Microsoft At Work### Architecture

Backgrounder

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A Week in the Life

"Just look at these expense figures," groaned Jim. "Fax costs up more than 40 percent from last year. There goes the headcount for Marty's new associate." As the person in charge of technology services, Jim knows his legal firm could cut costs significantly by using even a few of the features on existing fax equipment or telephones. "But teaching people to use them is probably futile. I'd be happy if everyone could just figure out how to send faxes with client codes attached to the numbers." As the image of the agonizing ritual of scrutinizing the phone bill to find calls that should have been billed to clients runs through his mind, Jim wonders if there isn't an easier way.

"Would the partners be willing to learn how to use cost-saving features they've already paid for if they knew that 30 percent of the firm's fax costs could be saved if they faxed things during cheaper rate hours? That's enough savings to hire that new associate!"

The phone on Jim's desk rings — on to other issues. "Oh, you need to speak to Beverley. She's working on that part of the project," said Jim. "I know she's in her office. Let me try to transfer you. This should work, but if I lose you ... "

Introduction

No doubt you can picture yourself in a similar situation. Yet wasn't there once a vision of modern business life that was very different? The "paperless office," the "office of the future," the "global village"? These phrases were coined to describe the concept of a tightly integrated work environment incorporating the latest in sophisticated office equipment, but like most businesspeople, you probably continue to look at the overflowing pile of paper on your desk, the reminder notes stuck to your PC screen and the message light flashing on your telephone. Somewhere in all that data is valuable information: faxes showing the latest sales figures, messages from important customers and copies of new product plans.

Throughout the last decade, everyday office work has been irrevocably altered by the personal computer. Typewriters and dedicated word-processing systems are now oddities in many offices. High-quality laser printers are commonplace. Access to electronic mail systems has changed communication between millions of people. The intense pace of modern electronic product development and competition has spurred advances in every office device. Sophisticated fax machines are available for a few hundred dollars. Your telephone probably has more special-function buttons than you know what to do with. You wonder whether you could make effective use of one of those pocket-sized organizers.

Every device on your desk gives you the ability to accept and generate more data. Yet synthesizing this data into timely, valuable information and communicating it to people who can act on it, remains difficult. To edit a fax usually requires retyping into a computer, despite the fact it was probably created on a computer. You can't review your voice mail and electronic mail messages at the same time, nor sift through voice mail messages randomly to select the most important ones first. Documents are distributed in different ways depending on whether speed, quality or editability is most important. "Phone tag" and now "voice-mail tag" are daily events.

The individual devices in the modern office just don't *work together* very well. And as newer devices of higher speed and greater capacity appear for still lower prices, the dual problems of data overload and incompatibility only get worse. That's why Microsoft Corporation, supported by key representatives from the office automation, telecommunications and computer industries, is leading a multicompany initiative to build office machines and computer products that offer the following:

Ease of use, allowing users to access all product features and to tailor the devices to their own preferences and the way they work.

A high level of integration, allowing all devices in the workplace to communicate seamlessly with one another, in any combination (phone, fax, copier, PC, handheld, etc.).

An enabling platform, allowing system developers to create a broad family of products that third parties can employ to develop a wealth of value-added software to solve real-world problems for users.

The Microsoft At Work### architecture will be a set of software building blocks that reside in both office machines and PC products, including the following:

Desktop and network-connected printers.

Digital monochrome and color copiers.

Telephones and voice messaging systems.

Fax machines and PC fax products.

Handheld systems.

Hybrid combinations of the above.

In addition to the shared objectives of creating a well-integrated office, the products mentioned above will also share the following Microsoft At Work architectural components. More and more information today is being created and stored digitally on computers. Building on the existing business and technical infrastructure, the Microsoft At Work architecture focuses on creating digital connections between machines to allow information to flow freely throughout the workplace. The Microsoft At Work software architecture consists of several technology components that serve as building blocks to enable these connections. Only one of the components, desktop software, will reside on PCs. The rest will be incorporated into other types of office devices, making these products easier to use, compatible with one another and compatible with Microsoft### Windows###-based PCs.

Microsoft At Work operating system. A real-time, pre-emptive, multitasking operating system that is designed to specifically address the requirements of the office automation and communication industries. The new operating system

supports Windows-compatible application programming interfaces (APIs) where appropriate for the device.

Microsoft At Work communications. Will provide the connectivity between Microsoft At Work-based devices and PCs. It will support the secure transmission of original digital documents, and it is compatible with the Windows### Messaging API and the Windows### Telephony API of the *Windows###* Open Services Architecture (WOSA).

Microsoft At Work rendering. Will make the transmission of digital documents, with formatting and fonts intact, very fast and, consequently, cost-effective; will ensure that a document sent to any of these devices will produce high-quality output, referred to as "What You Print Is What You Fax Is What You Copy Is What You See."

Microsoft At Work graphical user interface. Will make all devices very easy to use and will make sophisticated features accessible; will provide useful feedback to users. Leveraging Microsoft's experience in the Windows user interface, Microsoft At Work-based products will use very simple graphical user interfaces designed for people who are not computer users.

Microsoft At Work desktop software for Windows-based PCs. Will provide Windows-based PC applications the ability to control, access and exchange information with any product based on Microsoft At Work. Desktop software is the one piece of the Microsoft At Work architecture that will reside on PCs.

Microsoft believes the Microsoft At Work architecture will succeed in the market for the following reasons:

1. **It focuses on real user needs.** Information is the lifeblood of the organization, yet the principal tools people use every day to create, manipulate, analyze, exchange, present and communicate information are not connected. There is a tremendous need to move information both down the hall and across the globe. Making office equipment efficient and easy to use will permit people to get work done more quickly and cost-effectively.

2. **It is a pragmatic solution.** The world is not going to change overnight. Organizations will not discard existing, functioning equipment — much less rip out an entire installed base of systems — to get the incremental benefits of a new generation of office equipment. The Microsoft At Work architecture is a very practical, evolutionary approach. It defines a logical path to a more functional and well-integrated workplace. Microsoft At Work-based devices and products will be able to be deployed alongside of, and be compatible with, existing office products (for example, Microsoft At Work-based fax machines will communicate with existing fax machines and telephone networks). Microsoft At Work-based devices and products will build on the existing infrastructure. Of course, the architecture and devices will integrate well with the Microsoft Windows operating system, the widely used desktop operating environment. There are also compelling ease-of-use benefits to using a single Microsoft At Work-based device that is not integrated with PCs or other Microsoft At Work-based office machines.

3. **It relies upon relationships with others.** These relationships are with the leading companies in the office equipment, communications and computer industries. Thus, no single company faces the enormous challenge of producing the best product in every category to deliver on this vision; at the same time, a single, broad, and open platform will be established upon which many companies can build profitable businesses. By incorporating Microsoft At Work software, vendors can devote their resources to excellence in their own markets, and to producing high-quality, compatible products. Of course, the end result will be a wide variety of compatible products and services from which customers can pick and choose.

What Are the Common Architectural Benefits?

The Microsoft At Work architecture will make it easier for people to use office equipment in the workplace. In addition, it will let information to flow freely within an organization's information infrastructure ### no matter how large or small the organization.

