windows 95 by selecting the file, clicking the filename, and typing the new name. The hidden file extension is not affected when a file is renamed. Files can also be renamed from within the new common dialog boxes, including the Open and Save dialog boxes.

Try It!

Display the File Extensions

1. From any folder, choose *Options* from the *View* menu.
2. Select the *View* tab.
3. Deselect the checkbox for the *Don't display MS-DOS file extensions for files that are properly registered* option.

Samsung - Exhibit 1023 - Page 27

The Network Neighborhood: Accessing Networking Features

This section discusses how the network client in Windows 95 makes browsing networks not only possible but easy, regardless of the network provider (Windows NT Server, Novell NetWare, Windows 95, and so on). For more details about the networking capabilities of Windows 95, see Chapter 9, "Networking."

Network browsing is accomplished by means of the Network Neighborhood, which sits on the desktop and logically represents the resources not available via My Computer. Its icon is shown in Figure 8.



Figure 8. The Network Neighborhood icon

Browsing the network via the Network Neighborhood is as easy as browsing a local hard disk.

- **Top-level configuration.** The Network Neighborhood can be configured by the network administrator to display only those PCs, servers, and printers that are in the user's immediate workgroup. Top-level configuration insulates the user from the vastness of large corporate networks. The user can still browse the larger network by opening Entire Network from within the Network Neighborhood. (Until Windows 95, browsing the larger network was not possible.) When a user browses a server, network connections are made without drive "mapping" (the assigning of new drive letters to a specific network resource).
- **Systemwide support for UNC pathnames.** This technology makes obsolete the process of mapping drives and allows natural network browsing via the Network Neighborhood. UNC pathname support allows a whole host of usability improvements of which network browsing is just one.
- **The Network Control Panel tool.** This tool consolidates all networking configuration in one location, and thereby eliminates the difficulty of configuring networking under Windows 3.1 and Windows for Workgroups 3.*x*.
- **Easy drive mapping.** A Map Network Drive button on the Windows Explorer and browsing window toolbars make drive mapping available in Windows 95. (Power users can also right-click My Computer.) Mapped drives appear as connections in My Computer.
- **Networking and mobility.** The UI in Windows 95 was designed from the ground up with networking and remote access in mind. For example, when a file is copied over a slow-link (a modem connection), the Copy dialog box includes an *Estimated time to completion* status message.

- **Networking integration with new common dialog boxes.** The new common dialog boxes, which are standardized in applications that make use of them, provide a consistent way to open and save files on network resources as well as on local drives. In addition, the Network Neighborhood can be browsed directly from the common dialog boxes, and the majority of basic file management tasks can be performed from them.

Try It!

Create a Shortcut to a Network Folder on the Desktop

1. Browse the *Network Neighborhood* until you find an often-used network folder.
2. Point to the folder, hold down the right mouse button, and drag the folder to the desktop.
3. Choose *Create Shortcut Here*.
4. Close the network window.
5. Double-click the shortcut. The network folder opens in a new window. The shortcut will be available every time you boot Windows 95.

Use the UNC Path to "Run" a Favorite Network Folder

1. From the *Start* menu, choose *Run*.
2. Type the full UNC path to your favorite network folder, such as *\\MKTG\PROGRAMS\SARAHB*, and press ENTER. The folder opens in a new window, with no drive mapping.

Create a New Folder from Within Common Dialog Boxes

1. Click the *Start* button, and then choose *Programs*, *Accessories*, and *WordPad*. (WordPad is the word processing equivalent in Windows 95 of Write in Windows 3.1. It uses the common dialog boxes.)
2. From the *File* menu, choose *Open*, and click the *Look in* drop-down box, which provides access to the entire PC hierarchy, including the Network Neighborhood.
3. From the *File* menu, choose *Save*, and click the *Create New Folder* icon. Unlike in Windows 3.1, where you have to start File Manager or exit to the MS-DOS command prompt to a create a new folder, you can create a folder when you save a document.

Samsung - Exhibit 1023 - Page 28

The Recycle Bin: Easy Deleting and Undeleting of Files

The Recycle Bin is an easily recognizable metaphor for being able to "throw away" files and then recover them by simply removing them from the bin. Files deleted in Windows 95, or deleted from the common dialog boxes in applications that support them, are moved to the Recycle Bin. Users can remove an item from the Recycle Bin and drag or cut/copy/paste it to another location, or they can restore it to its original location by choosing Undo Delete from the Edit menu.

The Recycle Bin graphically indicates whether it is empty or contains items. Information about "deleted" items is available in the Recycle Bin's details view, as shown in Figure 9.

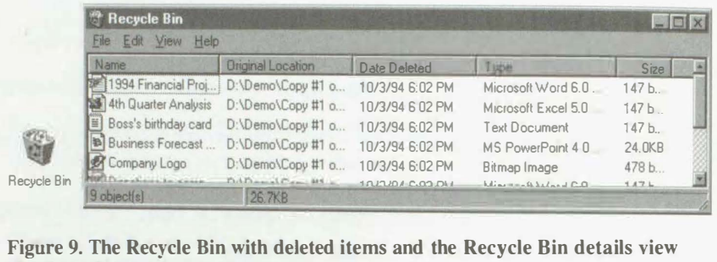


Figure 9. The Recycle Bin with deleted items and the Recycle Bin details view showing additional information

Focus on Documents: Working the Way Users Work

OLE introduced the concept of "document-centricity" by incorporating in-place editing of objects. In a document-centric environment, the application window changes and the document stays the same, so that software works the way people work, rather than vice-versa.

The UI in Windows 95 picks up on the concept of document-centricity in the following subtle but powerful ways:

- **Windows as views of objects**. When the user opens an object from anywhere in the UI, a new window opens. Logically, the title of the new window is the same as that of the object's icon. For example, when the icon of a Microsoft Word document called My Document is double-clicked from the anywhere in the UI, a new window opens entitled My Document—Microsoft Word.

- **Document creation from within folders and in the Windows Explorer**. From within any folder in Windows 95 or from the desktop, users can create new files in place by choosing New from the File menu and then selecting a file type. An icon like the one shown in Figure 10 is then created to represent the new file. This flexibility makes it very convenient to manage files based on projects, rather than at the whim of an application.



Figure 10. The icon for a new Word document

Try It!

Create a New WordPad Document from Within a Folder

1. Select a project folder in which you want to create a new WordPad document.
2. From the *File* menu, choose *New* and then select *WordPad Document*.
3. Type a name and press the ENTER key.
4. Double click the new document to open it in WordPad.

Hint: This functionality can also be accessed by right-clicking from within any folder or on the desktop.

Backtracking: Undoing File Operations

When working with files on your system, how many times have you said to yourself, "I didn't mean to do that!" after accidentally deleting, renaming, moving, or copying a file that you didn't intend to? Windows 95 has a simple answer for putting things back the way they were. Windows 95 provides a multilevel undo feature that allows users to undo one or more of their preceding actions. Users can undo file deletions, renames, moves, or copies by simply choosing Undo from the Edit menu of any UI window, as shown in Figure 11 on the following page.

