C H A P T E R   1 2

Mobile Computing Services

As computing moves beyond its traditional desktop environment, Microsoft is committed to leading the market by delivering system services and end-user functionality that dramatically improves the ease-of-use and power of mobile computing.

Vision of Mobile Computing with Windows 95

The goal for mobility in Windows 95 is to allow users—wherever they are and whatever computing they want to do—to do it easily. Our strategy for delivering on this vision is based on the following tenets:

u **Mobile computing encompasses anyone that moves away from their desktop PC and wants computing capabilities.** It includes everyone, from people who move from meeting to meeting in an office building, to those who shuttle between their homes and offices, to business travelers, to those who have no office at all and move from customer site to customer site.

u **The tasks people want to do away from their desks are fundamentally similar to those that they do on their desktop.** On desktop PCs, people 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 office and desktop PC, people want to continue performing these very same tasks.

u **The "mobile" computer environment is fundamentally different than the desktop environment.** When users move away from their desktop PC, 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 a video display often half the size of their desktop display. They can't easily access a file on a server or receive e-mail. In this way, the mobile computing environment can be constrictive to users.

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Mobile Framework in Windows 95

The challenges that mobile computer users experience today stem from three fundamental problems: moving to and from the desk, staying connected, and dealing with the mobile work environment.

u   Moving To and From the Desk

Desktop PCs operate in a fairly constant hardware environment. Mobile computers do not. For example, portable computer owners usually change video resolution, pointing device, and network state every time they change location (for example, when they undock). To change locations means tweaking configuration files, contending with error messages and restarting their computer a lot. Being mobile is a constant struggle to get the hardware to adapt to the new conditions the user is computing in.

To achieve easy, seamless mobility, these changes in hardware must be transparent to the user: the machine should properly re-configure itself to match the current environment, with no special intervention from the user. Microsoft's Plug and Play architecture, defined in partnership with other industry leaders like Intel and Compaq, provides an infrastructure to effectively tackle these problems.

u   Staying Connected

At their desk, users have a wide array of communication capabilities to keep them connected to other people, both inside and outside their organization. They have access to the LAN and all its services such as e-mail, file sharing, and print sharing. There is a phone, a fax machine, and perhaps a modem close at hand. When they leave their desks, these users become communication islands. They are cut off from their network and all its services. Phones, faxes, and modems are not readily available. Being mobile becomes 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 exist between their portable and their desktop PC, between themselves and the rest of their workgroup, and between themselves and the broader community of PC, fax, and other users. Windows 95 provides powerful, easy-to-use, end-user communication capabilities and an open, extensible set of services for applications to establish these connections.

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u Dealing with the Mobile Environment

Mobile users face problems and challenges that simply do not exist for desktop computer users. Examples include keeping multiple versions of files in synch (e.g., the copy of the proposal on your laptop vs. the copy on the file server), transferring files from the desktop to the portable or over the phone lines, or working with limited disk storage. In addition, many activities that are simple on the desktop–sending a fax, using electronic mail, or printing a document–become needlessly complex in the mobile environment. While solutions to some of these problems exist today, these solutions are often provided as utilities that are difficult to use and are not well-integrated into the overall computing environment.

Windows 95 includes a variety of features specifically designed and optimized to simplify the lives of mobile computer users. Rather than learning new and different ways to handle the challenges of mobile computing, Windows 95 enables users to concentrate on the task at hand, and delegate the intricacies of the computing environment to the operating system.

The development investments for mobile computing in Windows 95 have focused on delivering solutions that make it easier and more powerful to stay connected, adapt to changing hardware configurations, and deal with the mobile computing environment. The following table shows features that address the needs of mobile users.