Ease of Use

Incorporating graphical user interfaces into common office devices will effectively increase their usability. Whether on the device itself or on a connected PC, the graphical user interface will make powerful features both accessible and useful. It will replace the cumbersome button-and-code combination on many devices today. For example, context-sensitive icons will allow far richer information to be displayed and will be shown only when appropriate to the tasks being performed. Devices will lead users step-by-step through complex operations. Users will be able to better exploit existing features as well as the additional capabilities of this new generation of

office equipment. Consequently, complex machine functions, rarely exploited today, will become routine.
Simple, clean graphical user interfaces will free users so that they will not need to refer to printed operating instructions to accomplish tasks. For example, a phone could lead a caller through the process of setting up a conference call or forwarding voice mail. The current status of a print or copier job could be conveyed instantly through a visual display. Sending a fax to multiple people would be as simple as selecting their names from an on-screen list.

Once the capabilities of devices can be truly exploited, users will gain greater control over their communications, which they are too often controlled by. Many of us are enslaved by seemingly permanently illuminated voice mail lights. We spend our days walking between the printer, the copier or fax machine, and our desks — or sprinting to make overnight-mail pickup deadlines. The Microsoft At Work architecture promises to enable people to manage their communications more effectively and efficiently by prioritizing communication tasks, expediting urgent contacts or personalizing communication tasks for their own needs.

Integration

The communications capabilities of the Microsoft At Work architecture mean that all the devices in the workplace will readily and efficiently exchange digital information.
One key to achieving this cooperation between the different devices will be the storage and transmission of information in a standard digital format that each Microsoft At Work-based product will understand. What is initially sent to one office device will be able to be retransmitted to another without deterioration of information that does occur today when a document is faxed or copied repeatedly. With this format, a user will be able to send the final version of a document prepared on a PC directly to the copier and avoid any loss in reproduction quality. When viewed, these digital documents will always be of the highest possible quality permitted by the device, whether on-screen or on the printed page. In addition to the benefits of a common way to exchange documents, this digital format has other advantages as well. Documents will be able to be sent in editable form, ending the need to retype faxes, while other documents such as invoices may be sent as inalterable "published" documents. Confidential documents will be able to be sent in a secure format that only the intended recipient can read.

Devices will also cooperate to complete tasks so that users can combine the capabilities of different devices or effectively share devices. For example, a PC will be able to provide the phone number for a telephone to dial. When jammed, a printer will be able to notify a user waiting for a print job. A copier low on toner will be able to send a message to an administrator. A fax machine connected to a PC will be able to scan images into the PC without sending a fax. With network administration services and communication between devices, network administrators will be able to oversee the operation of all devices connected to the network. For example, instead of having to manually update the phone directories in every fax machine, administrators might download them electronically.

Users will also benefit from a single integrated "inbox." They will be able to access and manage all messages —
e-mail, voice mail, pager messages or fax — from a common interface, whether on a PC or other devices.

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Figure 1. PC-based Integrated Messaging.
Illustration of what an integrated messaging system may look like. Note the telephone and envelope icons that distinguish voice and visual messages.

An Enabling Platform

The Microsoft At Work architecture introduces a new concept for office equipment: These devices will become an open *platform* upon which to build a broad range of customer solutions. This notion means devices are configurable, upgradable, scalable, extensible and programmable. A platform with these attributes will allow corporate developers, manufacturers, independent hardware and software developers and anyone else to contribute, configure, modify and add value to the core products. A broader base of vendors building solutions on a common platform ensures more innovation and more customer needs will be fulfilled. Consumers will not be dependent on a single vendor to conceive of, much less deliver, every possible enhancement. Office equipment would be a more cost-effective investment if it were upgradable or scalable.

The ability to upgrade products solves two problems. First, when users outgrow a machine's capacity, they won't have to buy a new one. Second, organizations purchase a variety of product brands or models to address different usage patterns within an organization, and organizations frequently end up with devices that work differently. Machines have different user interfaces, feature sets and set-up procedures.

The Microsoft At Work architecture will allow manufacturers of office equipment to offer a full family of devices that can be upgraded and changed as users' needs change. For example, a user could buy a standalone fax machine and later decide to add a LAN connection module. He or she could buy additional memory or even a hard disk. When traffic increases, a second line could be added. This all adds up to a much more economic investment for the consumer.

In addition to being upgradable and compatible across a family of products, devices need to be extensible over time. The Microsoft At Work architecture is forward-thinking and by virtue of a modular design can accommodate the addition of new capabilities over time. As fax standards extend to cover the transmission of color documents, for example, the Microsoft At Work architecture would maintain compatibility with existing devices while incorporating new capabilities through upgrades.

Microsoft At Work-based devices, such as PCs, would include a microprocessor and would therefore be "programmable." Applications could be constructed that exploit the capabilities of the device to solve specific problems. This capability will provide a level of flexibility not found in today's office equipment, which cannot perform tasks beyond the basic set of functionality packaged into the device. For example, a law firm might add an application to its telephones that tracks calls by client and automatically forwards that information to the billing system, eliminating the need for the manual logging of calls. A retail outlet might put its inventory system on a handheld device so that employees could easily access the system while checking actual stock on the shelves. Or an organization might make commonly requested information, such as product price lists, available via fax to anyone who calls.

Applications such as these allow ordinary office equipment to be tailored to individual requirements and integrated into business systems. But to see the benefits of applications, they must be easy to develop. Fortunately, all systems based on Microsoft At Work are completely open to software developers and hardware systems manufacturers. Microsoft At Work-based devices will follow the same programming model of Microsoft Windows, a widely used applications development environment. Consequently, hundreds of thousands of programmers, already familiar with Windows, already know how to develop applications for devices based on Microsoft At Work. Third-party developers will create applications and services for both PCs and Microsoft At Work-based devices using the same standard Windows-based development platform and tools they use today to develop PC applications. The Windows-compatible APIs in devices based on Microsoft at Work allow developers to write and test new applications and services on PCs and then download them to new devices.

The Microsoft At Work-based Products

The Microsoft At Work-based Telephone System

The telephone is the most pervasive communications tool. In the United States alone, the volume of calls runs in the hundreds of billions each year. Despite its integral and ubiquitous role in the daily business routine, there have been few changes in how the telephone is used. It remains isolated from computers and other information devices, despite the fact it manages related information. New time-saving network features are available, but few people exploit them because they are so difficult to use. Innovations such as voice mail have become indispensable, but at the same time they have introduced their own set of frustrations.

The Microsoft At Work architecture offers a range of capabilities to enhance and integrate telephone systems. An array of products will give users greater access to the capabilities of different telephone networks, more flexible control over their communications and the ability to tailor phone systems to particular requirements. Future Microsoft At Work-based phone products include the following:

Microsoft At Work-based telephones. The latest evolution of the telephone. Users will be able to truly exploit rich networks to communicate more effectively and efficiently. These devices will include desktop, public and portable phones, and will be able to be integrated with PCs.

Microsoft At Work-based PC phones. Users of Windows-based PCs will also be able to tap rich communications when their PCs are connected to telephone networks. Microsoft At Work desktop software will be a standard component of the Windows operating system and will allow users to tap telephone networks connected via an add-in board, locally connected telephone or a LAN.

Microsoft At Work-based visual voice messaging servers. LAN-connected voice messaging solutions will allow access to voice messages via a visual interface on both Windows-based PCs and Microsoft At Work-based telephones. Users will be able to bypass time-consuming and confusing audio menus and access their voice messages with the push of a button. Messages will be able to be retrieved in any order and even delivered to a single mailbox along with other messages such as e-mail and faxes. These servers can provide applications beyond basic voice messaging, such as supporting voice annotation of PC documents or reading electronic mail over the phone to a traveler.