Samsung - Exhibit 1023 - Page 29

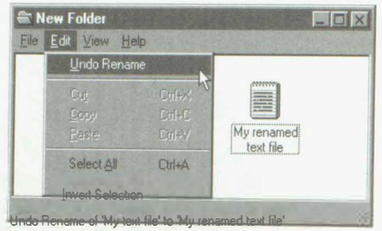


Figure 11. The Undo command on the Edit menu, which can be used to undo file operations

Try It!

Undo a File Operation

1. Open a folder and select a file.
2. Rename the selected file.
3. From the *Edit* menu, choose *Undo Rename* to undo the rename operation.

Undo Multiple File Operations

1. Open a folder and select a file.
2. Rename the selected file.
3. Drag the file from the folder to the desktop.
4. Delete the file.
5. Go back to the folder you first opened.
6. From the *Edit* menu, choose *Undo Delete* to undo the delete operation.
7. Choose *Undo Move* from the *Edit* menu to undo the move operation.
8. Choose *Undo Rename* from the *Edit* menu to undo the rename operation

Wizards: Guides to Powerful Capabilities

Originally developed in Microsoft's Applications Group and used in applications such as Microsoft Word and Microsoft Excel, Wizards are a proven tool that make it easy for all classes of user to take advantage of powerful but complex functionality. The Wizards guide a user through a series of questions, which are posed to the user in a friendly and straightforward way, and walk the user through a process like the one shown in Figure 12.

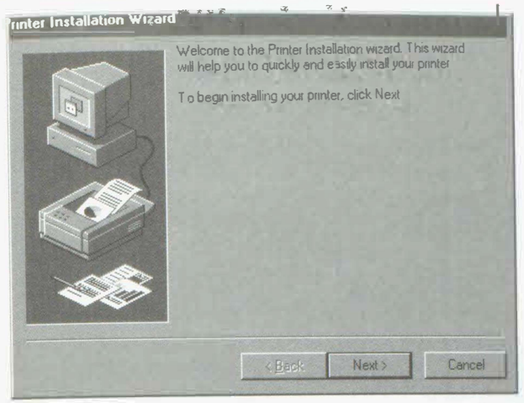


Figure 12. The Printer Installation Wizard, which walks the user through the printer installation process

Windows 95 uses Wizards throughout the operating system to assist all types of users. For example, Wizards are used to perform the following operations:

- Displaying Setup options to the user during the installation process
- Adding a new device to the system, such as a printer or modem
- Setting up remote access in the Network Neighborhood
- Creating a shortcut for an application
- Installing a new application
- Creating a Briefcase for synchronizing files between two PCs
- Creating a workgroup post office for use with the Microsoft Exchange e-mail client

A New Help Engine: Accessible and Useful Online Information

Online Help has been completely retooled in Windows 95. It underwent extensive usability testing and the result is a significantly easier-to-use and easier-to-learn Help system. Additionally, it is now dramatically easier for independent software vendors (ISVs) and corporate customers to customize and develop Windows help files. Following are brief descriptions of the major features of the new Help system in Windows 95:

- **Simplified interface.** Help in Windows 3.1 was difficult to learn and to use. It had three main functions: Contents, Search, and Glossary. The Contents view was not well organized and presented, and there was some ambiguity about which functions to use when. Windows 95 behaves much more intuitively and more like a real reference book. It only has two Tabs: Contents and Index.

Samsung - Exhibit 1023 - Page 30

- **The Contents tab.** Organized like a book's table of contents, the Contents tab displays top level "chapters" (iconically represented as books) from which users can "drill down" to subtopics (iconically represented as pages). Many chapters also have Tips and Tricks subsections that have proved popular in lab testing.
- **Short Help topics.** Topics all fit in one small window, so users don't have to scroll through large, complicated help information.
- **Shortcut buttons.** New shortcut buttons make using Help even easier in Windows 95. Some Help topics contain shortcut buttons, like the one shown in step 1 in Figure 13, that take users to the referenced area in Windows 95. For example, a user who is searching for help on how to change the date on a PC can "jump" right to the Clock Control Panel tool from within Help.

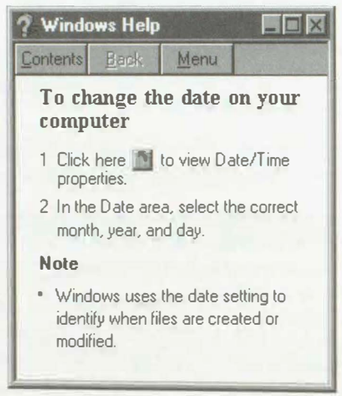


Figure 13. A Help shortcut button (in step 1)

- **What's This? button.** All Control Panel tools in Windows 95 have a ? button at the right end of their title bars. When the user clicks this button, the pointer changes to a question mark. Clicking any object in the dialog box with this pointer brings up a short description of the object. Users can also access the question-mark pointer by right-clicking within a Control Panel tool.

Try It!

Use Help's Shortcut Button to Change the Desktop Color

1. From the *Start* menu, choose *Help*.
2. Select the *Index* tab.
3. Type *display*. Double-click the *background pictures or patterns, changing* topic.

4. Click the *Properties for Display* shortcut button to move directly to this property sheet.

Transition Aids: Easy Migration to the Windows 95 User Interface

Windows 95 provides several aids for helping both users new to Windows and users of Windows 3.1 become productive quickly in the Windows 95 UI. Usability tests indicate that, with little or no additional training, users can complete common tasks under Windows 95 as quickly as they did under Windows 3.1, or even quicker. Windows 95 offers the following self-paced aids:

- **Quick tutorial of Windows 95.** This tutorial walks users through the basics of Windows 95 and covers topics such as starting programs, task switching between open windows, finding information on the local computer, and using the online Help system. The tutorial is designed for both novice users and experienced Windows users and shows how to complete common tasks.
- **Transition aids for Windows 3.1 users.** The Help system provides additional Help topics designed to make the transition to the UI in Windows 95 easier for Windows 3.1 users. These Help topics answer common questions to help users familiar with the components of Windows 3.1 quickly and easily find the respective tools or commands in Windows 95.
- **Readily available information in the online Help system.** The Help system in Windows 95 is designed to provide the information needed to complete the desired task. Topics include How To, Tips and Tricks, and Troubleshooting categories. Help is always available and can be easily accessed by choosing Help from the Start menu.

Powerful Features

Experienced users glean many of the same benefits from the taskbar and the Start button---quickly launching a new program, quickly switching to another task, and so on—as novices. However, experienced users need more, including the following:

- They need a powerful way to browse and manage file hierarchies, whether they are local or not.
- They need to be able to customize the UI to suit their needs and tastes.
- They need to be able to take shortcuts to get tasks done more quickly and efficiently.
- They need to be able to *do* more.

Samsung - Exhibit 1023 - Page 31

The new UI in Windows 95 definitely enables the experienced user to do more, as the following sections show.

The Windows Explorer: For File Management and Information Browsing

The Windows Explorer, shown in Figure 14, has been described as "File Manager on steroids." It is powerful, flexible, efficient, and extensible. It also solves many of File Manager's fundamental problems, such as having different windows for different drives. For many power users of Windows 95, the Windows Explorer will be the primary interface for navigating through information.

