

Mobile Computing Services

As computing moves beyond its traditional desktop environment, Microsoft is committed to delivering system services and end-user functionality that dramatically improve the ease-of-use of portable PC hardware and enrich the mobile computing experience.

The Windows 95 Vision of Mobile Computing

Windows 95 is the first desktop operating system designed from the beginning with mobile computing in mind. Portable PC's are forecasted to comprise 33% or more of the run rate of new computer systems in 1995; therefore, it makes sense to build strong mobile computing support into a mainstream operating system. When nearly one-third of the user community may be utilizing mobile computing features, it is unacceptable to add mobile computing support on as an afterthought or implement it as a set of utilities. Instead, in Windows 95, the core networking, device support, communications, and other architectures the following observations about mobile computing:

- **Mobile computing encompasses anyone who moves computing capabilities away from a traditional desktop PC.** The Windows 95 vision for mobile computing includes everyone who uses a portable PC (including “luggables,” notebook and subnotebook computers, but not PDAs), from people who move from meeting to meeting in an office building, to those who telecommute between their homes and offices, to business travelers, to those who have no office at all and move from customer site to customer site.
- **The tasks people want to perform away from their desks are fundamentally similar to those that they perform on their desktop.** While they're in the office, users want to draft a memo, review a budget spreadsheet, query a database, browse e-mail, peruse a presentation on the network, send a fax, or look at their schedule for the day. Away from their offices and their desktop PCs, users want to continue performing these same tasks.
- **The “mobile” computer environment is fundamentally different from the desktop environment.** When users move away from their office, their computing environment changes dramatically. Their hardware environment is dynamic, as they plug in and unplug different components to deal with the task at hand. Portable PC users may be operating in a power-constrained environment with video displays often half the size of their desktop displays. They can't easily access a file on a server or receive e-mail. As a result, the mobile computing environment can be constrictive to users.

According to customers, mobile computing presents three challenges: getting the most out of portable PC hardware; staying in touch; and keeping organized. Windows 95's mobile computing features are designed to address these challenges, and thus provide mobile users with an easier to use and more powerful environment.

- **Getting the Most out of Portable PC Hardware.** For most purchasers, a portable computer is a big investment. Customers expect their new hardware to work well, and not require time-consuming setup hassles or elaborate re-configuration for different work environments. Rapid advances in portable computing technologies have minimize the functionality and performance differences between desktop and portable PCs, and customers want to take advantage of new capabilities. At the same time, customers resist “forced obsolescence,” and hope to extend the lifetime of older but still useful machines with smaller hard disks.
- **Staying In Touch.** At their desks, users have a wide array of communications capabilities to keep them connected to other people, both inside and outside their organizations. They have access to the LAN and all its services, such as e-mail, file sharing, and print sharing. A phone, a fax machine, and perhaps a modem are close at hand. When they leave their desks, these users become communications islands. They are cut off from their network and all its services. Phones, faxes, and modems are not readily available. Being mobile entails a constant struggle to stay in touch. The ideal for most mobile users is to be as productive while mobile as they would be at a desk. To achieve this ideal, users must have easy access to powerful communications tools, regardless of location. Channels of communication must exist between their portable and desktop PCs, between themselves and the rest of their workgroup, and between themselves and the broader community of PC, fax, and other equipment users.
- **Keeping Organized.** The nature of the mobile work environment introduces significant, time-consuming organizational challenges – many of which can be addressed through software. For example, mobile users can spend inordinate amounts of time making sure that files stay “in synch” between a portable PC and a desktop PC or file server. Likewise, few good methods currently exist for managing print jobs created out of the office.

The development investments for mobile computing in Windows 95 have focused on delivering features which enable users to get the most out of their portable computing hardware (PCMCIA, Plug and Play, Disk Compression and Power Management), stay connected (Dial-Up Networking, Exchange and Microsoft Fax) and keep organized (the Briefcase and Deferred Printing). The following sections provide detailed explanations of these features and other Windows 95 support for mobile users.

Getting the Most out of Portable PC Hardware

Windows 95 is designed to enable computer users to get the most out their portable PC. On newer machines, Windows 95 supports innovations such as PCMCIA, docking stations and port replicators, and Advanced Power Management. Features like DriveSpace disk compression help to extend the useful life of older portable PCs. Inherent in Windows 95's new support for portable PC hardware are architecture enhancements which enable applications and system programs to be smart about conserving battery power and managing configuration changes.