Key Benefits

The key benefits of the different varieties of Microsoft At Work-based telephone systems include the following:

Far Greater Ease of Use

Making a telephone call today is as simple as dialing the number. But for operations beyond

dialing a call, telephone features are difficult to access. Today's telephone networks offer a rich variety of valuable features, but research consistently shows most go unused because the features are so hard to access. Some require users to remember complex activation codes. Others require immense dexterity, and errors result in losing the call. Even the most basic operations like conference calling or transferring a call are often preceded by the instructions, "If I lose you ... ," which illustrates how uncomfortable people are with using these features.

Phone systems using the Microsoft At Work architecture will allow users to control their phones from a graphical display, either on the phone itself or on a neighboring Windows-based PC. The graphical user interface will be able to make every feature easier to use and will present features in context and guide users through each step to accomplish a task. For example, the phone will let users easily specify urgent calls to take and forward all others to a receptionist.

Flexible Communications Management

The telephone does nothing today to help users manage their communications — they have little say in who they talk to or when they talk. There is almost no flexibility to handle callers in different ways.

Phone systems based on the Microsoft At Work architecture will help people to prioritize and expedite communication tasks, saving both time and money. Not all calls are equally valuable at any given moment. The need to prioritize communication is evident in the use of answering machines and receptionists — people even pretend to be their own receptionists to screen calls. The Microsoft At Work architecture will provide phone systems that let users decide which calls to take and will even handle specific calls automatically. A Microsoft At Work-based phone system will help complete connections between people so that they can conduct their desired communication. The goal is to win at "phone tag" and reduce the length and number of callback cycles.

The Microsoft At Work software will empower users to configure their phones to work the way they work, saving time and effort. If users choose to, they will be able to easily define and organize their communication capabilities based on personal preferences. For example, they would be able to record and save multiple outgoing messages for repeated use ("I'm out today but checking messages ... ," "I'm out today and will NOT be checking messages ... ," "I'm in today and will return your message as quickly as possible ... ").

Figure 2. Communications Management.
Illustration of how a graphical user interface will make all telephone capabilities accessible and truly useful. Features will only be presented in context and users will be lead through operations step-by-step, such as setting up a conference call. There will be no more codes or difficult-to-remember sequences of buttons.

Visual Voice Messaging

Voice-mail and answering machines are becoming ubiquitous for an obvious reason: A successful telephone call requires both parties to be available at the same time, which happens in only a minority of calls, hence the need for messaging. Despite their popularity, today's messaging systems are very inflexible. Messages are only accessed in sequence; there is no way to first check for messages from a boss or co-worker on an urgent project. It is also difficult and

time-consuming to navigate through menus of features. In addition, voice messages are difficult to save and retrieve at a later date. All callers are handled in the same way. One of the results of these inconveniences is "voice-mail tag."

The solution is *visual voice messaging*, which will provide graphical management of voice messages. Messages will be able to be displayed in a list, much like electronic mail, including the caller's name or number, the time he or she called and the length of the call. This information would let the user browse all messages and select the order for listening to the messages. Administrative options, such as creating a new greeting, will be accessed with a single button. Operations that are difficult today, such as forwarding a voice message to multiple people, will be dramatically simplified. One will simply select the recipients from the phone book and broadcast the message.

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Figure 3. Visual Voice Mail.
An illustration of how a visual interface for voice mail on telephones will allow users to listen to messages in any order, easily archive and retrieve messages and manage their voice messages with the click of a button. Navigating through complex and time-consuming audio menus will not be necessary.

Visual voice messaging will be delivered on telephones incorporating the Microsoft At Work architecture or on Windows-based PCs. Moreover, the Microsoft At Work architecture allows voice messages to be integrated with electronic mail, fax or other message types so that users will be able to access and manage all their different message systems from the same place in the same way.

Telephone Communications United With Information Systems

Telephone calls are transitory events. There is no record of what occurs in a phone call except what the people on each end record manually. Yet telephone calls rarely exist in a vacuum. More than 60 percent of all calls occur during business hours[1] and are usually part of a broader business process, such as a transaction, consultation or teleconference, where important information is at each end of the call. Integration of telephone communications with information systems will both record and provide important contextual information.

For example, a phone or neighboring PC could automatically "pop" information related to the caller, such as reminders of things to discuss. Providers of professional services, such as lawyers, could automatically track their calls by client for billing purposes. Customer service representatives could use related information to offer faster and better service. Other applications might do banking and other financial transactions, access white or yellow pages or anything else done over the phone today.

The Microsoft At Work architecture will transform the telephone from a closed, proprietary device into a platform
that a wide range of people can build applications for and integrate with other parts of the information infrastructure.

1Source: Northern America Telecommunications Association

The Microsoft At Work-based Fax

According to a recent Gallup poll, fax traffic grew 43 percent last year[1]. According to network traffic studies, faxes currently account for 10 percent of all network traffic and nearly 50 percent of traffic between the United States and the Far East[2]. Yet, despite this dramatic growth in usage, the fax is still a fairly primitive communications tool. Difficulty using machine features, low-quality printing, lack of integration with the work environment and lack of security are all commonly identified problems.

Microsoft At Work-based fax capabilities will address these deficiencies with a broad spectrum of fax solutions that will transform the fax from an independent tool to a powerful, integrated part of the modern communications process. Microsoft At Work-based fax products include the following:

Microsoft At Work-based departmental fax machines. A standalone multifunctional machine (fax, print, scan, copy) will be able to be used by a single person or an entire department of people. In addition to being great standalone devices, they will be able to be integrated completely with PCs. They will also be sharable via direct network connection or via direct PC connection.

Microsoft At Work-based fax servers. High-volume, LAN-connected fax solutions will offer the ideal platform for automating wide-area communication tasks, such as forms automation, billing and invoicing with suppliers, distribution of information to a field organization, etc. A host of new applications will be possible when users and developers can count on a widely deployed, secure, anywhere-to-anywhere messaging platform that will be provided by Microsoft At Work-based systems that are also integrated with Windows-based PCs.

Microsoft At Work-based PC faxes. Any user of Windows with an industry-standard fax board will benefit from rich document transmission through Microsoft At Work desktop software that will become a standard part of the Windows operating system and other Microsoft At Work-based products and services.

Microsoft At Work-based fax-enabled network. Public networks will be adding support for Microsoft At Work communications, allowing users to benefit from their high-volume broadcasting capabilities and the ability to access integrated, public mailboxes from any location.

Key Benefits

Key benefits of Microsoft At Work-based faxes (as implemented in any of the above products or services) will include the following:

Far Greater Ease of Use

While today's fax machines have dozens of advanced features, few are ever used. In fact, many users do not even know these features exist. The problem is that the small, cryptic display on

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1Gallup, 1993
2AT&T Network Traffic Study

today's fax machines makes these features inaccessible to users. To compound the problem, owners' manuals are rarely available when a problem occurs.

Microsoft At Work-based fax machines will use a graphical, touch-sensitive display to make every feature simple to use. Context-sensitive features will help guide users through tasks. For example, if a jam occurs, a picture showing users how to clear it will be displayed.