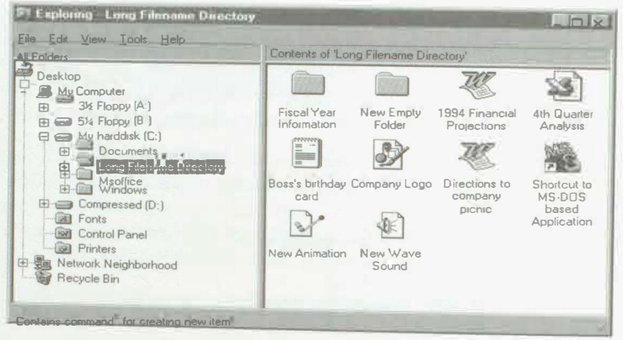


Figure 14. The Windows Explorer

The best way to understand the Windows Explorer is to experience it firsthand. However, here is an overview of its major features:

- **Single view of a world of information**. The Windows Explorer is the eyes of any PC running Windows 95. With it, users can view the entire namespace (all resources, local or connected) from the equivalent of 10,000 feet, or they can zoom down to the equivalent of 10 inches. My Computer and the Network Neighborhood can be browsed and managed, quickly and easily.
- **Flexible and customizable.** Via the Windows Explorer toolbar and the View menu, users can view folder contents in several ways, including large icon, small icon, list, and details views. Folder contents can easily be sorted by name, size, type, and modification date by selecting the column title. Users can also map network drives from the Windows Explorer toolbar.
- **Rich information about objects in details view.** Details view provides a wealth of context-sensitive information about folder contents. For example:
  - Files retain their identifying icons.

  - Drive sizes and free space (even mapped network drives) are reported in My Computer.
  - Descriptions of Control Panel tools are provided.
  - Jobs in the print queue are listed in the Printer folder.
  - Comments on other computers in the Network Neighborhood can be viewed.

All the powerful right-click and properties features described in the next two sections are supported in the Windows Explorer.

Try It!

Copy a File to a Different Drive Without Opening a New Window

1. Right-click *My Computer* and choose *Explore*. Maximize the window.
2. Select a file that you want to copy to a network or floppy drive.
3. Move to the left pane in the Windows Explorer and use the + icons to the left of the folder and drive icons to find the network folder to which you want to copy the file. Do not click the destination folder.
4. Go back to the right pane where the file is currently stored and drag or cut/copy/paste the file to the destination folder.

Operations like this one could not be performed in Windows 3.1 without opening two or more File Manager windows.

Right-Click to Create a New Folder

1. In the *Windows Explorer*, right-click an unused space inside a folder in which you want to create a new folder.
2. Choose *New Folder*.

Shortcuts: For Accessing Objects

Shortcuts are an extremely powerful tool for increasing efficiency. They are especially useful in a networked environment. Users can create a shortcut to any object, such as a file, program, network folder, Control Panel tool, or disk drive, and place it anywhere in the UI or in an application. Opening the shortcut opens the object that the shortcut is "pointing" to. For example, if a user creates a shortcut to My Network Folder on a network server and drops the shortcut on the local desktop, opening the shortcut actually opens My Network Folder. Shortcuts are represented by icons that have a small "jump" arrow in the lower-left corner, as shown in Figure 15 on the following page.

Samsung - Exhibit 1023 - Page 32



Figure 15. Shortcut icons for a folder and a program

Shortcuts are created by selecting an object and choosing Create Shortcut from the File menu or by right-clicking the object and choosing Create Shortcut. After creation, shortcuts can be renamed. If the shortcut is for an object that was created after installation of Windows 95 and the object is renamed, Windows 95 changes the shortcut definition to reflect the new name. For example, if a user creates a shortcut on the local desktop to \\Server\Share\Public Folder and the folder is subsequently renamed, the shortcut will still work. A shortcut can be deleted without affecting the object to which it points.

Uses for shortcuts are virtually limitless, but the following are some common powerful uses for shortcuts:

- **Shortcuts in the Programs folder.** Shortcuts are an extension of the icons that in Program Manager groups in Windows 3.1. The icons simply pointed to an executable file somewhere in the file system. In Windows 95, the icons that appear on the Start button's Programs menu, which can be customized by choosing Settings and then Start Menu from the Start menu, also appear as shortcuts in the Programs folder. When a shortcut is added to or deleted from the Programs folder, it is also added to or deleted from the Programs menu. As a result, users can keep shortcuts to all favorite programs in one central place, regardless of where the programs are actually stored.
- **Shortcuts on the desktop.** Power users can create shortcuts to commonly accessed files, programs, drives, folders, and utilities right on their desktops. This capability is especially powerful with network resources because no complicated browsing or drive mapping is required to access network folders.
- **Embedded shortcuts in applications.** A shortcut to a large file stored on the network can be dragged to an e-mail message. When the message recipient double-clicks the shortcut, the network file opens. This process is much more efficient than embedding the actual file in an e-mail message because the message is smaller, and embedding shortcuts cuts down on file version proliferation.

Try It!

Discover Where the Start Button's Programs Menu Is Stored

- From the *Start* menu, choose *Settings* and then *Start Menu*. The Start Menu folder, which is a sub-folder of the Windows folder, opens. The Programs folder contains the items that appear on the Start button's Programs menu.

The shortcuts and folders are those that appear on the Programs menu. Adding or deleting shortcuts and folders changes the items that appear on the menu.

Properties: For Customizing All Objects

Property sheets are a pervasive feature in Windows 95. All objects in the UI carry context-sensitive properties that can be accessed and customized by choosing Properties from the File menu or by right-clicking the object and choosing Properties. Good, consistent, easily accessible property sheets have been a favorite of power-user testers. Try the following examples to see how property sheets work.

Try It!

Rename a Hard Drive

1. In the *Windows Explorer* or *My Computer*, right-click to select your hard disk and choose *Properties* to open a property sheet like the one shown in Figure 16.
2. In the *Label* box, type a new name and choose *OK*.
3. From the *View* menu, choose *Refresh*.

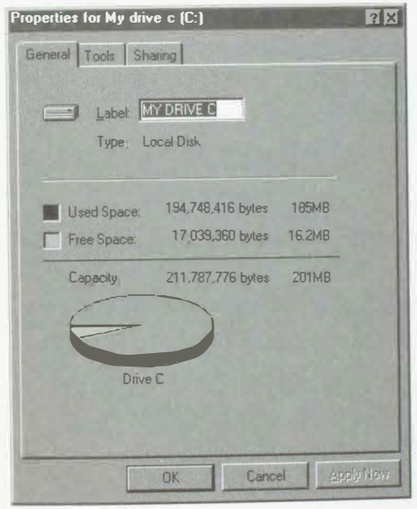


Figure 16. The properties for a disk drive

Share a Folder

1. In the *Windows Explorer*, right-click a folder you want to make available to others on your network and choose *Properties*.
2. Select the *Sharing* tab.
3. Select *Shared As*, and then complete the other fields in this dialog box.

Customize a Shortcut Icon

1. Click the *Start* button and choose *Settings* and *Start Menu*.
2. Open the *Programs* folder.
3. Right-click any shortcut and choose *Properties*.
4. Select the *Shortcut* tab.
5. Click the *Change Icon* button.
6. Select a new icon for the shortcut and choose *OK*.
7. From the *View* menu, choose *Refresh*.