PCMCIA Support

The emergence of PCMCIA cards has been one of the most exciting advances in the portable computer market. However, users were never sure whether a particular card was compatible with their portable PC, they had to struggle through installation and configuration of card drivers and socket services, and card insertion and removal were anything but dynamic.

Through the Plug and Play architecture, Windows 95 delivers power, compatibility, ease of installation, and dynamic card insertion and removal to PCMCIA users. PCMCIA drivers in Windows 95 are robust, 32-bit, dynamically loadable virtual device drivers with zero conventional memory footprint. Windows 95 ships with an updated version of card and socket services. Microsoft's compatibility testing/logo program ensures compatibility with these standards.

Installation of a PCMCIA device is as simple as inserting the card, and insertion and removal of cards happens dynamically. For example, when a user plugs in a PCMCIA network card, the portable computer detects the network card, loads the network drivers, and establishes a network connection. Then the shell updates its user interface to reflect that the mapped network drives are now active. Prior to Windows 95, users would have needed to shut down their systems and reboot in order to begin using the device.

DriveSpace Disk Compression

Many older portable computers have small disk drives. While these machines may still be perfectly functional for word processing, checking e-mail, or other non-compute-intensive tasks, the lack of disk space is a major constraint.

Windows 95 incorporates DriveSpace Disk Compression, the same compression technology used in MS-DOS 6.22. Windows 95 disk compression is backwards-compatible with compressed volumes created by DoubleSpace (DOS 6.0) and Stacker compression software.

In a major enhancement over MS-DOS 6.22 functionality, all disk compression in Windows 95 is handled by 32-bit protected mode code integrated into the file system. In addition to the inherent performance advantages, such tight integration with the underlying device driver code means that all compression operations are for the most part transparent to the user. Windows 95 is also much more sophisticated about the relationship between system files and compressed volumes. For example, system paging (swap) files can now reside on compressed drives (they are marked as "uncompressible" to avoid impacting system performance).

Power Management

The bane of a portable computer users' existence is battery life. While true innovation in battery life depends in large part on physics and hardware engineering, Windows 95 supports Advanced Power Management (APM) 1.1, which represents a major step forward from existing software-based power management technologies.

From an end-user perspective, APM 1.1 offers three major benefits:

- The Windows 95 shell includes a battery meter that provides users with an accurate representation of the battery life they have remaining.

- Users can put their systems in Suspend mode directly from the Start menu, as opposed to going to a hardware control. Users also have the option to automatically power their PCs off when they shut down Windows, instead of having to shut down Windows and then use the hardware power switch to shut off the PC. Software-managed power control enables Windows to properly deactivate and reset peripheral devices to prevent data loss and conserve power.
- Plug and Play APM messages allow application software to react to changes in the power state and battery life. For example, a mail program or a utility that does background disk compression could disable this feature when running on limited battery power, or could prompt the user to save their work and avoid data loss when battery power runs low.

Hot-Docking Support

Many portable PC users have had to compromise storage, extensibility, and display size and resolution in favor of mobility. Docking stations (or simpler port replicators) provide users with both the mobility of the portable PC and the storage, extensibility, and versatile display capabilities of a desktop PC. However, users with docking stations spend a lot of time reconfiguring and rebooting their machines when they take them in and out of their docking stations.

Microsoft forged partnerships with leading portable vendors like Toshiba and Compaq, and BIOS vendors like Phoenix Technologies to achieve a level of integration between hardware and software never achieved before. On the hardware side, docking stations have enabled docking and undocking operations without powering off the computer. On the software side, Windows 95 detects the impending changes in configuration and anticipates the resulting changes in hardware, manages any conflicts (such as open files on an external hard drive or network), and loads the hardware drivers appropriate to the new configuration.

Instead of rebooting and fooling with configuration files, users now simply click the UI's Start button and choose Eject PC from the Start menu. Windows 95 checks for any potential problems and then undocks, without users having to power down. After undocking, the system automatically reconfigures itself for the different hardware—for example, changing the video resolution to match the resolution of the built-in display—and continues running.