Figure 4. Mail Fax Screen.
Illustration of how clearly labeled buttons and context-sensitive help will make all features easy to access. Screens will be designed to make every fax operation fast and straightforward for the user.

Figure 5. Fax Send Screen.
Illustration of how a Send Fax screen will clearly list the number of designated recipients and display additional options for sending faxes, including Delay Send and Security.

Ability to Send Original-quality "Published" and Editable Documents

Today's fax machines send fuzzy pages that are often difficult to read. As a result, people either don't use a fax when the document has to look professional, or they send another "good copy" via courier. Today's machines also don't allow users to send editable documents, which would enable wide-area joint authoring and the automation of many communication tasks.

Using Microsoft At Work rendering technology, a fax machine will become a remote publishing tool, allowing users to distribute final, laser-quality versions of documents directly from PC applications. Users will also be able to send editable versions of documents to reviewers and co-authors so that changes can be made directly without re-keying information, and then be returned to the author.

Full Document Security

The most frequently faxed documents include contracts, internal correspondence and purchase orders[1]. Despite the sensitive nature of these documents, anyone can walk by and read or pick up received faxes, and there's no guarantee that the document will even get to the proper recipient. Some fax machines advertise security features, but these machines are not really secure. Passwords are included in the message, but the encryption method is easy to break. Moreover, all of these methods require both sending and receiving machines to be from the same manufacturer, a rare occurrence in today's market.

Microsoft At Work-based faxes will have strong built-in security that will allow users to encrypt messages so that documents aren't read by others. It will also be able to ensure that documents are delivered to intended recipients and verify document contents as authentic. By implementing Microsoft At Work security in both Windows-based applications and in devices from a broad base of manufacturers, secure messaging could become as commonplace in the future as regular fax transmissions are today.

Strong PC Connectivity

While the vast majority of all documents today are created on PCs, most users still print documents and manually feed them into fax machines. Users who choose to investigate PC fax

1 BISCAP Fax Usage Study, 1992.

alternatives find them unreliable and not well-integrated into their PC environment.
The Microsoft At Work-based fax is designed to fully integrate faxes with the rest of a PC's messaging environment by integrating this functionality into the operating system. Users will be able to send fax messages in the same way they send other messages, simply by selecting "Send" from their mail package or their favorite application. Received faxes will be automatically delivered into the user's mailbox — the same mailbox where
e-mail and voice-mail messages are received. They will be able to forward and reply to the message with a single button click.

MIS Support

Today's fax machines are a nightmare for MIS professionals. They can't be centrally managed, so someone has to walk around to every machine to update fax numbers, change settings, collect activity reports and fix problems. Most machines don't support "default settings," so they can't set up machines to do things such as automatically send faxes when telephone rates are lowest. Users frequently can't enter accounting codes to track costs, and even when they can, the resulting reports can only be printed out, so the data must be manually entered into the accounting system. Finally, fax machines represent a network entirely distinct from the advanced data networks that they pay every month to maintain. MIS professionals should rightly wonder why they can't send all that "charged-per-minute" fax traffic over the data lines for which they pay a fixed monthly fee.

Microsoft At Work-based fax machines are designed to let MIS manage fax services in the same way as other corporate communication resources. They will be centrally administrable so that any settings can be changed directly, and common resources such as address books will be able to be maintained and downloaded automatically. They are programmable so that faxes queued up after 4 p.m., for example, will be able to automatically be sent at discount rates, saving between 25 percent and 40 percent on toll charges[1]. Activity reports will be able to automatically be sent in binary format to accounting, where they could be entered into accounting systems directly. They will automatically send trouble reports when problems occur. They will easily route traffic over existing corporate data networks, saving 95 percent of the transmission costs[2].

Features to Reduce Fax Costs

Long-distance charges and the employee time required to send and receive faxes account for more than three-fourths of total fax costs, while the cost of the fax machine accounts for only 15 percent[3]. Yet today's fax machines do little to address these costs. Moreover, the few features that manufacturers have added are virtually unused because they are so difficult to access. For example, while most mid- to higher-end machines offer the ability to delay fax transmissions until rates decrease, few people know how to use this feature today.
Microsoft At Work-based fax machines will have features to dramatically reduce fax costs. In addition to making cost-saving features easy to find and use, Microsoft At Work rendering will reduce file sizes and, as a result, transmission times. Digital cover sheets can decrease the cost

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1Based on AT&T### After Hours discount rates. Other long distance carriers have similar discount programs.

2Based on a comparison of average per-minute toll charges to amortized T-1 transmission charges between Redmond, Wash., and New York City.

3Based in part on internal calculation of average toll charges per machine and lost labor walking to and from the fax machine, and is corroborated by BISCAP's finding that toll revenues for fax are three times the revenues from fax machine sales.

of a typical four-page fax by up to 25 percent[4]. As noted above, simple access to discount transmissions can reduce toll charges by 25 percent to 40 percent and integration with corporate networks would reduce toll charges by as much as 95 percent.

Microsoft At Work-based Handhelds

The promise of a new generation of small, powerful computing devices that will help you do everything you want, anywhere you want, is an alluring vision that has received a great deal of attention over the past year. Microsoft and others wishing to build products based on Microsoft At Work agree that there is incredible potential for such systems — but only if they are fully integrated with the rest of the existing information infrastructure. As with all Microsoft At Work-based systems, the handheld will provide a pragmatic solution. We have concentrated on the following:

Focusing on connecting users to their desktop work environment, where the vast majority of useful business information resides.

Providing an open, well-defined and accessible development environment that draws on the wealth of software talent embodied by more than 300,000 programmers for the Windows operating system.

Leveraging existing infrastructure such as the current phone system, while providing a
well-architected system that can integrate new capabilities as they come online.

Providing centralized, comprehensive communications management for fax, e-mail, pager and other mobile information sources.

Offering a highly customizable platform for quick, simple vertical and personal software solutions.

Key Benefits

Key benefits and attributes of the Microsoft At Work-based handhelds include the following:

Strong Personal Information Management

The modern office is evolving rapidly, giving people access to a wealth of information. Yet this information is largely unavailable when it is probably needed the most — when the worker is away from the office. A Microsoft At Work-based handheld is designed to fulfill the needs of a variety of mobile workers. The target system will be extremely small, encouraging the user to carry it always. Intrinsic software will allow complete management of personal information by providing address book, calendar, to-do list, note taker, clock and calculator applications. Communications will be supported by built-in mail connectivity as well as special features for sharing information with desktop computers efficiently and accurately. Additional applications will be added easily through the Microsoft At Work open architecture and development tools — by OEMs for market segmentation purposes and corporate developers who want to create

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4BISCAP Fax Usage Report, 1992. Cost savings assumes that digitally transmitted header eliminates the majority of cover sheet data that is currently sent in bitmap form.

custom solutions.

Desktop Connectivity

While creating a device that will provide rich information to the mobile user is valuable in its own right, some of that value is lost if the device does not cooperate with the other tools of the modern office. The most important of these is the desktop PC, which holds the majority of information and around which work centers in most offices. For instance, if meetings are added to the schedule on a handheld, they should be reflected on the desktop seamlessly. If notes are made about tasks that need to be completed, they should be reflected in the priorities list on the PC. Microsoft At Work-based handhelds will reflect these kinds of messages by providing transfer and synchronization software for both the handheld and the PC. In addition, users will need the ability to access spreadsheets, word processing and other files created on the PC or stored on the network from the handheld. Microsoft At Work-based handhelds will enable users to access any desktop file, allowing spreadsheets and word-processing files to be downloaded, viewed, annotated or even sent via fax or public e-mail.

