

Apple Confidential / Need to Know

From: Dave Garr

Monday, February 26, 1990

Macintosh vs. OS/2: Sales Implications

## Summary

This document compares the Macintosh operating system with OS/2 1.2. Its primary purpose is to describe OS/2 and identify the Macintosh advantages over OS/2. It also discusses the potential objections to the Macintosh operating system, and how Apple can respond to those objections.

## What You Should Know about OS/2

New version of OS/2 is more attractive. In late 1989 IBM began shipping OS/2 Version 1.2, which offers a number of enhancements over the previous version of OS/2. For example, it is more visually attractive than before and features more direct manipulation.

Poor sales of OS/2 Presentation Manager. International Data Corporation estimates that only 124,000 copies of OS/2 were shipped worldwide in 1989, compared with over a million copies of the Macintosh operating system. The key reasons for OS/2's lack of acceptance are its significant hardware requirements and the scarcity of Presentation Manager applications.

OS/2 Presentation Manager isn't finished. Another reason that OS/2 has not been accepted by customers is that it is not a completed operating environment. Even Peter Neupert, Microsoft's senior general manager of OS/2, admitted that "until we solve some of [OS/2's] warts, you are hard-pressed to use it today."

## Comparing Macintosh with OS/2

Macintosh operating system is BEST. We believe the Macintosh operating system is ahead of OS/2. Following are the four key Macintosh advantages over OS/2. We have used the mnemonic BEST to help you to remember these Macintosh advantages.

Broad product line—Runs across a broad product line whereas OS/2 only runs on high-end PCs.

Easy—Easier to learn and use than OS/2.

Speedy—Applications run faster than similar OS/2 applications.

Thousands of consistent applications—Will have more applications than OS/2

for years.

Macintosh has other advantages over OS/2 which are described in this document. Although System 7.0 will provide the Macintosh with even more advantages over OS/2, this document primarily compares Macintosh System 6 with OS/2 1.2 since those are the products currently shipping.

OS/2 has some advantages over Macintosh system software. OS/2 offers preemptive multitasking with protection, multithreading, virtual memory, and interprocess communications. In addition, OS/2 Extended Edition, priced at \$830, offers a Database Manager and a Communications Manager. These capabilities are currently not available in the Macintosh system software (although many will be added in System 7). This document advises how Apple people can respond when these objections are raised.

## The Future

Various operating environments will be popular on PC compatibles. In contrast to the past, when DOS was the standard for all PC compatibles, different operating environments are now becoming popular to different markets. We expect Windows' popularity to grow over the next two or three years, especially for price sensitive markets. OS/2 should eventually become the standard in large business. However, we believe MS-DOS will continue to be the most popular operating environment for PC compatibles in all markets for the next few years.

Macintosh is a stable environment. The uncertainty about which operating environment will become the standard has left PC compatible users and developers confused. They aren't sure where to commit their resources. Apple has an opportunity to take advantage of that confusion by promoting the relative stability of the Macintosh platform. The fact that Macintosh today has one operating system for its complete product line and provides an excellent software migration path could be used to sway these frustrated customers and developers into looking at Macintosh systems.

## Introduction

This document is divided into two sections: the present and the future. The present section gives an overview of OS/2 1.2 and how it compares with the Macintosh. We explain many of the advantages of the Macintosh over OS/2 so that you can compete more effectively against OS/2. The future section discusses OS/2 2.0, Windows 3.0, and which operating environment we predict will become most successful on PC compatibles.

Competitive Analysis has written other documents that are relevant to

operating system comparisons. "Beyond User Interface" discusses Macintosh differentiation. "Competition in Graphical Interfaces" describes competing graphical user interfaces. "Windows 3 and the 386sx" discusses Windows 3 and how Apple should respond to it.

## WHAT YOU SHOULD KNOW ABOUT OS/2

This section describes OS/2 1.2, how it has been enhanced over OS/2 1.1, what applications are available for it, and why its sales have been slow.

### Overview of OS/2 1.2

OS/2 is IBM's next generation (after DOS) operating system which was announced in 1987. OS/2 requires at least an 80286 processor to operate. It will also run on 80386- and 80486-based machines. The current shipping release of OS/2 is version 1.2. Presentation Manager is the graphical user interface that runs on top of OS/2 (similar to Windows, which is a graphical shell on top of DOS).