Right-Clicking: For Performing Actions on Objects

Right-clicking, like properties, is a pervasive, context-sensitive feature of Windows 95. (In this book, "right-clicking" refers to clicking the secondary mouse button. Most right-handed people set their mouse options to use the left button as primary and the right button as secondary.) Usability tests have shown that right-clicking as a shortcut way of performing common actions on an object is a very popular power-user feature. However, in general, right-clicking is not a feature that novices discover or remember, so the vast majority of functions that can be performed by right-clicking can also be performed by choosing the corresponding menu commands.

The power of right-clicking can be explored by carrying out the following examples.

Try It!

Right-Click the Desktop to Customize It

1. Right-click a blank space on the desktop.
2. Choose *Properties*.

Minimize or Tile All Open Windows

1. Right-click a blank space on the *Taskbar*.
2. Choose *Minimize All* or *Tile Horizontally*.

3. To undo this operation, right-click a blank space on the *Taskbar* and choose either *Undo Minimize All* or *Undo Tile*.

Create a Shortcut

1. Right-click an object for which you want to create a shortcut.
2. Choose *Create Shortcut*.

Drag a File and Create a Shortcut

1. Right-click and drag a file from the *Windows Explorer* onto the desktop. A menu like the one shown in Figure 17 appears.
2. Choose *Create Shortcut(s) Here*.



Figure 17. The menu that appears when a file is dragged using the right mouse button

Right-Click a Screensaver to Test It

1. Choose *Find Files or Folders* from the *Start* menu.
2. Type *bezier* and choose *Find Now*.
3. Right-click *Bezier*.
4. Choose *Test*.

Close a Task from the Taskbar

1. Right-click the *Task* button for a window or program you want to close.
2. Choose *Close*.

Access the Property Sheet for an Open Window

1. Right-click the mini-icon in the upper-left corner of any window.
2. Choose *Properties*.

Samsung - Exhibit 1023 - Page 34

The Control Panel: The Consolidated Control Center

The objective of the Control Panel is to consolidate all command, control, and configuration functions in one location. With Windows 3.1, these functions were difficult to find, use, and remember—for example, video resolution was changed in Windows Setup, but a printer was installed by selecting the Control Panel's Printers icon. As shown in Figure 18, in Windows 95 distinct graphics make all important functions instantly recognizable and previews are offered where appropriate.

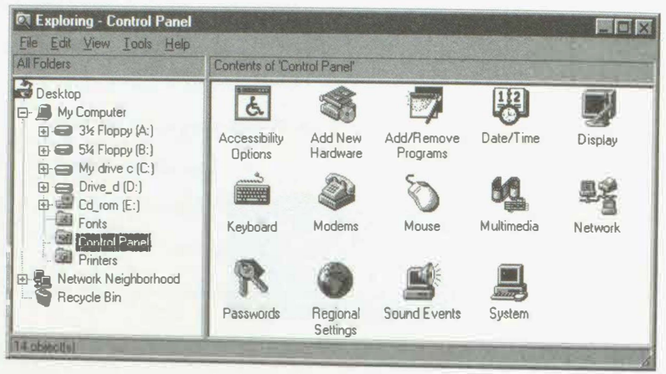


Figure 18. The large icon view of the Control Panel in the Windows Explorer

The individual functions available through the Control Panel tool are discussed in the relevant sections of this book—for example, the Network tool is discussed in Chapter 9, "Networking." However, one Control Panel tool, Display, controls the configuration of the UI in Windows 95 and allows users to customize the UI itself. As shown in Figure 19, its property sheet has the following four tabs:

- **Background.** Allows pattern and wallpaper configuration and preview.
- **Screen Saver.** Allows screen saver configuration and preview.
- **Appearance.** Allows configuration and preview of all of the user interface metrics (fonts, sizes, colors, and so on).
- **Settings.** Allows configuration of monitor resolution and color palette size.

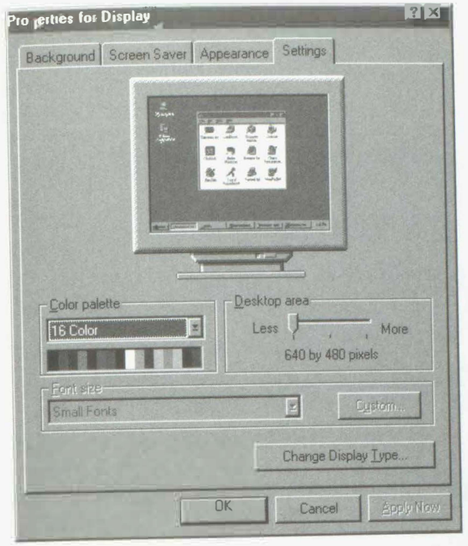


Figure 19. The display properties

Try It!

Switch the Display Resolution

Dynamic resolution switching allows the resolution of the display to be changed without having to restart Windows 95 or reboot the PC. This feature depends on several factors, including the type of video card and the selected color palette.

1. Choose *Settings* and then *Control Panel* from the *Start* menu.
2. Open the *Display* icon.
3. Select the *Settings* tab.
4. Set *Color Palette* to *256 colors* and click *Apply Now* to restart your PC.
5. After your PC restarts, repeat steps 1 and 2 to reopen the Display icon.
6. Choose another video resolution that is supported by your card by sliding the *Desktop Area* slider bar. For example, change the desktop area size from 640 x 480 to 1024 x 768.
7. Click *Apply Now*.
8. Now try playing an AVI clip.

Samsung - Exhibit 1023 - Page 35

Finding Files or Folders: Easy and Efficient

A powerful new Find utility is built into Windows 95. As shown in Figure 20 and Figure 21, it goes far beyond the minimal functionality of File Manager's Search utility in Windows 3.1.

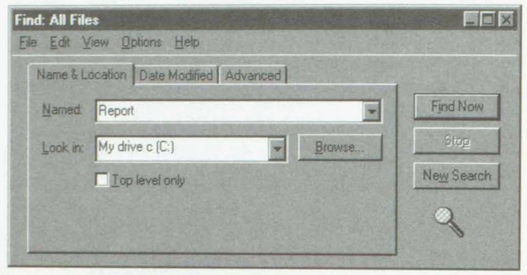


Figure 20. Finding files or folders in Windows 95

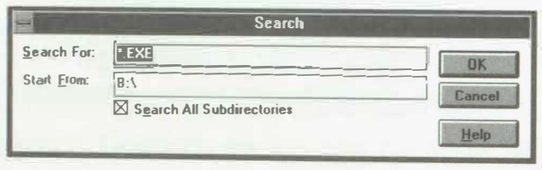


Figure 21. Searching in Windows 3.1

The Find utility includes the following features:

- **Partial name searches.** Type *rep* in the Find Files Named window, and all files and folders with *rep* somewhere in their names are found.
- **Searches on last modification date.** Because files can be searched on their last modification dates, users can perform searches such as *Find all Word documents modified in the last 3 days.*
- **Full-text searches.** Documents containing specified text can be searched for.
- **Saving of search results.** Complex or useful searches can be saved.
- **File management from the search results pane**. Operations such as renaming files or viewing file properties can be carried out within the results pane in the same way as in the Windows Explorer.