New Message Support

The Windows Plug and Play initiative provides a new set of Windows messages that alert applications and device drivers to changes in the hardware so that they can react intelligently. These messages include the following:

- **Docking.**
 - About to change configuration (for example, when the user is about to undock)
 - Device about to be removed
 - Configuration changed (for example, when the user just undocked)
 - Device about to be added
- **Power management.**
 - System about to suspend

- System suspended
- System resumed
- **PCMCIA.**
 - Device inserted
 - Device removed
- **Miscellaneous.**
 - New device inserted (for a device that needs to be set up)
 - Serial mouse inserted
 - Parallel cable inserted

These messages enable applications and system services to better support portable PC users. Windows 95 itself takes full advantage of these messages. For example, the applications shipped with Windows 95 use the *Configuration changed* message in the following ways:

- The Briefcase uses it to try to start updating.
- The print spooler uses it to print all deferred print jobs.
- Mail uses it to try to reestablish a network connection.

The Registry

The Registry provides centralized, dynamic data storage for all Windows settings. The Registry defines a current-configuration branch to enable ISVs to better serve the needs of mobile users. This branch stores information on a per-configuration basis. For example, the Control Panel's Desktop tool stores per-configuration information about video resolution changes and Print Manager stores per-configuration information about the default printer.

Configurations are created when Windows 95 queries the BIOS for a dock serial ID, asks the user for a name for the configuration, and then stores information about hardware and software associated with this configuration. Multiple configurations can also be created manually via the Hardware Profile manager. This functionality enables users to create different configuration settings for the same hardware setup. Applications access and store information for each of the different hardware configurations used by mobile users. This Registry support enables applications to gracefully adapt to different hardware configurations.

Flexible Video Resolution Support

"Poor displays" have been cited as a leading limitation of portable computers. To overcome that limitation, portable computer vendors are putting high-end video controllers into portable PC systems, and users are plugging external monitors into their portable PCs when they are at their desks.

Windows 95 stores video resolution on a per-configuration basis and supports dynamic resolution changes. As a result, when users have monitors attached to their portable PCs, they can set the video to a higher resolution—for example, 1024x768. When they undock (or detach the monitor), the video resolution changes to 640x480. Whenever they return to their connected or docked configuration, the resolution automatically returns to 1024x768.

Pointing Devices

Portable PC users often describe difficulties in switching between the integrated pointing device on their portable computers—for example, a trackball or clip-on mouse—to a desktop pointing device. Windows 95 addresses these difficulties in two ways:

- When users change configurations, Windows 95 automatically detects which pointing device is available and enables it.
- When users connect a Plug and Play serial mouse, the system detects the new mouse and dynamically reconfigures itself to enable its use. No manual configuration changes are necessary.

Document Viewers

Like other PC users, portable PC users often exchange documents with customers or other people in a different work environment. Because of limited disk space or lack of network access, however, mobile users often don't have the applications needed to view the files they receive.

An extensible, replaceable File Viewer technology has been seamlessly integrated into the Windows 95 UI. File Viewers enable portable PC users to view many common file formats, even though their machines may lack the disk space or processor power to run full versions of the underlying applications. Users simply select a file and choose Quick View. Windows 95 directly supports more than 30 file types and publishes interfaces to allow applications to add support for additional formats (and even to add their own viewer). For more information, see Chapter 4, "The Windows 95 User Interface."

Staying In Touch

To enable mobile computer users to stay in touch with essential information resources, Windows 95 provides powerful, easy-to-use, end-user communications capabilities and an open, extensible set of services for applications. Dial-Up Networking support has been integrated into the Windows 95 network architecture and user interface; finally, accessing a network via a modem is as easy and reliable as using a hardwired network adapter. Similarly, the Exchange email client and Microsoft Fax system are optimized to enable portable computer users to easily send and receive email and faxes while mobile.

Dial-Up Networking

In the office, well over 50 percent of PC users have become accustomed to full workgroup computing capabilities—printing to a network printer, sending and receiving e-mail, and accessing shared files. However, when users leave the office, they cannot take all the shared resources from their workgroup environment with them.

The dial-up networking features in Windows 95 give users complete workgroup computing capabilities while mobile. Dial-up networking is smoothly integrated into the Windows 95 shell. Whether users are running a client-server application, accessing a customer database, downloading and/or browsing e-mail, or accessing shared files, network access while mobile looks and works exactly like network access in the office, and establishing a remote connection works the same as establishing a connection in the

office. Users simply double-click the desired network object. Similarly, if users double-click Mail, a remote connection is automatically established.