OS/2 1.2 is a single-user multitasking operating system that uses the protected-mode operation of the 80286 microprocessor. Protected mode gives programs written for OS/2 access to the full 16 MB memory space of the 80286 and allows the operating system to implement multitasking with protection. OS/2 includes support for virtual memory (using disk space to simulate memory), for running multiple threads (multiple tasks) in a single program, and for interprocess communication (which allow programs to transfer data between each other).

OS/2 1.2 comes in two different editions—Standard Edition and Extended Edition. IBM and Microsoft codevelop OS/2 Standard Edition. IBM develops a version called Extended Edition, which includes the Standard Edition and adds the Database Manager and Communications Manager. See Appendix C for a further description of Extended Edition.

IBM began shipping OS/2 1.2 Standard Edition in October. Its price is \$340. IBM's version of OS/2 1.2 is only certified to run on PS/2 machines (Model 50 and above), although it appears to run correctly on Compaq systems. Many PC compatible vendors, like Compaq, will be offering their own specific versions of OS/2 1.2 Standard Edition, which have been tailored for their machines, later this year. IBM will not ship the Extended Edition of OS/2 1.2 (priced at \$830) until March 31.

### Enhancements in Version 1.2

The key enhancements to the latest version of OS/2 are that it looks better than Version 1.1, allows for more direct manipulation, and has a high

performance file system. Following is a list of the main enhancements. Appendix D shows what the OS/2 1.2 user interface looks like.

More attractive looking.

- Better looking icons. The icons in OS/2 1.2 are more professionally drawn.
- 3D effect. IBM and Microsoft have added shadowing to Presentation Manager, giving it a 3D effect. For example, the buttons look raised, and the menus are drop shaded.
- Similar to the NeXT user interface. OS/2 1.2 has a number of new interface features that resemble NextStep. For example, dragging the sliders in the scroll bars moves the text in (some) windows dynamically. The graphics artist who helped design the NeXT user interface worked for Microsoft on the user interface of OS/2 1.2.

More direct manipulation.

- In the directory tree. Users can now drag icons to move folders and files in the Directory Tree view of the file manager. (See Appendix D for a screen shot of the Directory Tree.)
- Launching and printing files. Users can open a file by simply dragging it onto the icon for the application that created it. Similarly, a file can be printed by dragging it onto the printer icon.

High performance file system. HPFS features faster performance and long filenames (up to 254 characters). However, the hard disk must be reformatted to use this feature. Also current Presentation Manager applications must be rewritten to take advantage of the long file names.

Online command reference. OS/2 1.2 has 300 pages of reference materials describing OS/2 commands and syntax which can be browsed on the computer screen.

Support for non-IBM printers. OS/2 1.2 now supports Epson and compatible printers. Previously, OS/2 had only support for IBM impact printers.

Larger DOS compatibility box. The DOS compatibility box in OS/2 1.2, which allows an OS/2 user to run one DOS application at a time, now provides 542 KB of space, which is about 40 KB more than the previous compatibility box.

Dual boot utility. Users can choose to load either DOS or OS/2 from the same disk drive. This is a nice option, but is very difficult to install.

## Presentation Manager Applications

Few Presentation Manager applications shipping. Very few applications that customers want are shipping for Presentation Manager, and this is a key weakness of Presentation Manager. Following is a list of the only 16 Presentation Manager applications that we believe are currently shipping. (This list does not include programming tools or languages.)

Company	Product Name	Product Category
3Com Corp.	3+Open Lan View	Communications
Aldus Corp.	PageMaker	Desktop Publishing
Borland	SideKick Plus	Desktop Utility
Cawthon	Chipchat	Communications
Describe, Inc.	DeScribe Word	Word Processing
IBM Corp.	OfficeVision	Business
Lifetree Software	Net Results	Business
Lotus	Notes	Workgroup
Micrografx	Designer 2.0	Drawing
Microsoft	Excel	Spreadsheet
Microtel Pacific	LEDAX Plus	CAD/Engr.
Polaris Software	PackRat	Information Manager
SPSS Statistics	SPSS Statistics	Statistics
Tesseract	HRMS Intuition	Database
TimeStar	TimeStar 2.0	Time Management
XcelleNet Inc.	WAN Manager	Communications

Only a few of these applications, primarily Excel and PageMaker, have much of a market presence.