Try It!

Save the Results on a Complex Search

1. Click the *Start* button, and choose *Find* and then *Files or Folders*.
2. Type a partial string that you know will be present in many files, such as *rep* or *doc*.
3. Select the *Date Modified* tab.
4. Select *Modified during the previous seven days*.
5. Select the *Advanced* tab.
6. If necessary, select a file type.
7. Click *Find Now*.
8. When the find operation is complete, choose *Save Search* from the *File* menu. (Notice that because the Find feature is 32-bit preemptively multitasked, you have control and can go perform other tasks while Find is running.) A *Find Results* icon is automatically created on the desktop.
9. Double-click the *Find Results* icon.

The Printers Folder: Consolidated Printer Control

The Printers folder, shown in Figure 22, offers one-stop shopping for printer management and configuration. It replaces the troublesome Print Manager and Printers dialog box in the Windows 3.1 Control Panel, which is shown in Figure 23 on the following page.



Figure 22. The Printers folder in Windows 95

Samsung - Exhibit 1023 - Page 36

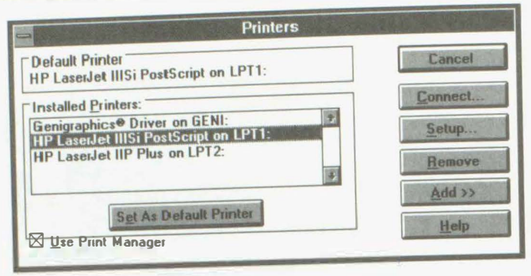


Figure 23. The Printers dialog box in Windows 3.1

The Printers folder is discussed in more detail in Chapter 11, "Printing."

Font Settings: More Powerful Font Management and Preview

The Fonts folder represents a single namespace in which all fonts used in the system can be installed or manipulated. (If any fonts are identified in the WIN.INI file, Windows 95 moves them to the Fonts folder on startup, so all fonts in the system reside in a single location.) Different views of the Fonts folder present additional information about the fonts installed in the system, as shown in Figure 24.

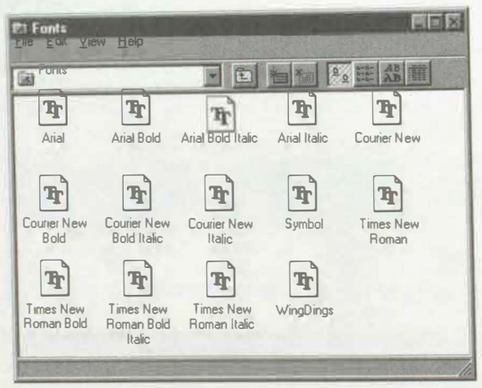


Figure 24. The large icon view of the Fonts folder

Operations can be performed on fonts in the same way they are performed on other file system objects. For example, a font can be removed from the Fonts folder by dragging it to another location, a font can be deleted from the system by deleting it from the

Fonts folder, and a font can be added to the system by dragging it from another location into the Fonts folder.

Try It!

Preview the Fonts

1. Open *My Computer* and double-click the *Fonts* folder, or open the *Fonts* icon in the *Control Panel*.
2. Right-click the font you want to preview.
3. Choose *Open*. Samples of the selected font are displayed and may be printed.

Quick Viewers: Examining Files Without Opening Them

The Quick Viewers allow users to preview a file from the UI without having to open the application that created the file. In fact, users don't even have to have the application that created the file on their system. As a result, documents can be sent over a network or through e-mail. Figure 25 shows a quick view of a Microsoft Excel worksheet.

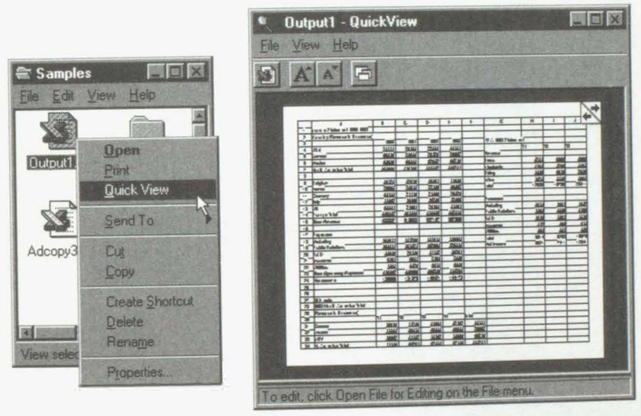


Figure 25. A quick view of a Microsoft Excel worksheet

For more information about the Quick Viewers in Windows 95, see Chapter 20, "Applications and Utilities."

Samsung - Exhibit 1023 - Page 37

Try It!

Quick-View a File

1. Right-click an icon for a file created by a registered application—for example, a bitmap, a text file, or a WordPad document.
2. Choose *Quick View*.

Compatibility

Compatibility is a requirement for Windows 95. It is a no-excuses, "no-brainer" upgrade from Windows 3.1. Overall, compatibility is most important for third-party software and hardware. However, it also applies to the UI. The UI in Windows 95 must be compatible with the way current Windows and MS-DOS users work, and it must scale itself to the level and preferences of individual users.

For Users of Windows 3.1

Of primary importance is that new UI features be easy for current Windows 3.1 users to learn at their own pace. In addition, UI visual elements and operations in Windows 95 must be consistent, to the extent possible, with the elements users are already familiar with in Windows 3.1. In addition to providing aids for users migrating from Windows 3.1, Windows 95 also includes tools familiar to Windows 3.1 users. For example, the system menu in the upper-left corner of most windows, and keyboard shortcuts such as ALT+F4, ALT+TAB, CTRL+X, CTRL+C, and CTRL+V, are present in Windows 95, easing the requirement for relearning or retraining.

With minimal changes in appearance, Program Manager and File Manager run under Windows 95 and are easily accessible via the Start button. As of this writing, the designs for access and default configuration of these Managers is not yet set. For example, when a user who has upgraded boots Windows 95 for the first time, the Program Manager window might be open. Or the Start button might have a Windows 3.1 Compatibility menu item that will launch Program Manager and File Manager. Regardless of the final design, many help and learning devices will be specifically designed for the upgrade, such as a Click Here to Begin arrow that zooms to the Taskbar when the user first boots Windows 95.

For Users of MS-DOS

Users of the command line in MS-DOS won't have to give it up when they move to the graphical UI of Windows 95. In fact, "command-line junkies" will find that the usability and power of the MS-DOS command prompt have been dramatically improved. New command-line functionality includes the following:

- Launching Windows–based applications

- Opening documents from a command-line
- Scaling the size of the MS-DOS command prompt
- Using cut/copy/paste operations to integrate information from MS-DOS and Windows–based applications
- UNC pathname support

See Chapter 6, "Support for Running MS-DOS–based Applications," for more information.