Figure 6. Mobile Address Book.
An illustration of how the Microsoft At Work-based handheld system address book will hold the fax number and e-mail address for important contacts and clients, all of which will be accessible by communications applications. Additions and changes while on the road will be synchronized with a desktop personal computer.

Integrated, Modular Communications

When working away from the desktop, communication is clearly the key. Microsoft At Work-based handhelds will provide for communications through a number of mechanisms. The built-in e-mail client and underlying modular connectivity layers will allow for simple, centralized management of e-mail, fax, pager and informational messages from a variety of sources. A fax from a supplier, e-mail from a co-worker and a page from the boss will all appear on a single screen from which the user can reply appropriately, with automatic support for the varied transmission methods. The Microsoft At Work-based handheld will include connectivity to a variety of popular networks. The modular nature and open architecture of this system will allow for simple development and integration of drivers to support additional services or new technologies.

Pragmatic Solutions for Today and Tomorrow

Microsoft is building handheld solutions that will make the best use of existing technology to provide real solutions for users. Microsoft has designed these systems to evolve with technology so that they remain the optimal solution. Two examples are in communications and user interface.

Today's data communications are predominantly over wireline networks, providing low-cost transmissions at a respectable speed. Wireless communications hold great promise, but are currently costly, and standards are still being set. The modular communications architecture in Microsoft At Work-based handhelds will make efficient use of both wireline and existing wireless networks immediately, while being flexible enough to accommodate new approaches as they develop.

The Microsoft At Work-based handheld user interface will also develop with technology. By making use of many metaphors familiar to the Windows-based user, this pen-centric system is being custom-crafted to provide intuitive, reliable usage of highly portable devices. A fundamental problem with pen-based computing continues to be the low acceptability of handwriting recognition. While handwriting recognition is expected to improve in time, the Microsoft At Work-based handheld device will be highly usable before such improvements occur. Design goals include a simple navigation and selection system, which will allow most operations to be complete with the touch of a pen. The system will be trainable by the user, and background learning and explicit training sections can be made available. All of these factors make the handwriting recognition in the Microsoft At Work-based handheld a functional, reliable system today.

Extensive Third-party Support

Microsoft realizes the success of a computing system is dependent on its ability to provide solutions to a wide range of customers, and that encouraging third-party software and hardware support is the most effective way to do this. Microsoft will encourage such development through several channels. First, applications will be able to be built using the Microsoft At Work-based handheld software development kit (SDK) on any desktop PC. Second, the Microsoft At Work-based handheld SDK will support desktop development of mobile applications under all the most popular languages, including C, C++ and Assembler. Finally, the familiarity of Windows constructs will allow companies to port existing software to Microsoft At Work-based handhelds with a minimal amount of redesign or reeducation.

Figure 7. Electronic Newsletter.
An illustration how public information such as news stories will be obtainable via telephone line or wireless carrier. Users will be able to obtain general information, such as headline stories, and personalized data, such as particular stock quotes and local sports scores.

The Microsoft At Work-based Printer

With more than 25 million new PC printers introduced into the workplace in 1992 alone and an avalanche of more than 90 billion original paper documents created annually, it's no surprise that the advent of the "paperless office" has been yet again delayed[1]. Undoubtedly, occasions will always exist when there is no substitute for having information literally at your fingertips in the form of a paper document.

While the volume of paper we produce continues to grow year by year, the complexity of those documents has also increased dramatically. The widespread acceptance of the Windows operating system and its graphically oriented applications has made it easier than ever for users to enrich the design and appearance of their documents by integrating scalable type, graphics and photographic images. But the process of printing these high-quality documents has not kept pace with rapidly escalating user expectations. At Microsoft, more than 25 percent of all calls received by the product support organization involve printing problems of one type or another — difficulty installing printers and their associated software, inability to access sophisticated printer features, lengthy delays in printing documents and mismatches between what appears on the PC display and what the printer actually produces on paper. Once again, the Microsoft At Work architecture offers solutions, effectively streamlining communication between the PC and the printer; greatly simplifying users' control and access of printer features; and enabling faster, higher-quality and less costly printing products.

Key Benefits

Fast, Bidirectional Communications

Unlike many of today's copiers and fax machines, printers are already connected to PCs. The vast majority of these printers and PCs communicate over Centronics### or parallel ports. Unfortunately, given the increased sophistication and complexity of many office documents and the increased performance capability of laser printer engines, transferring data over the parallel port has become a key performance bottleneck, severely limiting the speed and robustness with which the PC and printer can exchange information. Even more limiting is the fact that the parallel port has historically been a one-way communication path, meaning that the PC could transfer information to the printer, but the printer could never supply information about its status or operation back to the PC to inform users. The Microsoft At Work architecture for printers will resolve both of these problems, dramatically improving the speed at which data can be transferred over the parallel port and using new software components in both the PC and printer to enable full bidirectional communication, regardless of whether a printer is connected over the serial port, the parallel port or over a network.

Sound and Visual Feedback

Using bidirectional communication, the Microsoft At Work architecture will allow information to flow from the printer back to the PC, enabling users to monitor such things as the time required to finish the current print job, precise error conditions, and paper and supplies status on the PC screen. Exploiting the sound and graphic capabilities of Windows, Microsoft At Work-based printers provide users with rich audio and visual feedback directly from the printer,

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1 Source: Dataquest

forever eliminating the guesswork typically associated with printer operation. Users of Microsoft At Work-based printers will get instant, visual notification of vital printer information, such as low toner, no paper or jammed paper, as well as information about what to do about the problem in order to continue printing.

Figure 8. Printing Status Screen.
After the user initiates a print job, a graphical screen will provide continuous status on time remaining to complete a print job, including prompts to add paper to the cassette or the form-feed tray.

Simple Installation

By exploiting bidirectional communication capabilities, Microsoft At Work-based printers will deliver benefits to their owners even before the first page is printed. Once connected to a Windows operating system, the printer will be able to automatically instruct the host system to load the required printer driver and choose the optimum communication protocol. Thus, users will be liberated from having to choose from a myriad of installation options, and true plug-and-play functionality will be assured.

An Intuitive Graphical User Interface

Microsoft At Work-based printers will be tightly integrated with their Windows PC-based counterparts, using the PC's high-resolution graphics display to provide an interactive graphical user interface. Access and control of all printer features will be as easy as pointing and clicking a mouse, representing a dramatic improvement over the traditional printer control panel with its single-line liquid crystal display and confusing online and nested Menu buttons. Directly from the PC screen, users will be able to easily select and verify the printer's active paper source from simple dialog boxes; manage formatting options, such as print resolution, collating, informative header or trailer pages, and long- or short-edge binding; choose two-sided printing; and enhance images with multiple halftone settings, each with brightness and contrast options.

Figure 9. Printer Set-up.
From a graphical screen on a personal computer, users will be able to point and click to select paper options and cassettes on the printer, check printer status, and select advanced options such as document collation. PC-based control of the printer is enabled through bidirectional communications between the two devices.

Faster Performance

By fully integrating the printing subsystem with the PC operating system, the communications channel and
the Windows imaging model, Microsoft At Work-based printers will exploit Microsoft At Work rendering to enable PCs and printers to share work and information several times faster on the average than traditional
page-description languages can do.