## OS/2's Lack of Acceptance

International Data Corporation estimates that only 124,000 copies of OS/2 were shipped worldwide in 1989, compared with over a million copies of the Macintosh operating system. The key reasons for OS/2's lack of acceptance are its significant hardware requirements and the scarcity of applications.

OS/2 Presentation Manager isn't finished. Another reason that OS/2 has not been accepted by customers is that it is not a completed operating environment. Here are some examples demonstrating that point:

- OS/2 includes few device drivers.
- OS/2 software development tools are incomplete.
- The Presentation Manager interface is still changing in major ways.
- Some of OS/2's own components have not been written as Presentation Manager applications and are still character-based, such as the

Introducing OS/2 tutorial.

- OS/2 for 386 systems has yet to ship, and even that version will not be completely rewritten to use the 386 processor's 32-bit architecture.

Even Peter Neupert, Microsoft's senior general manager of OS/2, admitted that "until we solve some of [OS/2's] warts, you are hard-pressed to use it today." While OS/2 Presentation Manager is still being completed, the Macintosh, which has been available for six years, is being enhanced in exciting new ways.

## COMPARING MACINTOSH WITH OS/2

OS/2 with Presentation Manager offers many Macintosh-like interface features. For example, it offers resizable windows, pull-down menus, scroll bars, mouse support. It has a file manager which includes icons and allows direct manipulation of files. And it includes a clipboard for cutting and pasting data between applications.

However, there are still many differences between these two environments. The following sections will discuss some of the advantages of the Macintosh over OS/2, and some of the advantages of OS/2 over Macintosh. These Macintosh advantages should be useful in sales situations. In our discussion of OS/2 advantages, we suggest how Apple can respond to those objections when they are raised.

### Macintosh Advantages over OS/2

This section explains the Macintosh advantages over OS/2, so that you can compete more effectively against OS/2. We begin by describing the four key long-term competitive advantages that the Macintosh has over OS/2. Then we list some additional advantages, at both the operating system level and the user interface level.

Macintosh System 7.0 will offer additional advantages over OS/2 that are not covered in this document. When System 7.0 becomes available, we will publish a document comparing it with OS/2 2.0 (both are expected to ship in the fall of 1990). This document focuses on the Macintosh operating system advantages available today.

### Macintosh Key Advantages over OS/2

Macintosh operating system is BEST. We believe the Macintosh operating system is ahead of OS/2, and will stay ahead. We have used the mnemonic BEST to help you to remember the four most important Macintosh operating

system advantages. After we discuss the four key advantages of Macintosh over OS/2, we list some additional operating system advantages and user interface advantages.

**Broad product line**—Runs across a broad product line whereas OS/2 only runs on high-end PCs.

**Easy**—Easier to learn and use than OS/2.

**Speedy**—Applications run faster than similar OS/2 applications.

**Thousands of consistent applications**—Will have more applications than OS/2 for years.

**Broad product line.** Macintosh software will run across a wide range of platforms, from the economical Macintosh Plus to the high-end Macintosh IIci. In contrast, OS/2 will only run on high-end machines. It will not run on 8086 or 8088 machines. And its performance on 80286 machines has been criticized by many industry analysts.

Part of the reason the Macintosh operating system runs across such a broad product line is that it requires less hardware than OS/2. Microsoft recommends 4 MB of RAM and a 40 MB disk for OS/2 1.2 Standard Edition. Here are Gartner Group's estimates of the minimum hardware required to run various operating environments:

According to Gartner Group, Macintosh System 6 and System 7.0 require less hardware than the IBM operating environments.

**Easy.** The general industry consensus is that the Macintosh operating system is easier to learn and use than OS/2. For example, Stuart Alsop stated that "The Macintosh is still the clear leader in interface design...Apple still maintains about a three-year development lead over Microsoft and the IBM world." The section below "Other Macintosh User Interface Advantages over Presentation Manager" points out examples of how the Macintosh is easier to learn and use than Presentation Manager.