Samsung - Exhibit 1023 - Page 38

CHAPTER 4

Base System Architecture

Ease on the surface requires power and speed at the core, and the modern, 32-bit architecture of Windows 95 meets these requirements. Freed from the limitations of MS-DOS, Windows 95 preemptively multitasks for better PC responsiveness—for example, users no longer have to wait while the system copies files—and delivers increased robustness and protection for applications. Windows 95 also provides the foundation for a new generation of easier, more powerful multithreaded 32-bit applications. And most important, Windows 95 delivers this power and robustness on today's average PC platform while scaling itself to take advantage of additional memory and CPU cycles.

The mission of Windows 95 is to deliver a complete, integrated operating system that offers modern, 32-bit operating system technology and includes built-in connectivity support. In addition to the high-level mission of Windows 95, market requirements dictate delivery of a high performance, robust, and completely backward-compatible operating system that provides a platform for a new generation of applications.

This chapter discusses the base system architecture used by Windows 95. The base architecture covers low-level system services for managing memory, accessing disk devices, and providing robust support for running applications.

Summary of Improvements over Windows 3.1

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

- **A fully integrated 32-bit protected-mode operating system.** The need for a separate copy of MS-DOS has been eliminated.
- **Preemptive multitasking and multithreading support.** System responsiveness and smooth background processing have been improved.

Samsung - Exhibit 1023 - Page 39

- **32-bit installable file systems.** Systems such as VFAT, CDFS, and network redirectors provide better performance, u e of long filenames, and an open architecture that supports future growth.
- **32-bit device drivers.** Available throughout the system, these drivers deliver improved performance and intelligent memory use.
- **A complete 32-bit kernel.** Included are memory management, scheduler, and process management.
- **Improved system-wide robustness and cleanup.** This more stable and reliable operating environment also cleans up after an application ends or crashes.
- **More dynamic environment configuration.** The need for users to tweak their system s is reduced.
- **Improved system capacity.** Included are better system resource limits to address the problems Windows 3.1 users encountered when running multiple applications.

A Fully Integrated Operating System

The first thing that users of Windows 3.1 and MS-DOS will notice when they turn on their computers is the lack of an MS-DOS command prompt from which they would formerly have invoked Windows. Windows 95 is a tightly integrated operating system that feature s a preemptive multitasking kernel which boots directly into the graphical UI and also provides full compatibility with the MS-DOS operating system.

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

A Preemptive Multitasking Operating System

The job of the operating system is to provide services to the applications running on the system and, in a multitasking environment, to provide support that allows more than one application to run concurrently. In Windows 3.1, multiple applications ran concurrently in a *cooperative* multitasking manner. The Windows 3.1 operating system required an application to check the message queue every once in a while to allow the operating system to give control to other running applications. Applications that did not check the message queue on a frequent basis effectively hogged all the CPU time and prevented switching to another running task.

Windows 95 uses a *preemptive* multitasking mechanism for running Win32–based applications, and the operating system takes control away from or gives control to another running task depending on the needs of the system. Unlike Win16–based applications, Win32–based applications do not need to *yield* to other running tasks in order to multitask in a friendly manner. (Win16–based applications are still cooperatively multitasked for compatibility reasons.) Windows 95 provides a

mechanism called *multithreading* that allows Win32–based applications to take advantage of the preemptive multitasking nature of the operating system and that facilitates concurrent application design. In operating-system terms, a running Win32–based application is called a *process*. Each process consists of at least a single *thread*. A thread is a unit of code that can get a time slice from the operating system to run concurrently with other units of code. It must be associated with a process, and it identifies the code path flow as the process is run by the operating system. A Win32-based application can *spawn* (or initiate) multiple threads for a given process. Multiple threads enhance the application for the user by improving throughput and responsiveness and aiding background processing.

Because of the preemptive multitasking nature of Windows 95, threads of execution allow background code to be processed in a smooth manner. For example, a word processing application (process) can implement multiple threads to enhance operation and simplify interaction with the user. The application might have one thread of code responding to the keys pressed on the keyboard by the user to enter characters in a document, while another thread is performing background operations such as spell-checking or pagination, and yet another thread is spooling a document to the printer in the background.

Some available Windows 3.1 applications provide functionality similar to that just described. However, because Windows 3.1 does not provide a mechanism for supporting multithreaded applications, the application developer has to implement a threading scheme. The use of threads in Windows 95 facilitates the adding of asynchronous processing of information to applications by their developers.

Applications that use multithreading techniques can also take advantage of improved processing performance available from a symmetric multiprocessing (SMP) system running Windows NT, which allows different portions of the application code to run on different processors simultaneously. (Windows NT uses a thread as the unit of code to schedule symmetrically among multiple processors.)

For information about how Windows 95 runs MS-DOS–based applications in a preemptive manner (as Windows 3.1 does today), Win16–based applications in a cooperative manner (as Windows 3.1 does today), and Win32–based applications in a preemptive manner (as Windows NT does today) see later sections in this chapter.

No CONFIG.SYS or AUTOEXEC.BAT?

Windows 95 doesn't need the separate CONFIG.SYS or AUTOEXEC.BAT file required by MS-DOS and Windows 3.1. Instead, Windows 95 is intelligent about the drivers and settings it requires and automatically loads the appropriate driver files or makes the appropriate configuration settings during its boot process. If a CONFIG.SYS or AUTOEXEC.BAT file is present, the settings in these files are 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

Samsung - Exhibit 1023 - Page 40

or AUTOEXEC.BAT file, compatibility is maintained with existing software or environments that may require one or both of these files.

No MS-DOS?

Unlike Windows 3.1, Windows 95 is not dependent on real-mode operating system components for its interaction with the file system. However, 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 any real-mode drivers and TSRs that are identified in a CONFIG.SYS or AUTOEXEC.BAT file is processed. Because these drivers explicitly look for or use MS-DOS application support, the real-mode operating system components of Windows 95 help maintain compatibility with software that users already have on their system. After the real-mode drivers are loaded, Windows 95 begins loading the protect-mode operating system components. In some cases where a protect-mode Windows–based driver is provided, Windows 95 actually removes real-mode drivers from memory. More information about this subject is given later.

32-Bit Versus 16-Bit Components

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, Windows 95 uses a combination of 32-bit and 16-bit code. In general, 32-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 and maintaining compatibility with existing applications and drivers. System reliability is also improved without a cost in terms of compatibility or increased size.

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 26 depicts the relative distribution of 32-bit code versus 16-bit code present in Windows 95 for system-level services.

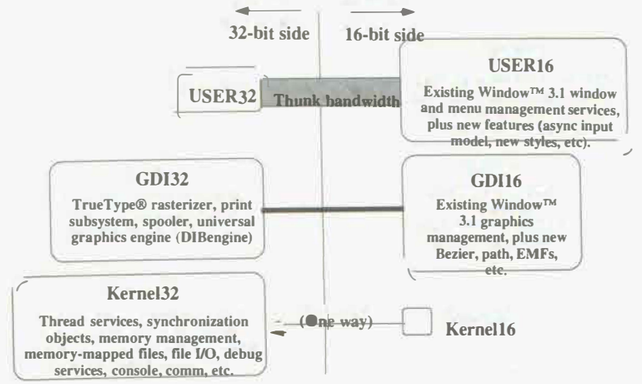


Figure 26. The relative code distribution in Windows 95

As shown in 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. 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 environments 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 technique 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

A virtual device driver 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 helps to have a basic understanding of what virtual device drivers (VxDs) are and the role they play in the Windows 95 environment.