The Dial-Up Networking client software component, like the rest of networking in Windows 95, provides an open architecture and connects to a broad set of networks, including Windows NT, NetWare Connect, and the Internet. Support is included for TCP/IP, IPX, and NetBEUI network protocols, using industry standard point-to-point protocol (PPP) over the wire, as shown in Figure 86. Because remote access is part of the dynamic 32-bit protected-mode network architecture of Windows 95, users don't have to reconfigure or reboot their computers to continue working after establishing or ending a connection.

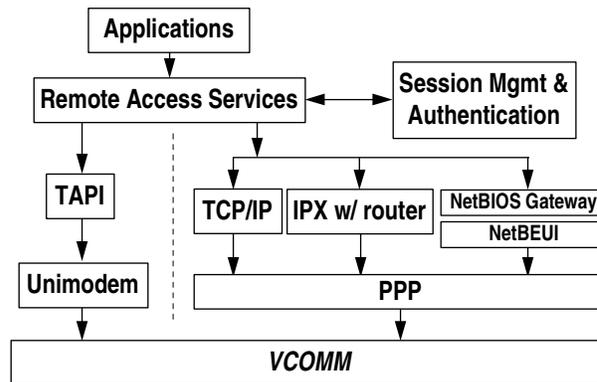


Figure 86. The Windows 95 remote access functionality, which supports TCP/IP, IPX, and NetBEUI over PPP.

As Figure 87 shows, a Windows 95 desktop PC can be used as a convenient access point to a small LAN or simply to the desktop PC itself. (Windows NT Server 3.5 supplements the remote network access functionality in Windows 95 to provide a large network solution that allows for as many as 256 simultaneous dial-in sessions.) When used as a host computer—that is, the computer the user dials into—a Windows 95 PC provides an easy-to-use, single-port host, capable of multiprotocol routing for IPX and NetBIOS with pass-through user-level security. The Windows 95 security scheme employs the Windows NT or NetWare authentication mechanism and user database to validate the user. Share-level security is also available. Using the desktop management capabilities in Windows 95, an administrator can disable dial-up access so users cannot dial into a particular desktop PC or cannot remotely access the entire network. (For more details about the desktop management infrastructure in Windows 95, see Chapter 9, “Networking.”) If the user dials into a host system, such as Windows NT, Shiva Netmodem/ LanRover, or NetWare Connect, Windows 95 offers full connectivity.

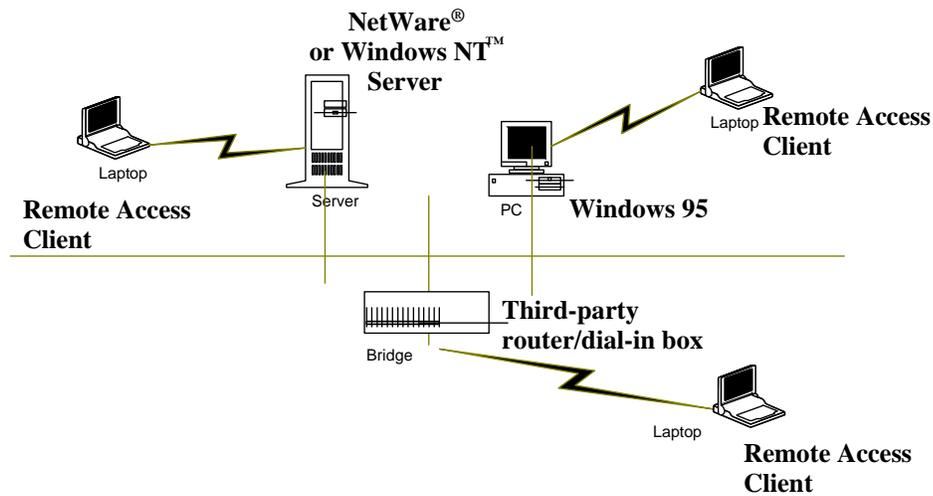


Figure 87. The flexible remote connectivity options and broad network access provided by Windows 95

Windows 95 provides a modular, open architecture that enables applications to establish a “pipeline” to the remote network. The Remote Access API, a component of the Win32 API, provides ISVs with services to initiate and resume a remote connection, as well as to gather information about the type and status of the connection. These APIs enable applications to adjust their behavior depending on the transmission speed and other characteristics of the network connection.