**Speedy.** Macintosh applications run faster than similar OS/2 applications, since the Macintosh was designed from the start to give optimum performance in a graphical environment. National Software Testing Laboratories ran benchmarks comparing the performance of the 25-MHz Macintosh IIci with the 25-MHz PS/2 Model 70 386 running OS/2 with Presentation Manager. Excel and PageMaker were benchmarked because they are the only applications that run in both the Macintosh and Presentation Manager environments. NSTL determines overall performance by calculating the geometric mean of all the timings for each application.

The lower the geometric mean, the faster the machine.

Averaging the results of these two applications shows that the IICI was 17% faster than the IBM Model 70 386. Assuming that the hardware is comparable (although the IBM machine is more expensive when comparable configured) these benchmarks indicate that the Macintosh operating system runs applications faster than OS/2.

Thousands of applications. The variety and depth of OS/2 Presentation Manager software will fall short of the Macintosh for years. The Macintosh offers around four thousand applications, compared to 16 that we verified for Presentation Manager. In fact, the Macintosh has many more applications than Presentation Manager, Windows, and the GUI-ized UNIX environments (MOTIF, Open Look, NeXT, etc.) combined.

#### Other Macintosh Operating System Advantages over OS/2

This section lists some additional advantages that the current Macintosh operating system provides over OS/2. Keep in mind that the advantages listed below are for Macintosh System 6. Macintosh System 7.0 will offer additional advantages over OS/2, both in terms of the underlying operating system features and in terms of user interface.

Greater consistency of applications. Today, Macintosh applications are much more consistent than MS-DOS applications. It is not clear that applications under Presentation Manager will achieve the degree of consistency that has been obtained with the Macintosh for the following reasons:

- Large developers may not follow Microsoft's lead. For obvious political reasons, the major PC developers (like Lotus and Ashton-Tate) may not let an aggressive competitor like Microsoft dictate the look and feel of their own products.
- DOS developers already have a huge stake in existing interfaces. To an experienced 1-2-3 or dBASE user, any new interface—which presumably will incorporate new ways to implement familiar operations—is likely to be more confusing than helpful. Mainstream DOS developers may not adhere to all the rules of the Presentation Manager interface.
- Less evangelism from Microsoft and IBM. Historically Apple has promoted adherence to interface guidelines more heavily for Macintosh than Microsoft and IBM have done for Presentation Manager. Although Microsoft has recently increased its evangelism efforts, we believe that Apple will continue to be more effective in this area.
- PC developers are used to autonomy. DOS software developers are



used to writing programs in the way that seems best and fastest to them. They may ignore Presentation Manager recommendations from IBM or Microsoft when they feel they have a better idea for their applications.

Easier installation/configuration of software and peripherals. PC software is more complex to configure compared to Macintosh software. Installing OS/2 (six diskettes for Standard Edition) takes about 30 minutes, and you have to answer questions about the hardware that is connected to your system. Furthermore, adding peripherals to the Macintosh is usually easier than adding them to an OS/2 system. If you install the wrong OS/2 mouse driver, which we found was easy to do, you must reinstall OS/2.

Presentation Manager has limited drivers. IBM has only supplied a few Presentation Manager printer drivers and monitor drivers. This means that only a few printers and large screen monitors can currently work with Presentation Manager. Other Presentation Manager drivers, such as for input devices or scanners, are also scarce. However, manufacturers have been hesitant to invest in writing Presentation Manager drivers since so few customers are using OS/2. (OS/2 1.2 shipped with a PostScript driver, but that version does not work correctly with all applications. Microsoft acknowledges the problem and has said the new driver will ship with a future release of OS/2.)

Less expensive. The Macintosh operating system is free, while OS/2 Standard Edition is priced at \$340 and Extended Edition at \$830.

Presentation Manager is complex to develop for. Developers have stated that Presentation Manager applications are time consuming to write because of the complexity of the development environment and because the development tools are incomplete. As a case in point, it took Microsoft (codeveloper of Presentation Manager) two years to migrate Excel from Windows to Presentation Manager.