The term *VxD* refers to a general virtual device driver, with *x* representing the type of device driver. For example, VDD is a virtual device driver for a display device, a VTD is a virtual device driver for a timer device, a VPD is a virtual device driver for a

Samsung - Exhibit 1023 - Page 41

printer device, and so on. 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 virtual machine (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 only data applicable 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—for example, 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 enhanced by eliminating ring transitions that result in executing 32-bit applications that access 16-bit real-mode services, because 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, instead of using the device drivers previously available as real-mode MS-DOS device drivers. Functionality that was previously supported as MS-DOS device drivers but is now supported as VxDs in Windows 95 includes the following components:

- 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 SHARE.EXE TSR
- Disk device drivers including support for SCSI devices
- DriveSpace (and DoubleSpace) disk compression

In summary, in Windows 95 VxDs provide the following advantages:

- Improved performance as a result of a 32-bit code path and the elimination or reduction of the need to 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
- Improved system stability and reliability compared to MS-DOS device driver counterparts

Virtual device drivers in Windows 95 can be identified by .VXD extensions, and virtual device drivers from Windows 3.1 can be identified by .386 extensions.

The System Architecture Layout in Windows 95

Figure 27 illustrates the layout of the base system architecture for Windows 95. Components of the system are divided between Ring 0 and Ring 3 code, offering different levels of system protection. The Ring 3 code is protected from other running processes by protection services provided by the Intel processor architecture. The Ring 0 code consists of low-level operating system services such as the file system and the virtual machine manager.

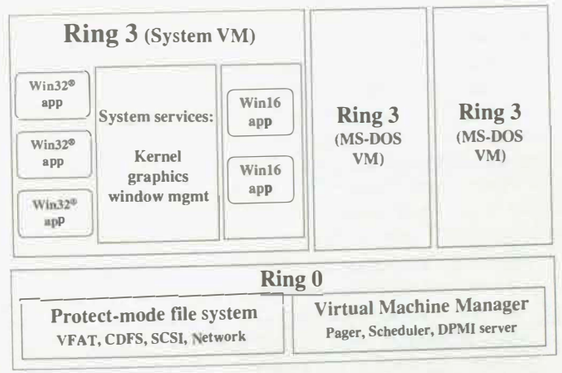


Figure 27. The integrated architecture of Windows 95, which supports running MS-DOS–based, Win16–based, and Win32–based applications

Figure 27 also depicts the way that MS-DOS–based, Win16–based, and Win32–based applications run in the system. The following section discusses the provisions that the system makes for running these applications.

Samsung - Exhibit 1023 - Page 42

Support for Win16–Based Applications

Win16–based (16-bit) applications run together within a unified address space and run in a cooperatively multitasking manner, as they do under Windows 3.1. Win16–based applications benefit from the preemptive multitasking of other system components, including the 32-bit print and communications subsystem and the improvements made in system robustness and protection from the system kernel in Windows 95.

Based on customer needs, resource needs, and market needs, three goals drove the architectural design of Win16–based application support: compatibility, size, and performance. Functionality adjustments, such as preemptively running Win16–based applications together in the Win16 subsystem or running Win16–based applications in separate VMs, were considered, but each of the options considered failed to meet the three design goals. The following discussion provides some insight into the architecture of Windows 95 as far as running Win16–based applications in a fast, stable, and reliable way is concerned.

Compatibility

First and foremost, Windows 95 needs to run existing Win16–based applications without modification. This factor is extremely important to existing users who want to take advantage of the new functionality offered in Windows 95, such as 32-bit networking, but don't want to have to wait until new Windows 95–enabled applications are available on the market.

Windows 95 builds upon the Windows 3.1 platform to provide support for running existing Win16–based applications and using existing Windows–based device drivers, while providing support for the next generation of 32-bit applications and components. Windows 95 extends the Windows 3.1 architecture in areas that have little or no impact on compatibility, as well as enhances the architecture to deliver a faster, more powerful 32-bit operating system.

Size

While many newer computer purchases are Intel 80486–based computers with 4 MB or 8 MB (or more) of memory, a high percentage of 80386DX–based computers with 4 MB of memory running Windows 3.1 are still in use. To support the needs of the market, Windows 95 must run on a base platform of an Intel 80386DX–based computer with 4 MB of RAM and provide access to its new features and functionality without requiring an upgrade of existing hardware or the addition of more RAM.

To meet its goals, Windows 95 is designed to occupy a working set of components no larger than Windows 3.1, thereby ensuring that any Win16–based application running at a perceived speed on a 4 MB or 8 MB (or greater) computer runs at the same (or higher) speed under Windows 95 without suffering any performance degradation. To meet the size goals of Windows 95, Win16–based applications run within a unified address space, resulting in little overhead beyond that required by Windows 3.1 to support the running of Windows–based applications. Running in a unified address space allows Windows 95 not only to fit on a 4 MB computer, but also to perform well. The architecture of Windows 95 includes innovative design features, such as dynamically loadable VxDs, to decrease the working set of components and memory requirements used by the operating system.

Meeting the size design goal (as well as meeting the compatibility goal) precluded the strategies of running Win16–based applications in a separate VM (by running a separate copy of Windows 3.1 on top of the operating system, which would involve paying a several megabyte "memory tax" for each application) as OS/2 does, or of emulating Windows 3.1 on top of the Win32 subsystem (which would also involve paying a "memory tax" for running Win16–based applications) as Windows NT does.

Running Win16–based applications in separate VMs is very expensive memory-wise. This strategy would require separate GDI, USER, and KERNEL code in each VM that is created, increasing the working set by as much as 2 MB for each Win16–based application that is running (as is the case with OS/2 for Windows). On a computer with 16 MB or more, this increase may not appear significant. However, bearing in mind the existing installed base of computers, running Win16–based applications in their own separate VMs in 4 MB of memory is impossible, and running them in 8 MB with the level of performance observed and expected under Windows 3.1 is very difficult.

Performance

Users expect their existing Win16–based applications to run as fast as or faster than they do under Windows 3.1. Both Win16–based applications and MS-DOS–based applications benefit from the 32-bit architecture of Windows 95, including the increased use of 32-bit device driver components and 32-bit subsystems.

Win16–based applications run within a unified address space and interact with the system much as they do under Windows 3.1. Running Win16–based applications in separate VMs requires either mapping Win16 system components in each address space, as Windows NT does, or providing a separate copy of each system component in each address space, as OS/2 for Windows does. The additional memory overhead required for Win16 system components in each VM to run a Win16–based application has a negative impact on system performance.

Windows 95 balances the issue of system protection and robustness with the desire for better system performance and improves on the system robustness of Windows 3.1. The improvements in this area are briefly discussed in the next section and are described in greater detail in Chapter 5, "Robustness."

Protection

The support for running Win16–based applications provides protection of the system from other running MS-DOS–based applications or Win32–based applications. Unlike

Samsung - Exhibit 1023 - Page 43

Windows 3.1, an errant Win16–based application cannot easily bring down the system or other running processes on the system. While Win32–based applications benefit the most from system memory protection, the robustness improvements in Windows 95 result in a more stable and reliable operating environment than Windows 3.1.