Another key component of the Windows 95 architecture is the Remote Access subsystem. This open subsystem is network-independent and device-independent to enable universal connectivity. For example, Windows 95 supports ISDN boards, PBX modems, and so on. This capability is accomplished through service providers—software components that manage physical connections and network traffic over the remote media.

The Remote Access subsystem includes a modular authentication provider that can be supplemented or replaced to provide custom security services. For example, if a company wants to provide its own custom services, that company can replace the authentication DLL in Windows 95 with its own to take advantage of company-specific security features.

Figure 88 highlights the various components of the Remote Access subsystem that can be replaced by third-party service providers. The shadowed items can be replaced to add functionality not provided by Windows 95.

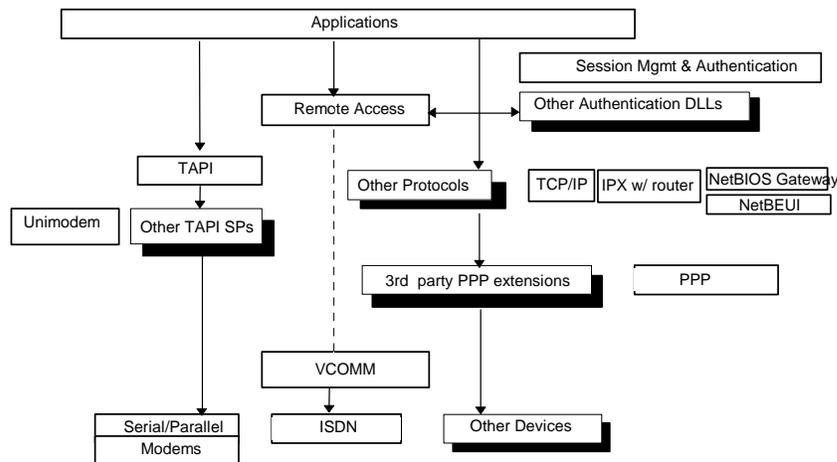


Figure 88. The Windows 95 Remote Access architecture, which allows direct integration by third-party service providers

Telephony API

To communicate in a mobile environment, users and applications must dial phones or modems. Whether the device is a phone on a PBX system, an ISDN board, or a modem, applications can use the Telephony API (TAPI) in Windows 95 to dial. TAPI provides services that allow applications to share a line so that more than one application can wait for an incoming call while another dials out. TAPI itself is extensible, so third-party developers can write TAPI service providers to extend dial support to new devices. One such TAPI service provider is UniModem, which is discussed in detail in the following section.

TAPI also provides the Dial Helper to guide users through the process of defining a correct phone number, given their location and telephone system. The Dial Helper gives users the opportunity to define phone numbers in a location-independent fashion. Users enter an area code and phone number, and the Dial Helper applies location-specific parameters to the number, such as a prefix to get an outside line. When users dial this same number from a different location, they simply switch their location, and Dial Helper automatically adjusts the prefixes, area codes, and other parameters.

UniModem

Windows 95 provides an easy, central, extensible mechanism for installing and configuring modems. (This mechanism is similar to the Windows 95 infrastructure for printers.) Windows 95 automatically detects the modem and provides a default configuration for it. After the modem is installed, it is available to all applications, which no longer need to store modem commands or data about the capabilities of different modems. Windows 95 ships with support for the top 200 modems worldwide. Adding new modems is as simple as supplying the appropriate installation data (.INF) file. Microsoft will certify the .INF files for each new modem and provide a logo identifying it as Windows-compatible.

Both TAPI and UniModem use the extensible 32-bit communications architecture in Windows 95. For more information, see Chapter 12, “Communications.”

Dynamic Networking

Historically, network users with portable computers have dealt with CONFIG.SYS files and a regular stream of error messages as they connected and disconnected from the network.

To adapt to changes in link speed and configuration, the network architecture in Windows 95 is completely dynamic, regardless of whether users are using the NetWare-compatible components or the Microsoft networking components. All the underlying drivers, transports, and redirectors are robust, 32-bit, dynamically loadable, protected-mode virtual devices that support Plug and Play. This architecture enables Windows 95 to load and unload components of the network stack as demanded by hardware events. For example, when the user docks a portable PC or inserts a PCMCIA network card, the appropriate network components are loaded and connections are established without user interaction. Even assigning a TCP/IP address is now dynamic, using the Dynamic Host Configuration Protocol (DHCP) servers to allocate addresses on demand.