True What You See Is What You Get (WYSIWYG)

To guarantee true WYSIWYG, where the type, graphics, and colors that appear on the screen are

the same as those printed on the page, Microsoft At Work-based printers will use the same font and imaging technology that Windows itself uses. This guarantees the highest level of fidelity between display and printed output, avoiding the inconsistent appearance and slow performance that some printers generate when forced to translate from the Windows imaging model to their own proprietary imaging language before printing requested documents.

Lower Cost

Microsoft At Work-based printers will do more than improve performance, simplify operation and expose new functions to their owners. They will also exploit tight integration with PCs to yield substantial cost savings to both users and manufacturers. The efficiency of the overall architecture will allow printers to be designed with less processing power, less memory, fewer buttons and controls and generally less expense — all while providing printer manufacturers with an enabling platform for new features and models.

Compatibility

The benefits of the Microsoft At Work architecture for printers are not just limited to future printer designs. As with other Microsoft At Work-based devices, Microsoft and others are already hard at work extending the benefits of this new technology to the large installed base of existing printers. In fact, the first implementation of a Microsoft At Work-based printer is already shipping: the Microsoft Windows### Printing System cartridge is specifically targeted to extend the benefits of Microsoft At Work-based printing to the more than 7 million HP### laser printers that customers already own.

The Microsoft At Work-based Copier

The copier is a ubiquitous device in the office. The majority of documents that reach someone's hands in final form have gone through a copier to get there. Yet little attention has been paid to how the copier is used or how it *could* be better used in the modern office. Part of the reason for this is the analog nature of today's copiers. Copiers today literally take a photograph of a document and reproduce it over and over again. While efficient, this process has a number of shortcomings:

Since the print engine in the copier doesn't take digital input, users must print documents before copying. This is a time-consuming process, especially if the printer is occupied.

There is no way to integrate communications into today's copiers so that they function as document distribution tools, because they cannot receive, print, store or send image data in the same way a fax machine does today. As a result, the typical mail room has a copier and a fax machine standing side by side, when one device could easily play both roles.

Little special processing can be done on the documents beyond simple reduction and enlargement. For example, users today who want to create numbered copies must do so by hand, stamping each page of each copy, when overlaying this information on each copy of a digital document could be a simple task.

This process will change in the future. Digital technology is finding its way into the world of copiers, and with it comes a wealth of new functionality. Microsoft At Work-based digital copiers will be a family of monochrome and color copiers that will enhance the copier's existing role as a focal point for document distribution in the modern office. Key features include the following:

Key Benefits

Ease of Use

As with other Microsoft At Work-based devices, copiers will use a touch-sensitive graphical user interface to give users access to advanced document imaging and output management functions. Online, context-sensitive help will eliminate annoyingly common experiences, such as putting letterhead paper stock in upside down and backward. Users will be able to preview document appearance on the screen before printing, avoiding errors such selecting the wrong output paper size.

Figure 10. Copier Screen.
An illustration of how both simple and advanced options, including device diagnostics and copier service needs, will be clearly marked on-screen. A paper source picture will help users make sure they have selected the right paper size and cassette before copying begins.

Desktop Connectivity

From their favorite word processor, users will be able to print 10 copies, double-sided, stapled and sorted. All imaging and output handling options will be directly and easily accessible. Users will also be able to save a copy of the document on a copier's mass storage so that others can walk up and make a quick reprint from the digital original whenever they need to.

Document Distribution

Users will be able to publish documents to all recipients directly from a PC application. For example, users will be able to create a cc: list in their word-processing document. When users select "publish," the job will be sent to the copier. Copies for local recipients will be printed on the copier with a header that identifies the recipient. Copies for people in offsite locations will use the messaging functionality shared with Microsoft At Work-based faxes to transmit the document to fax machines or other remote copiers for final printing and distribution.

True WYSIWYG Color and Monochrome Reproduction

Today's printing devices often produce output that looks significantly different from what one sees on a
computer screen. This is caused by at least one of two potential problems. First, output may be transformed into a page-description language, and sometimes information gets lost in the process. Second, there may be no calibration between the different output devices. This second problem is particularly prevalent in color devices, where the capabilities of different input and output devices vary greatly. Microsoft At Work rendering solves these problems. First, it will use an imaging model that is compatible with the Windows imaging model. Second, it will use a color model that is compatible with the color model being added to Windows. By implementing imaging and color models that are compatible with Windows, the Microsoft At Work-based copier will be able to guarantee that colors you see on your screen or in the original document will be exactly matched on the printed page.

Image Editing

Digital imaging, coupled with a well-structured software environment, will greatly increase the types of special document-processing features that are possible on Microsoft At Work-based devices. For example:

Image filters will eliminate stray marks on documents.

It will be possible to insert overlays to automatically number copies, stamp documents as confidential or add company logos.

Color accenting or other techniques will be available to emphasize a selected portion of the document.

Edge-detection algorithms will be available to blow up a portion of a document. For instance, users will be able to select an article in the newspaper by circling it. The copier would identify the area to be enlarged and would reprint the circled area as a full-page image.

Optical character recognition filters (typically from third parties) will convert analog text information into digital information.

It will be possible to cut and paste areas from one document into another. Other

areas can be deleted.

It will be possible to merge two documents into one at high speed; for instance, in a mail merge, addresses will be placed at the appropriate point in form letters.

Figure 11. Copier Imaging Application — Document Segmentation and Smart Article Abstraction. An illustration of how an imaging screen might be developed for a copier based on Microsoft At Work. Microsoft At Work-based copiers will include standard support for watermark stamps, such as "confidential," and image enhancement.

On-demand Reproduction

Users will be able to store copies of documents in the copier's mass storage media or on other LAN-connected servers. When a quick copy is needed, users will be able to walk up, access the document and print the number of copies required. This capability will be used by companies to maintain frequently used documents, such as expense forms, time sheets, product catalogs and employee procedures, for easy access and storage. With PC file systems and file formats on all copiers, walk-up users also will be able to insert a floppy disk into the copier to get copies.

Remote Administration and Diagnostics

As with other Microsoft At Work-based office machines, copiers will be managed remotely using simple PC administration tools. Administrators will be alerted whenever a problem such as a paper jam or paper outage occurs. The copier also will have a built-in diagnostic engine that uses a powerful inference model to determine the most likely cause of trouble and shows users how to resolve the problem. Technicians also will be able to access the copier and run diagnostics remotely.

What is the Microsoft At Work Architecture?

The Microsoft At Work architecture is the foundation for a new line of intelligent office machines comprising many hardware configurations and many product feature packages. Product lines based on this architecture will grow and change over time, so the architecture must accommodate both the creation of products in the near term that will excite buyers and accommodate future products.

The Microsoft At Work architecture is a layered, modular software architecture: Each major software element has a well-defined applications programming interface (API) and communication paths between elements are minimized where possible. A small software layer of abstraction has been built between the hardware and the great majority of the software elements, permitting hardware changes to be made invisibly to the software above the abstraction layer. The operating system provides real-time services, such as pre-emption, and its interfaces are compatible with those of the Microsoft Windows operating system. So the applications that provide Microsoft At Work architecture-based machines with new features will be created just like PC applications: quickly, easily and cost-effectively. The combination of modularity, speed and Windows-based compatibility make the Microsoft At Work architecture an excellent platform for office machines today and in the future.