Win16–based applications run within a unified address space and cooperatively multitask as they do under Windows 3.1. The improvements made to overall system-wide robustness greatly enhance the system's ability to recover from an errant application, and improved cleanup of the system lessens the likelihood of application errors. General protection faults (GPFs) under Windows 3.1 are most commonly caused by an application overwriting its own memory segments, rather than by an application overwriting memory belonging to another application. Windows 3.1 did not recover gracefully when a Windows–based application crashed or hung. When a GPF caused the system to halt an application, the system commonly left allocated resources in memory, causing the system to degenerate.

Because of improved protection in Windows 95, an errant Win16–based application cannot easily bring down either the system as a whole or other running MS-DOS or Win32–based applications. At most, it can impact other running Win16–based applications.

Other protection improvements include the use of separate message queues for each running Win32–based application. The use of a separate message queue for the Win16 address space and for each running Win32–based application provides better recovery of the system and doesn't halt the system if a Win16–based application hangs.

Robustness Improvements

System robustness when running Win16–based applications under Windows 95 is greatly improved over Windows 3.1. Windows 95 now tracks resources allocated by Win16–based applications and uses the information to clean up the system after an application exits or ends abnormally, thus freeing up unused resources for use by the rest of the system.

Robustness improvements are discussed in Chapter 5, "Robustness."

Support for MS-DOS–Based Applications

Windows 95 includes many improvements over Windows 3.1 for running MS-DOS–based applications. As with Windows 3.1, each MS-DOS–based application runs in its own VM. A VM takes advantage of the Intel 80386 (and higher) architecture, which allows multiple 8086-compatible sessions to run on the CPU and thereby allows existing MS-DOS applications to run preemptively with the rest of the system. As with Windows 3.1, the use of virtual device drivers provides common regulated access to hardware resources, causing each application running in a VM to think that it is

running on its own individual computer and allowing applications not designed to multitask to run concurrently with other applications.

Windows 95 provides a flexible environment for running MS-DOS–based applications. In Windows 3.1, users sometimes needed to exit Windows to run MS-DOS–based applications that were either ill-behaved or required direct access to system resources. MS-DOS–based application compatibility is improved in Windows 95 to the point that almost all MS-DOS–based applications should run under Windows 95.

A detailed discussion of the improvements made to the support for running MS-DOS–based applications within the Windows environment is provided in Chapter 6, "Support for Running MS-DOS–based Applications."

Protection

In Windows, VMs are fully protected from one another, as well as from other applications running on the system. This protection prevents errant MS-DOS–based applications from overwriting memory occupied or used by system components or other applications. If an MS-DOS–based application attempts to access memory outside of its address space, the system notifies the user and terminates the MS-DOS–based application.

Robustness Improvements

System robustness is greatly improved when running MS-DOS–based applications in Windows 95. Robustness is discussed in Chapter 5, "Robustness."

Support for Win32–Based Applications

Win32–based applications can fully exploit and benefit significantly from the design of the Windows 95 architecture. In addition, each Win32–based application runs in its own fully protected, private address space. This strategy prevents Win32–based applications from crashing each other, from crashing running MS-DOS–based applications, from crashing running Win16–based applications, or from crashing the Windows 95 system as a whole.

Win32–based applications feature the following benefits over Win16–based applications in Windows 95 and over Windows 3.1:

- Preemptive multitasking
- Separate message queues
- Flat address space
- Compatibility with Windows NT
- Long filename support

Samsung - Exhibit 1023 - Page 44

- Memory protection
- Robustness improvements

Preemptive Multitasking

Unlike the cooperative multitasking used by Win16–based applications under Windows 3.1, 32-bit Win32–based applications are preemptively multitasked in Windows 95. The operating system kernel is responsible for scheduling the time allotted for running applications in the system, and support for preemptive multitasking results in smoother concurrent processing and prevents any one application from utilizing all system resources without permitting other tasks to run.

Win32–based applications can optionally implement threads to improve the granularity at which they multitask within the system. The use of threads by an application improves the interaction with the user and results in smoother multitasking operation.

Separate Message Queues

Under Windows 3.1, the system uses the point when an application checks the system message queue as the mechanism to pass control to another task, allowing that task to run in a cooperative manner. If an application doesn't check the message queue on a regular basis, or if the application hangs and thus prevents other applications from checking the message queue, the system keeps the other tasks in the system suspended until the errant application ends.

Each Win32–based application has its own message queue and is thus not affected by the behavior of other running tasks on their own message queues. If a Win16–based application hangs, or if another running Win32–based application crashes, a Win32–based application continues to run preemptively and can still receive incoming messages or event notifications.

Message queues are discussed in more detail in Chapter 5, "Robustness."

Flat Address Space

Win32–based applications benefit from improved performance and simpler construct because they can access memory in a linear fashion, rather than being limited to the segmented memory architecture used by MS-DOS and Windows 3.1. To provide a means of accessing high amounts of memory using a 16-bit addressing model, the Intel CPU architecture provides support for accessing 64K chunks of memory, called *segments*, at a time. Applications and the operating system suffer a performance penalty under this architecture because of the manipulations required by the processor for mapping memory references from the segment/offset combination to the physical memory structure.

The use of a flat address space by the 32-bit components in Windows 95 and by Win32–based applications allows application and device driver developers to write

software without the limitations or design issues inherent in the segmented memory architecture used by MS-DOS and Windows 3.1.

Compatibility with Windows NT

Win32–based applications that exploit Win32 APIs common to Windows 95 and Windows NT can run without modification on either platform on Intel–based computers. The commonality of the Win32 API provides a consistent programmatic interface and allows application developers to leverage a single development effort to deliver software that runs on multiple platforms. It also provides scaleability of applications and broadens the base of platforms available for running ISV or custom applications with minimal additional effort.

Application developers are encouraged to develop applications either under Windows 95 or under Windows NT and to test compatibility on both platforms.

Long Filename Support

Win32–based applications that call the file I/O functions supported by the Win32 API benefit from the ability to support and manipulate filenames of up to 255 characters with no additional development effort. To ease the burden of the application developer, the Win32 APIs and common dialog support handle the work of manipulating long filenames, and the file system provides compatibility with MS-DOS and other systems by automatically maintaining the traditional 8.3 filename.

Memory Protection

Each Win32–based application runs in its own private address and is protected by the system from other applications or processes that are running in the system. Unlike errant Win16–based applications under Windows 3.1, errant Win32–based applications under Windows 95 end only themselves, instead of bringing down the entire system if they attempt to access memory belonging to another application.

The use of separate message queues for Win32–based applications also ensures that the system continues to run if an application hangs or stops responding to messages or events.

Robustness Improvements

Win32–based applications benefit from the highest level of system robustness supported under Windows 95. Resources allocated for each Win32–based application are tracked on a per-thread basis and are automatically freed when the application ends. If an application hangs, users can perform a *local reboot* operation to end the hung application without affecting other running tasks, and the system then cleans up properly.

Samsung - Exhibit 1023 - Page 45