How have we made it...	Staying Connected	Moving To and From the Desk	Dealing with the Mobile Environment
Easier	Dial-Up Networking wizard; Implicit connections; Password management;	Hot Docking; Automatic device detection and setup; PCMCIA support; Hardware Suspend UI; Battery Monitor	File Synchronization: Briefcase UI, automatic reconciliation; Deferred Printing; File Viewers; At Work™ Fax
More Powerful	PPP, SLIP protocols; Support for faster baud rates; Dynamic Networking; Modular, extensible network architecture; More network APIs	Power Management messages and APIs baked into OS; Dynamic video resolution; Dynamic networking	Direct Cable Connection; OLE reconciliation engine; Remote Mail; Integrated compression
Compatible	Unimodem drivers; Built-in support for Windows, NetWare, Internet hosts	Supports today's PCMCIA standards; APM 1.1 specification	

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The following sections detail how Windows 95 provides improved communication, hardware-adaptability, and productivity features for the mobile user.

Staying Connected

Dial-Up Networking

In the office, well over 50% 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 of 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 the user is 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. Establishing a remote connection works the same as establishing a connection in the office—the user simply double-clicks on the desired network object. Similarly, if the user double-clicks on 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 IPX, NetBEUI, and TCP/IP network protocols, using industry standard point-to-point protocol (PPP) over the wire, as shown in Figure 1. Because remote access is part of the dynamic 32-bit protected-mode network architecture of Windows 95, users don't have to re-configure or reboot their computers to continue working after establishing or ending a connection.
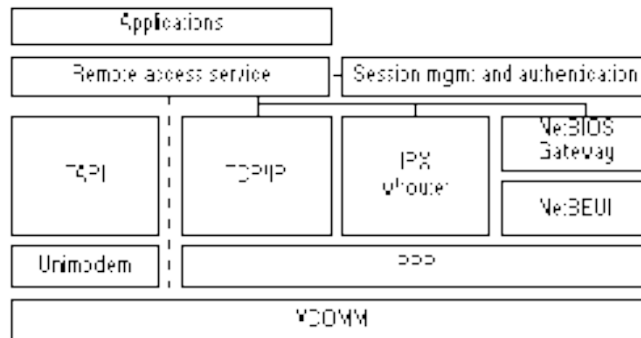
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Figure 1. Remote Access Functionality in Windows 95 Supports TCP/IP, IPX, and NetBEUI over PPP

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 v3.5 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, which a user dials into—Windows 95 provides an easy to use, single-port host, capable of multi-protocol 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-in 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 the Networking section earlier in this Guide.) If the user chooses to dial into a host system such as Windows NT, Shiva Netmodem/ LanRover, or NetWare Connect, Windows 95 offers full connectivity.

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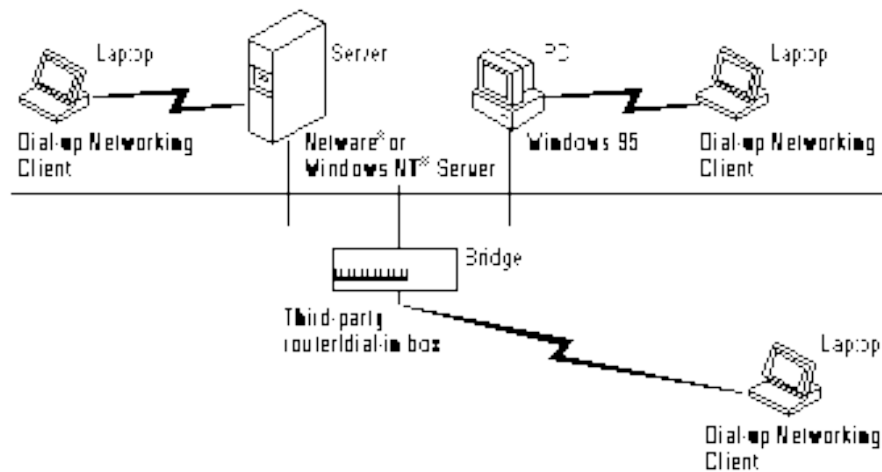
Figure 2. Windows 95 Supports Flexible Remote Connectivity Options and Broad Network Access

Windows 95 provides a modular, open architecture which 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- and device-independent to enable universal connectivity. This means, for example, that 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 modular authentication provider that can be supplemented or replaced to provide custom security services. For instance, suppose the BrandX Company wanted to provide its own custom services. That company can replace the authentication DLL in Windows 95 with its own to take advantage of BrandX-specific security features.