Can copy and paste DOS on a Macintosh with Soft PC. When using a third party DOS emulator, Soft PC, the Macintosh can copy from DOS/Windows applications and paste to the Macintosh. The compatibility box won't allow copying DOS or Windows data to OS/2.

Macintosh system software can be enhanced faster. It will probably take longer for Microsoft to evolve Presentation Manager than for Apple to evolve the Macintosh system software since Microsoft must work together with IBM.

#### Other Macintosh User Interface Advantages over Presentation Manager

Overall, the Macintosh interface is easier to learn and use than Presentation Manager. Byte magazine (Dec. 1989, p. 138) states that "the Mac OS is faster at the basics of file management than OS/2, because its interface is

more intuitive and easier to learn. It's also easier to use, since its windowing interface is smoother and more refined. Apple's head start shows when you sit a Mac next to an OS/2 box and play with both. Start a program, do computer housekeeping (e.g. file copying or deleting, or directory changes), cut and paste using the clipboards, shift from program to program, and you'll see what I mean. While OS/2 is a huge improvement over DOS, it still feels like its interface and graphics were bolted on, rather than designed from the ground up."

The key Macintosh user interface advantages are that it has an overall metaphor, it provides more flexible manipulation, its Finder is better than Presentation Manager's File Manager, and Presentation Manager has inconsistencies.

Macintosh has a desktop metaphor. One of the most important Macintosh user interface advantage is that it has an overall metaphor, whereas Presentation Manager does not. On the Macintosh, you organize files and programs in folders stored in a variety of containers (usually equivalent to disks) on the desktop. You throw things away in the trash can. You can drag frequently used applications or documents onto your desktop so they are easy to access. OS/2 doesn't have a consistent overall metaphor. It resembles a desktop metaphor at times (with files residing in folder icons), but it lacks other fundamentals (such as an icon for deleting files, or the ability to drag files out onto a desktop).

Macintosh provides more flexible manipulation. The Macintosh allows the user to point and click to accomplish functions that are multistep processes for OS/2.

- When using OS/2's Directory Tree, only one folder can be manipulated at a time. Therefore, you have to copy or delete each folder individually. The Macintosh can perform direct manipulation on numerous folders at once.
- In OS/2's view by icon mode, you can't rearrange the icons. The icons always appear alphabetically. And if you resize the window, the icons shift places. In View by Icon on the Macintosh you can position icons so that they appear logically arranged to you. And they don't move when you resize the window.
- On the Macintosh, you can click and type on a file to change its name. With OS/2, you must click on the file to select it, select Rename from the File menu, and type in the new name.
- Naming files is more flexible on the Macintosh. You can use spaces and lower case with any Macintosh application. To get that with Presentation Manager, the application has to be written to support long file names. Assuming an application has been written to support long file names,

Presentation Manager imposes some awkwardness in handling those extended attributes. To use spaces in a filename, you must type quote marks before and after that name. If you type a very long name, you cannot see that whole name in view by icon mode. It becomes truncated. On the Macintosh, you can see the whole filename in view by icon.

- If you have more folders than can be seen in the OS/2 Directory Tree window, there is no easy way to move a folder on top of the tree to a folder on the bottom. This can be done on the Macintosh by moving a folder to the desktop, and then into another folder. And in System 7.0, the window will scroll as you drag.

Weaknesses in OS/2's File Manager. The Macintosh was designed from the beginning to have an integrated file system. Indeed, the Macintosh file system, the Finder, is built into the desktop interface. In contrast, the OS/2 File Manager is an application that must be launched (usually taking between 10 and 20 seconds) before the user can work with individual files. Here is a listing of some of the other weaknesses of the OS/2 File Manager:

- On the Macintosh, when you insert a diskette, a diskette icon appears on the desktop. OS/2 doesn't automatically recognize when a disk has been inserted.
- If an OS/2 file folder window is open, and the user creates a new document in an application, it will not appear in the file window, even when you quit the application. You must choose the Refresh menu option to have that new file listed in its window. In contrast, the Macintosh displays the new file icon as soon as it is created.
- The OS/2 Directory Tree window only shows directories. It doesn't display any individual files. So, for example, when you click on the drive A icon to see what's on drive A, you don't see any files listed. That could confuse beginning users. You have to double click on the A:\ to show what files are in the root directory.
- Double clicking on an OS/2 document doesn't automatically open the application that created it. You have to "Associate" the document with the application file first. With some applications, such as PageMaker, after you have associated one document with the application, clicking on other documents will open the application. With at least one application, DeScribe, every document has to be associated with the application before double clicking on the document will launch the application.
- Presentation Manager lists many obscure files in the root directory. Ten of these obscure files are F80000.BIO, F80100.BIO, F80402.BIO, F80702.BIO, F80902.BIO, F80C00.BIO, F80D00.BIO, FC0400.BIO, FC0403.BIO, FC0500.BIO.

Inconsistencies in Presentation Manager. Presentation Manager has a

number of inconsistencies. It is inconsistent with its previous release (Version 1.1). Furthermore, the actions required to perform certain functions are not always consistent.

- OS/2 is evolving. Version 1.2 makes you relearn things from version 1.1. For example, in version 1.1 you dragged files with the left mouse button. In version 1.2 you drag files with the right mouse button. Furthermore, in 1.1 the default action when you drag a file was a copy. In 1.2 the default is a move (like the Macintosh). Therefore, some of the functions that were learned for Version 1.1 will have to be relearned for Version 1.2. In contrast, functionality continues to be added to the Macintosh interface, but things you learned don't need to be discarded and relearned. This is an example of how the Macintosh provides growth without disruption.
- The Extended Edition portions of OS/2 (the Database Manager and the Communications Manager) are still character-based applications, not Presentation Manager programs. Furthermore, the "Introducing OS/2" application that comes with OS/2 1.2 is also character-based. It is not a graphical Presentation Manager application.
- During startup, Presentation Manager shows a variety of miscellaneous information in character-based mode, before it moves into a graphical mode. The Macintosh was designed from the beginning to have a graphical user interface, and it never goes into another mode.
- You drag icons in the File Manager with the right mouse button (you select them with the left mouse button). You drag icons on the "desktop" with either mouse button.
- Double clicking in the close box closes some OS/2 windows, but not others (such as Desktop Manager and Print Manager because the tasks they represent are always running). Double clicking does close the Task Manager window, even though the Task Manager is always running.

## OS/2 Advantages over Macintosh and Apple Responses

The following sections discuss some advantages that OS/2 has over the Macintosh System 6. We begin with the key advantages that OS/2 has over Macintosh. Then we discuss other operating system advantages and user interface advantages. We include these sections to alert you to objections that you are likely to face when you compete against OS/2. After each OS/2 advantage (except some user interface advantages that we consider to be minor), we suggest of how Apple may want to respond when this objective is raised. Many of OS/2's advantages will disappear when Macintosh System 7.0 becomes available.

## OS/2 Key Advantages over Macintosh

These are the three key long term advantages that OS/2 has over Macintosh. It is especially important that you understand these three objections and the suggested Apple responses, because these objections will remain even after System 7.0 becomes available.

**Preemptive multitasking.** OS/2 uses a time-sliced, priority-based preemptive scheduler. This means that OS/2 automatically grants a certain amount of CPU time (a "time slice") to each process. The applications do not have to take any special action or issue any API calls to enable the operating system to perform the scheduling. This is a consequence of the preemptive nature of the OS/2 scheduler: OS/2 interrupts a running process when its particular allotment of CPU time has run out and then allows the next process to continue to execute with its appropriate slice of CPU time.

The preemptive scheduling of OS/2 provides advantages over the cooperative method used by MultiFinder. Applications running under MultiFinder must actively yield control to the operating system in order for other applications to get a chance to run. Unfortunately, there are situations where applications need to perform a CPU intensive task, such as a complex mathematical calculation or database sort. Such a situation will leave all other Macintosh applications virtually helpless. Those that are running in the background will get no slice of the CPU, and the user will not be able to do anything useful until the the CPU intensive application yields control or is somehow halted by the user.