Users can forget about the intricacies of network hardware and configurations. Virtually every aspect of networking, including dynamic configuration, is handled transparently by Windows 95

Password Management

Users constantly strive to protect the data on their portable computers from prying eyes and hands. This chore is not easy. Password protection at boot-up, after a suspend (reduced power) state, and at network logon means users must often contend with inconsistent user interfaces and multiple passwords.

The Security icon in the Windows 95 Control Panel provides a central, extensible mechanism for users to easily manage the security of their computers. The Master Password gives users the opportunity to unify all their different passwords under a single password.

The interface for the Control Panel's Security tool is open and extensible. As a result, ISVs and portable PC manufacturers can add their own security property sheets and hook their password services to the Master Password.

Microsoft Fax

Fax is one of the most common tools mobile users employ to send messages and documents. Rich fax services are seamlessly integrated into the Microsoft Exchange e-mail client provided with Windows 95. Users of Windows 95 send a fax message the same way they send any other electronic message.

Microsoft Fax services extend the capabilities of today's "paper-based" fax machines. For example, users can address a fax message in the Microsoft Exchange client and attach a binary file, such as a word processing document. Depending on the capabilities of the recipient's PC or fax machine, the message could appear as a message in their inbox with an attachment or, in the case of Class 3 fax machines, the attached document could be rendered and printed with a cover sheet. Microsoft Fax provides security to ensure the correct recipient via an RC4 encrypted password or public key and private key encryption.

If users want to send faxes when they are not connected to a phone line or network, they can spool them to their outbox. When they reconnect, the faxes are automatically sent.

Microsoft Fax uses the open, extensible architecture of MAPI, plugging in as a transport provider and then leveraging the user interface provided by the Windows 95 client. Users do not need to learn how to operate a separate fax software package. For more information, see Chapter 14, “Microsoft Exchange: E-Mail, Fax, and More.”

Remote Mail

Historically, when users left the office, they left behind robust e-mail capabilities. Microsoft, Lotus, and other e-mail vendors are changing this scenario. Windows 95 delivers the next generation of remote mail so that users can simply connect a phone line to their modem and start using mail. The remote connection is established automatically using Remote Access services.

Windows 95 has also optimized Mail to gracefully handle remote network connections and slow network links. Performance over the wire has been enhanced, and users can browse message headers and download specific messages, getting an estimated time to download and status of the download process.

The Messaging API

More than any other class of users, mobile users need access to multiple messaging providers and the ability to seamlessly move between these providers. While desktop users receive most of their electronic mail through a corporate or network-based electronic mail system, mobile users frequently connect to several different messaging providers—for example, both CompuServe and their corporate network.

The Windows 95 Messaging API (MAPI) makes the communications abilities of mobile users significantly more powerful. MAPI is an open, extensible messaging infrastructure standard that ensures complete independence of Windows applications and client software from underlying messaging systems, while enabling vendors to supply a wide array of providers. To the end-user, each messaging provider looks more or less the same. MAPI provides the support to dynamically switch between providers and associate multiple providers and preferences with a “profile.”

Keeping Organized

The mobile computing environment presents significant data-management challenges for end users. Since portable PCs typically exist in at least two states: on the network and off, portable users need to contend with the possibility that they and their data will be separated. Most portable computer users deal with this possibility by making copies of important documents on their portable PCs. This practice introduces the problem of file synchronization. What happens to the portable PC user if the original copy of the document changes? What if the portable PC user edits his copy of the document? Windows 95 attempts to address these issues through the metaphor of a Briefcase.

Windows 95 also addresses the problem of getting a portable PC connected to a desktop PC or for the purposes of transferring files through Direct Cable Connect, which enables a standard parallel cable to serve as a simple network connection.

Deferred printing support handles the problem of creating print jobs while on the road. Instead of forcing users to contend with error messages when printers are unavailable, Windows 95 is “smart” about managing the printing process in different environments.

The Briefcase

Portable PC users who also have desktop PCs (or who connect to a network) need to keep the most up-to-date files on the computer they are currently using. Users most often stay up to date by comparing the dates stamped on files and manually copying files from one machine to another—a tedious, unintuitive, and error-prone process.