The following diagram 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 offered by the basic provider supplied with Windows 95.

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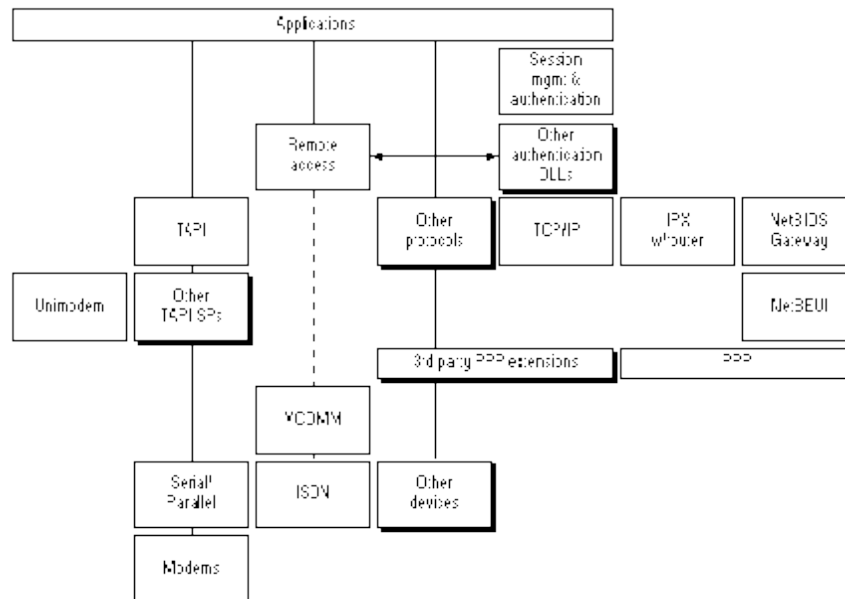
Figure 3. Third-party service providers integrate directly into the Windows 95 Remote Access architecture

Telephony API

To communicate in a mobile environment, users and applications must dial phones or modems. Applications can use the Telephony API (TAPI) in Windows 95 to dial, whether the device is a phone on a PBX system, an ISDN board, or a modem. TAPI provides services to 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 (discussed in detail in the following section).

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

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switch their location, and Dial Helper adjusts the prefixes, area codes, and other parameters automatically.

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Unimodem

Windows 95 provides an easy, central, extensible mechanism for installing and configuring modems (very similar to Window's infrastructure for printers). Windows 95 automatically detects the modem and provides a default configuration for it. Once the user installs a modem, it is available to all applications. Applications no longer need to store modem commands or data on 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.)

It is important to note that both TAPI and Unimodem use the extensible 32-bit communications architecture in Windows 95. See the Communications Architecture section of this guide for additional information.

Dynamic Networking

Historically, network users with a portable 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 the user is 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 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.

Finally, 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.

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Password Management

Users constantly strive to protect the data on their portables from prying eyes and hands. This is no easy chore. 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 computer. The Master Password gives users the opportunity to unify all their different passwords under a single password regardless.

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

Moving To and From the Desk

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 re-configuring and re-booting 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 choose "Eject PC" from the shell's "Start" menu. Windows 95 checks for any potential problems before undocking, and the system undocks (without powering down, if the user chooses). Once undocked, the system automatically reconfigures for the different hardware (for example, changing video resolution to 640x480 to match the resolution of the built-in display), and continues running.

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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 they can react intelligently. These messages include:

u **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

u **Power Management**
   System about to suspend
   System suspended
   System resumed

u **PCMCIA**
   Device inserted
   Device removed

u **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 the portable PC user. Windows 95 itself takes full advantage of these messages. For example, the applications shipping with Windows 95 alone use the Config Changed message in the following ways:

u the Briefcase uses it to try to start updating

u the print spooler uses it to print all deferred print jobs

u Mail uses it to try to reestablish a network connection.