**Apple response:** You should find out what customers really want from multitasking. Our experience is that MultiFinder provides the benefits of multitasking that many customers want. MultiFinder allows multiple applications to run with operations occurring in the background, such as a long recalculation or downloading from a host system. As Byte magazine says (Dec. 1989, p. 139), "Since most people simply want to use multitasking to perform downloads or print in the background, the benefits of OS/2's multitasking are dubious."

Stuart Alsop also questions the usefulness of OS/2's multitasking: "In almost every respect, OS/2 is missing the very features—namely common routines for routine tasks, a sophisticated user interface, bit-mapped printing interface—that applications software actually uses in the Macintosh System today, while the features on which OS/2 is clearly given the advantage—namely, preemptive multitasking, named pipes, distributed processing, and multi-processing—are not used by any leading-edge or best-selling application program on any computer sold as a personal computer (yet)" (PC LETTER, May 14, 1989, p. 1).

Furthermore, by using the cooperative method, MultiFinder gives top priority to the user and the application that he is currently interacting with, which is

what many customers want. In contrast, preemptive systems like OS/2 do not ensure that the application currently being used gets top priority. This difference reveals itself when an individual performs an action, such as clicking on the mouse. The Macintosh provides immediate feedback, whereas OS/2 may perform other tasks before giving the user feedback.

**Multithreading.** OS/2 supports multithreading, which is the concurrent processing of multiple tasks within a single application (as opposed to multitasking, which allows multiple applications to run concurrently). For example, the OS/2 version of PageMaker can reformat a document in the background while allowing you to edit a specific page. Since the Macintosh does not support multithreading, the Macintosh version of PageMaker does not allow concurrent tasks.

Apple response: The primary value of multithreading is to make an application more responsive. However, the increased responsiveness provided by multithreading may not be too significant. Even without multithreading, Macintosh applications usually run faster than comparable OS/2 applications. For example, benchmarks done by National Software Testing Laboratories showed that the Macintosh version of PageMaker was 19% faster than the OS/2 version of PageMaker which makes substantial use of multithreading (when both were running on 25-MHz systems).

Furthermore, implementing multithreading in an application can require a significant investment for developers. They must write their program so that portions of the program—threads—can run simultaneously in the background. An Aldus spokesperson stated that “it took about three extra man-months to implement all the multitasking and multithreading capabilities” in PageMaker for OS/2. It is not clear whether other developers will implement multithreading as extensively as Aldus did with PageMaker.

**Memory protection.** OS/2 offers memory protection, which means that each application is protected from others running on the same machine. If one application crashes, the others should remain running. The Macintosh operating system does not have memory protection, so it cannot prevent different applications from accidentally (or intentionally) modifying each others' memory areas.

Apple response: This is an advantage for OS/2. However, just because OS/2 supports memory protection does not mean that an OS/2 system never freezes. It just means that it doesn't freeze as often as a system without memory protection. It is not uncommon for the crashing of an OS/2 application to freeze the whole system. In addition, whenever the DOS compatibility box crashes, the entire OS/2 system freezes. Therefore, this OS/2 advantage is not as robust as it might initially appear.

Other OS/2 Operating System Advantages over Macintosh

Here are some additional, although less significant, advantages that OS/2 has over Macintosh in terms of operating system features. Some of these are less significant because Macintosh System 7.0 will negate that advantage when it becomes available.

16 MB of physical memory support. OS/2 permits applications to address up to 16 MB of real (physical) memory. This is a consequence of the 16 MB addressing capabilities of the 80286 processor. The Macintosh operating system currently only supports 8 MB of physical memory.

Apple response: System 7.0 will have an advantage over OS/2 1.2 by supporting 128 MB of physical memory on Macintosh systems that support 32-bit addressing.

1 GB of virtual memory support. OS/2 applications can exceed the physical limits of main memory by addressing up to 1 GB of virtual memory. OS/2 accomplishes virtual memory by swapping the least recently used information to disk as necessary, allowing an application to "overcommit" memory. The Macintosh does not currently support virtual memory.

Apple response: A third party (Connectix) offers a program which provides virtual memory on the Macintosh. In addition, System 7.0 will support up to 1 GB of virtual memory.

Compatibility box. The compatibility box is a feature of OS/2 that allows an MS-DOS application to run unmodified under OS/2. The MS-DOS application executes in real-mode, using the 8086 emulation capability of the 286. Only one real mode screen group is allowed, so only one MS-DOS application can be run at any one time in the compatibility box.