The Windows 95 Briefcase minimizes the headaches of staying up to date by keeping track of the relationships between different versions of a file on different computers. As shown in Figure 89, the user interface for this feature employs a simple metaphor that users are already comfortable with: a briefcase.

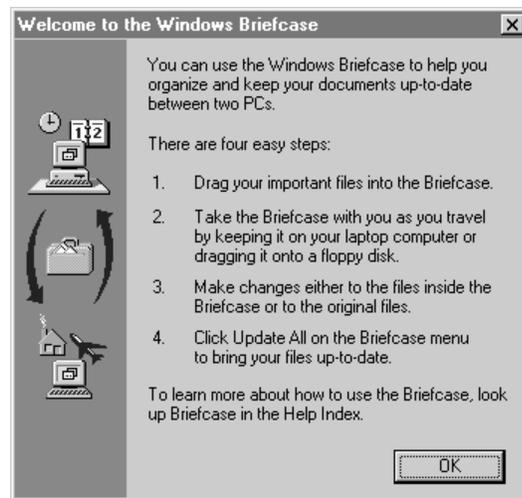


Figure 89. The initial Briefcase screen, outlining the Briefcase process

After installing the Briefcase software on their portable PCs, users can specify which files and directories they want to keep up to date, by dragging and dropping those objects into the Briefcase. When users reconnect their portable PCs to a network or their desktop PCs, the Briefcase automatically updates unmodified files on the host with the recently modified files from the portable computer. Figure 90 shows the contents of a typical Briefcase.

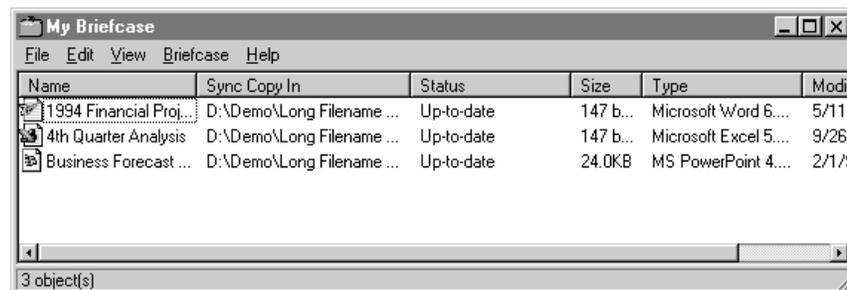


Figure 90. Sample Briefcase contents, showing document status

Windows 95 provides a set of OLE 2.0 interfaces that allow applications to define “reconciliation handlers.” When both the file in the Briefcase and the corresponding original document have changed, Windows 95 calls the appropriate reconciliation handler to merge the two files. (The Windows 95 reconciliation APIs will also serve as the foundation for Cairo’s reconciliation APIs. As a result, ISVs writing to the reconciliation APIs in Windows 95 can leverage that investment as they write Cairo applications in the future.)

“Local” Connections

Roughly 70 percent of portable PC users also use a desktop PC. As a result, they constantly need to transfer files and other data between the two machines. A simple way to effect these transfers is via a direct parallel or serial cable connection. Windows 95 makes this process significantly easier than it was under Windows 3.1. Like remote access, establishing a local connection is seamlessly integrated into the shell and provides full participation for the client on a variety of networks. The services provided by a direct cable connection are much the same as those provided via a dial-up connection, only faster!

Wireless technologies, such as infrared (IR), provide another form of local connection. Using the extensible device driver architecture in Windows 95, Microsoft is working closely with creators of wireless devices to develop and ship Windows drivers for these new technologies.

Deferred Printing

Users generate print jobs regardless of where they are. Windows 95 supports “deferred” print jobs, enabling users to generate print jobs even if a printer is not currently available. The print jobs are stored by the system until a printer becomes available, at which time Windows 95 detects the connection and automatically spools the print jobs as a background process.

Windows 95 also gives users the ability to print to a generic printer. If they aren’t sure which printer they will be connected to, they can queue the print jobs and specify the printer only when a physical device is available. This functionality enables users to easily use printers available at customer sites, in copy centers, and so on.

Finally, to better support the mobile user, Windows 95 stores the default printers on a per-configuration basis. If users have a different printer at home than they do at the office, Windows 95 changes the default printer when it detects the computer’s change in location—for example, from docked status to undocked status.