The Registry

The Registry provides a centralized, dynamic data store for all Windows settings. The Registry defines a "current configuration" branch to enable ISVs to better serve the needs of a mobile user. This branch stores information on a per-configuration basis. For example, the Desktop Control Panel 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, asking the user for a friendly name for the configuration, and then storing hardware and software associated with this configuration. Applications access and store information for each of the different hardware configurations that the mobile

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user uses. This registry support enables applications to gracefully adapt to different hardware configurations.

PCMCIA Support

The emergence of PCMCIA cards has been one of the most exciting advances in the portable market. To date, however, users were never sure if the card was compatible with their portable, 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-memory footprint. Windows 95 ships with an updated version of card and socket services. A compatibility testing/logo program ensures compatibility with these standards.

Installation of a PCMCIA device is as simple as inserting the card. Finally, insertion and removal of cards happens dynamically. For example, when the user plugs in a PCMCIA network card, the portable 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.

Power Management

One of the curses of a portable user's existence is battery life. Windows 95 supports Advanced Power Management (APM) 1.1, which represents a major step forward from APM 1.0.

From an end-user perspective, there are three major changes. First, the Windows 95 shell includes a battery meter that provides the user with an accurate representation of the battery life they have remaining. Second, the user will be able to put their system in "Suspend" mode directly from the "Start" menu, as opposed to going to a hardware control. Third, users will have the option of automatically powering their PC off when they shut down Windows. (In the past of course, the user had to shut down Windows, then use the hardware power switch to shut off the PC.)

From a software vendor's perspective, Plug and Play APM messages allow applications to react to changes in the power state and battery life. For example, a mail program or utility that does background disk compression could disable this feature when running on limited battery power.

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Flexible Video Resolution Support

In one focus group after another, "poor display" was cited as the number one limitation of portable computers. To overcome that limitation, portable vendors are putting high-end video controllers into portable PC systems, and users are plugging an external monitor into their portables 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 the user has a monitor attached, they can set their video resolution at 1024x768, for example. When they undock (or detach the monitor), the video resolution changes to 640x480. Whenever they return to their connected or docked configuration, the resolution will automatically return to 1024x768.

Pointing Devices

In our focus groups, portable PC users often described difficulties in switching between the integrated pointing device on their portable (for example, a trackball or clip-on mouse) to a desktop pointing device.

Windows 95 improves on this in two ways. First, when the user changes configurations, Windows 95 automatically detects which pointing device is available to use, and enables it. Second, users can plug in a Plug and Play serial mouse and the system will detect the new mouse, and dynamically reconfigure so the user can it. No manual configuration changes are necessary.

Dealing With the Mobile Environment

File Synchronization: The Briefcase

Portable PC owners who also have a desktop PC (or who connect to a network) need to keep the most up-to-date files on the computer they are currently using. Today, users most often do this by comparing the dates stamps on files, and manually copying files from one machine to another–a tedious, un-intuitive, and error-prone process.

The Windows 95 Briefcase minimizes these headaches by keeping track of the relationships between different versions of a files on different computers. The user interface for this feature employs a simple metaphor that users are already comfortable with—a briefcase.