The architecture components consist of an operating system, communications, rendering, graphical user interface and desktop software.

Microsoft At Work Operating System

The Microsoft At Work operating system is a modern operating system that will support the real-time communications needs of office automation and telephony systems. It has the following key features:

Pre-emptive, real-time support. Communication devices such as fax machines and phones are distinct from personal computers in that they have critical real-time needs. Consequently, the software in these devices must attend to communication hardware such as modems very frequently, so that pieces of the communication are not lost. To support this need, the operating system was designed to be able to put other processes “on hold” temporarily in order to service the communication hardware before continuing other functions.

Small footprint. The operating system has been designed to be very small so that the memory requirements of these devices are kept as small as economically possible.

Compartmentalized. Like the Windows operating system, the Microsoft At Work operating
system is designed so that interfaces to hardware, such as printers, scanners and touch screens, are well-defined and so that software unique to the particular hardware is collected together in special “device driver” software routines, providing two benefits to developers and to end users. First, it provides a simple way to

deliver a very broad array of products to the marketplace. For example, it makes it easy to create a Microsoft At Work-based telephone product line with a low-end model that makes use of a small, monochrome display and a more full-featured model that might make use of a larger display or even a color display. The second advantage is that the operating system allows developers to very quickly introduce new models when new hardware becomes available, because they need to modify only a single piece of software. These two benefits translate into broader product lines and more cost-effective solutions for end users.

Extensible. The software is designed to allow both manufacturers and customers to add new features. For example, local area network connectivity will be able to be added easily by installing an optional LAN hardware module and a software driver. Additional memory will be able to be added to the system, and the system will automatically make use of this memory. New image-processing software and communications protocols will be able to be added on the premises, and it will even be able to be done over the phone line, allowing manufacturers to create basic models that can be enhanced in many different ways to fit the needs of different user groups.

Windows-based, PC-compatible development environment. The operating system presents APIs that are compatible with those found in the Windows operating system. Consequently, the more than 300,000 software developers that know how to develop software for Windows will know how to develop software for Microsoft At Work-based devices. In addition, the broad array of tools available to develop software for Windows can be used to develop software for these devices. In fact, software can even be developed on the PC and then downloaded to Microsoft At Work-based devices for testing.

Having a Windows-compatible programming environment also means that the Microsoft At Work operating system can leverage software from the Windows environment. For example, Microsoft At Work-based handheld systems will include the run-time library of the Microsoft Visual Basic### programming system, which allows software developers to create software applications simply. Additionally, software from the Windows operating system can be integrated into the Microsoft At Work operating system. For example, the Open Database Connectivity interface can be added to give these devices rich database connectivity.

Microsoft At Work Communications

Microsoft At Work communications will provide two important capabilities:

Rich, secure transmission of digital documents (messaging) between any two Microsoft At Work-based devices, whether office machines or PCs.

Strong control and feedback capabilities between Microsoft At Work-based devices and PCs.

The actual communication methods used to carry out these functions can be divided into two

categories:
message-based communication (used to store and forward messages between devices) and interactive communications (used to communicate back and forth in real time). Both of these methods are discussed below. The elegance of the Microsoft At Work communication services is that either method will be able to be employed on any communication media that is available, including serial ports, parallel ports, fax modems, data modems, LAN connections, etc.

Message-based Communication
The Microsoft At Work message protocol will provide for the exchange of messages and documents from anywhere to anywhere over any communication media, including the public-switched telephone network. It will allow any two users with a PC fax board, fax server or fax machine to exchange either editable or high-quality "published" documents with the following key features:

Digital document transmission. The message protocol will allow users to exchange digital documents that do not degrade over time. These documents will be in one of two forms: either high-quality "published" form using the Microsoft At Work rendering technology (described below), or as an editable document. The ability to send any editable, binary file to other Windows-based users over simple phone lines is a powerful enabler of wide-area workgroup computing. For example, corporations could send invoices and billing information in editable form to their suppliers, which would enable those suppliers to automatically download that information into their accounting systems. Companies could also send automatic updates to online product catalogs for their sales forces.

Security. The Microsoft At Work message protocol employs a powerful form of security called public key/private key encryption, which will allow users to encrypt documents before transmission, so that only the intended recipient can read the document when received. It also will allow users to request that the recipient be "authenticated" before the message is delivered to ensure that the document is delivered only to the intended recipient. Finally, users will be able to include a "digital signature," which can be used to verify that the document sent is authentic.

Capabilities exchange. When a Microsoft At Work-based device connects to another Microsoft At Work-based device, the capabilities of those devices, the capabilities of the communication hardware, support for color or not, etc., will be exchanged so that the sender can create the best possible document format for the recipient. These capabilities will be stored by the sender so that they can use them in future transmissions. We've also defined the capabilities exchanged in an extensible fashion so that as printing devices, scanners, personal computer and communication hardware capabilities expand, so will the capabilities of the message protocol.

Compatibility with standard fax machines. Any solution that ignores the 20+ million fax machines worldwide will be much less useful. That's why the message

protocol is designed to be backward-compatible with existing fax machines. If a message is sent to such a machine, the document will be converted into a form understood by those machines. Of course, some capabilities, such as high-resolution rendering and security, are lost in communications with these machines.

Integration with Windows messaging. The Microsoft At Work message protocol interfaces with the Windows Messaging API (MAPI). Consequently, users will be able to send and receive messages to and from Microsoft At Work-based devices through any MAPI-enabled e-mail software. Microsoft At Work-based message recipients are just a different recipient type whose address happens to be name plus phone number. Another important benefit of this integration is that users will be able to send messages to e-mail and Microsoft At Work-based recipients seamlessly. Finally, integration with MAPI means that all mail-enabled applications will be able to automatically make use of the Microsoft At Work message protocol with no modifications.

The same MAPI technology is implemented on Microsoft At Work-based devices as well, so we will be able to leverage advances in messaging that are added to MAPI on the desktop (e.g., the ability to have multiple communication "transports," or communications methods, operable at the same time) on Microsoft At Work-based devices. In addition, software developers will be able to leverage their understanding of MAPI on the desktop to develop applications for Microsoft At Work-based devices.

Device control and feedback. The Microsoft At Work message protocol will also be able to be used to control any functions of the Microsoft At Work-based devices over LAN connections, serial connections and even phone lines, allowing users to download new address books, change options and settings, and even load new software remotely. The protocol also supports the return of device status to the user. For example, a Microsoft At Work-based device can inform a user that it is experiencing difficulties such as paper jams or persistent communication problems.

Bidirectional, Interactive Communication

Interactive communication will provide real-time device control and diagnostics. It will allow users and software to control all functions of the Microsoft At Work-based system remotely and provide feedback on system status. For example:

A Microsoft At Work-based fax machine will also be able to operate as a desktop scanner. A scanning application operating on a user's PC would instruct the device to scan the paper and return the scanned image to the application over a serial, parallel, enhanced parallel (i.e., Enhanced Call Processing), or even a LAN connection.

The Microsoft Windows Printing System uses interactive communication to determine printer capabilities, to tell users the current status of print jobs, and to inform users of current printing problems.

Microsoft At Work-based fax machines and copiers will use interactive communication to perform remote diagnostics so that repair specialists and even users can determine the source of system problems.

Microsoft At Work Rendering

The dream of the "paperless office" will probably remain just a dream. Even in the most highly integrated modern office, documents will continue to play a key role. Therefore, printing is critical to the efficiency of the entire office. The most important requirement is the ability for any office device (fax, copier or PC) to efficiently and cost-effectively produce high-quality printed output. Regardless of the actual output device, the best printing technology is of vital importance.

After carefully examining developers' and end users' needs, Microsoft decided to approach the challenge from an overall system perspective, looking at how PCs and printing devices can cooperate to produce better results. The solution is Microsoft At Work rendering, which is at the core of both the Microsoft Windows Printing System and the Microsoft At Work architecture. Essentially, rendering extends the definition of "the system" to encompass the Windows operating system, the Windows imaging model, the CPU/memory on the PC, the CPU/memory on the printing device and the communication channel. Microsoft At Work rendering has been optimized for the capabilities and limitations of all of these elements. Key attributes include the following:

Harnesses the CPU and memory on the host. Rendering improves performance and reduces printer costs by harnessing the CPU and memory resources on both host and printer. By optimally dividing the print job between host and printing device, performance will be maximized, and any printer will be able to print any page, no matter how complex.

Creates a more efficient document printing and transmission format. Rendering describes pages in terms of "resource primitives," which will closely mirror the internal graphics routines, referred to as "GDI," used by the Windows operating system. This will have three key benefits to the user:

1. Eliminates the majority of the processing required to translate from GDI to PostScript###, PCL###, bitmap or other page representations, decreasing processing time on the PC.
2. Because the "resources" are readily executable on the printing device, rendering will eliminate the inefficiencies of parsing and interpreting a more complex printing language on the printing device, which will increase printing speed and reliability.
3. Because rendering takes full advantage of the redundancy found in most documents (for example, the letter "e" is found over and over again in a document), it will create fax messages that are much smaller than those generated by traditional fax machines (sometimes by a factor of ten), drastically reducing transmission time and line charges.

What You Print Is What You Fax Is What You Copy Is What You See. Since Microsoft At Work rendering is so much more efficient than other page representations, there will be no need to sacrifice drawing in order to improve performance. In addition, rendering leverages the font technology that Windows has built in. The result is true WYSIWYG — always.

Microsoft At Work Graphical User Interface

Microsoft At Work-based devices will use a common graphical user interface so that they are easier to use and so that all device features are accessible. The guiding principles in the design of these user interfaces include the following:

Use graphics to provide more information to the user. A picture replaces a thousand words. Through the use of graphics, Microsoft At Work-based systems will be able to rapidly show the user exactly what is happening. For example, the Windows Printing System can already provide rich information about the effect of different printing options by showing that effect on a sample document. A Microsoft At Work-based phone will provide a view into users' voice mail boxes, showing them how many messages have been received, who each message is from and any special handling instructions that were requested.

Use graphics to provide context and feedback. Microsoft At Work user interfaces will change based on the tasks that users are performing. Only options that are appropriate to a particular activity will be presented. Visual feedback will tell users what is happening and will prompt them for more information where appropriate.

Provide a consistent look and feel across devices. Using a common set of controls and graphical metaphors across all devices will mean users who are familiar with one device will be familiar with them all, saving training and task execution time.

Use graphics in a way that is appropriate for the application. Some applications will reside on the device, some on the PC and some on both. The key is to use the interface in the most appropriate, cost-effective manner to help users.

Microsoft At Work Desktop Software

All Microsoft At Work-based products will include desktop software that fully integrates these devices into users' desktop computing environments. For example:

Remote administration applications will let users change system options and download new software and other system resources remotely.

Windows Messaging API and Windows Telephony API-compatible drivers and transports will integrate devices' rich communication functions into the desktop.

Printer drivers will give users access to all printing options available on the devices.

Handheld software will synchronize the information on handhelds with the information on PCs.

What Is Microsoft's Role?

In November 1990, Microsoft Chairman Bill Gates described the company's vision for the future of Microsoft and its corporate mission. Entitled *Information At Your Fingertips*, this statement of direction embodies the vision of the personal computer as an indispensable information appliance. However, *Information At Your Fingertips* involves far more than personal computers. Its far-reaching goals imply change and innovation in all aspects of technology. Above all, *Information At Your Fingertips* speaks to the integration of many diverse information sources into an accessible and easy-to-use communications infrastructure. Stated simply, it is the ability to get the information we need quickly and easily, when and how we need it, from wherever it resides.

The Microsoft At Work architecture is the next logical step in Microsoft's effort to deliver on the *Information At Your Fingertips* vision. Microsoft At Work-based devices will concentrate on the enhancement and integration of familiar office products into an underlying information framework.

Microsoft will contribute its software expertise and its understanding of the form and importance of industry standards to the Microsoft At Work architecture effort. Clearly, Microsoft alone cannot bring about the necessary level of product innovation and development to make the Microsoft At Work architecture successful. Those building Microsoft At Work-based products are an equally important element in the overall success of the effort.

Microsoft's expertise to this end is in software technology and usability. Microsoft is in a unique position to help tie all the diverse elements of the Microsoft At Work architecture together. The company's broad view of industry requirements will be invaluable in making the Microsoft At Work architecture practical.

Microsoft fully expects the depth and strength of product innovation based on the Microsoft At Work architecture to result in the development of a wide variety of high-quality products. Many existing companies will be successful in this market. Many new companies with products that we cannot yet envision will also make a significant market impact.

Microsoft believes the workplace of the future will be a more efficient, cost-effective and functional place — one in which the talent and creativity of individuals will be truly enhanced by the immense technological capabilities that the Microsoft At Work architecture can deliver.

Several Years From Now

"Jim, I faxed you the purchase order this afternoon. Sign it and fax it back, so we can get going. Talk to you soon." Jim turns to his PC and checks his message box. Sure enough, there's the fax. He double-clicks on the document and reads through it. At the end of the document, Jim embeds a copy of his digital signature in the designated space. A couple of more clicks and the document is queued for transmission back to the vendor tonight. He checks his watch. It is already 7 p.m. on the East Coast. They won't see it until tomorrow. He clicks on the Use Cheap Rates option and sends the document. It used to be a lot harder than this...

Jim stands at a pay phone in the airport, handheld system open and ready. He taps his way through the dialog boxes on the screen and waits for the connection to his office computer. Because it is almost time to board his flight, he sets the filter to look for specific messages to reduce transmission time and costs. Any other messages can be dealt with first thing in the morning when he is back in the office. The list of messages pops up on the screen. Bob says Carol needs a quick call this afternoon. Jim smiles. He used to have to shuffle through pockets, travel documents and briefcase looking for slips of paper with people's phone numbers. He touches the Phone Book button on his handheld and holds his thumb on the scroll bar. N ... P ... R ... Ra ... Re ... Robinson. There it is: 212.555.5555. Second message. The partners need a copy of the Memphis proposal routed to everyone tonight, in order to get it read and approved by the end of the week. Jim sends a copy of the document from his handheld to the office copier, addressed to each team member. Time to get on the plane. Jim taps the Hang Up button and slips the handheld into his pocket. It used to be a lot harder than this ...

Founded in 1975, Microsoft (NASDAQ "MSFT") is the worldwide leader in software. The company offers a wide range of products and services for business and personal use, each designed with the mission of making it easier and more enjoyable for people to take advantage of the full power of computing every day.

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