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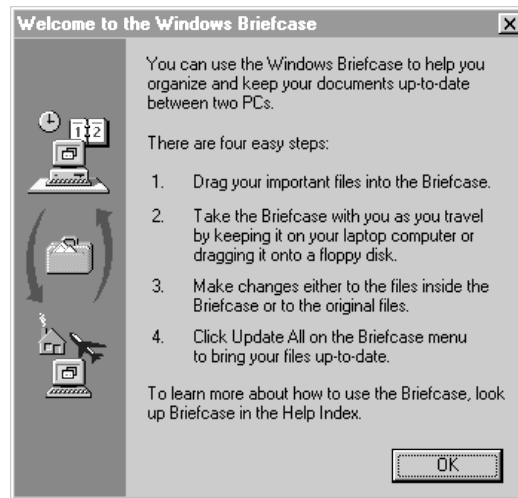
Figure 4. Initial Briefcase Screen Outlining the Briefcase Process

After installing the Briefcase software on the portable PC, a user can specify which files and directories he or she wants to take keep up-to-date by dragging and dropping those objects into the Briefcase. When the user reconnects the portable to the network or desktop PC, Briefcase automatically updates unmodified files on the host with the recently modified files from the portable. If both files have changed, Windows 95 calls the appropriate application to merge the disparate files.
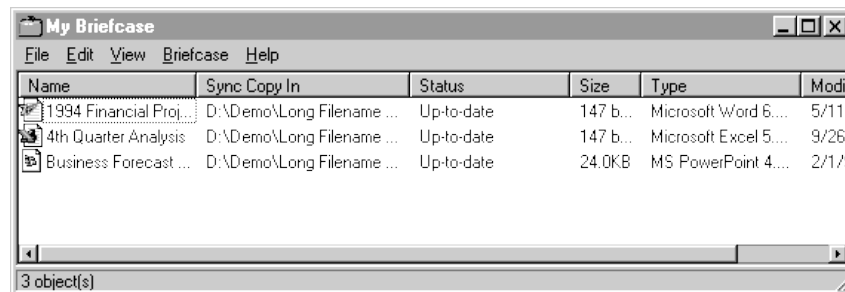

Figure 5. Sample Briefcase Contents Showing Document Status

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

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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.

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, a user can address a fax message in the Microsoft Exchange client and attach a binary file (such as a word processing document) just the way they do in mail today. 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, for those people with a Class 3 fax machine, 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 the Microsoft Exchange section in this guide.

"Local" Connections

Roughly 70% 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 this transfer is via a direct (parallel or serial cable) connection. Windows 95 makes this process significantly easier. 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 like Infrared (IR) provide another form of local connection. Using the extensible device driver architecture in Windows 95, Microsoft is

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working closely with creators of wireless devices to develop and ship Windows drivers for these new technologies.

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Document Viewers

Like other PC users, portable PC users often exchange documents with customers or other people in a different work environment. Many times, however, a mobile user (owing to limited disk space or lack of network access) doesn't have the applications needed to view files that they're received.

An extensible, replaceable file viewer technology has been seamlessly integrated into the Windows 95 shell. Users simply select a file and choose "Quick View". Windows 95 directly supports more than 30 different 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 the Windows 95 User Interface section in this guide.

Deferred Printing

Users generate print jobs regardless of where they are. Windows 95 supports "deferred" print jobs, which enables a user to generate print jobs even if a printer is not currently connected. The print jobs are stored by the system; when a printer becomes available, 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. So, if they aren't sure which printer they will be connected to next, users can still queue the print jobs, then specify the printer only when a physical device is available. This functionality also enables users to easily use printers available at customer sites, in copy centers, etc.

Finally to better support the mobile user, Windows 95 stores the default printers on a per configuration basis. If the user has a different printer at home then they do the office, when Windows 95 detects the change in location (for example, docked versus undocked state on a computer), it will change the default printer.

Remote Mail

Historically, a user leaving the office also left behind robust e-mail capabilities. Microsoft, Lotus and other e-mail vendors are changing this. Windows 95 delivers the next generation of remote mail. They simply connect a phone line to their modem and start using mail. The remote connection is established automatically for them 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, downloading only specific messages and getting an estimated time to download and status of the download process.

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Messaging API

The Windows 95 Messaging API (MAPI) makes the communications abilities of mobile users significantly more powerful. More than any other class of users, mobile user need access 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 (e.g. both CompuServe and their corporate network).

MAPI is an open, extensible messaging infrastructure standard. This standard 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."

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