Apple response: The Macintosh can run MS-DOS applications when a third party product is added, such as SoftPC or a 286 board. When running these third party products, the Macintosh can copy from DOS/Windows applications and paste to the Macintosh, while the compatibility box won't allow copying DOS or Windows data to OS/2.

Interprocess Communications. IPC allows applications to communicate among each other; to share data without requiring user intervention. For example, IPC allows a spreadsheet application to connect to a communications program that receives real-time stock quotes and feed the data directly into the spreadsheet cells. OS/2 provides many different types of IPC mechanisms. In fact, the variety of IPC offerings in OS/2 might dictate a significant learning curve for developers. Macintosh does not currently support IPC.

Apple response: Macintosh will offer IPC in System 7.0. System 7's IPC will provide an architecture allowing applications to work together more

consistently and extensively than OS/2's IPC.

SAA compatible. SAA (Systems Application Architecture) is a set of standards from IBM that attempt to provide consistent interconnections and applications among all of IBM's computers. OS/2 and Presentation Manager are SAA compliant.

Apple response: This is probably more a marketing advantage than an actual product advantage. SAA specifications are changing and are so broad, especially in the user interface area, that SAA compliance doesn't mean as much as IBM's marketing message would imply.

Context sensitive help. Presentation Manager has excellent context sensitive help. It is also hypertext-based, so that certain words are highlighted which, when clicked on, will take you to related subjects.

Apple response: System 7.0 offers short context sensitive help (although it will not offer hypertext to related subjects).

Database and Communications Managers in EE. IBM has released extensions to OS/2 that provide database, networking and communications capabilities. These extensions are packaged as separate products called Extended Edition and LAN Server. The current release of Extended Edition (1.1) includes a single-user SQL database manager, the client part of LAN Server and some communications programs, such as 3270 and VT100 terminal emulation and asynchronous communications capability. See Appendix C for more information on the Database and Communication Managers.

Apple response: IBM charges extra for these components: \$830 for Extended Edition and \$1,040 for LAN Server. In addition, Extended Edition has very stiff hardware requirements. System 7.0 will offer some of these database and communications features at no additional cost. Furthermore, System 7's database solutions work with a wide variety of database types and vendors. OS/2's Database Manager is primarily focused on working with DB2, IBM's mainframe database.

Richer graphics model. Presentation Manager offers a rich graphics API that combines elements of the Windows API with IBM's mainframe graphics package GDDM. It supports such features as outline fonts, curves (beziers), and device independence.

Apple response: Presentation Manager does have a more comprehensive graphics model than Macintosh, even when System 7.0 becomes available. However, System 7.0 will offer outline fonts, which is the advanced graphics element most requested by Apple customers. Furthermore, Presentation Manager graphics are complex and so are difficult to program. And based on the few Presentation Manager applications available, the speed of Presentation Manager graphics appears to be slower than Macintosh



graphics.

### Other Presentation Manager User Interface Advantages over Macintosh

As we stated earlier, the general industry consensus is that the Macintosh has a better user interface than Presentation Manager. For example, Stuart Alsop said that “Compared to the Macintosh, Presentation Manager is disjointed, non-intuitive, and confusing.” Even though he was referring to version 1.1 of Presentation Manager, we believe that analysts will reach a similar conclusion for version 1.2 as well.

Presentation Manager does have a few user interfaces advantages over Macintosh. However these advantages are so minor compared to the Macintosh user interface advantages that we don't think the competition will choose to do battle with the Macintosh in the user interface arena.

Additional windowing features.

- You can resize Presentation Manager windows from every side. You can only resize Macintosh windows from the lower right corner.
- In Presentation Manager, while moving the sliders in the scroll bar, the window scrolls at the same time. Apple response: This doesn't always happen, which is another example of inconsistency in Presentation Manager. For example, the System Editor doesn't operate that way.
- Presentation Manager can automatically cascade directory windows, meaning it will arrange open windows in an overlapped fashion so that part of each title bar and window is showing.
- Presentation Manager can minimize (shrink down to an icon) a running application. On Macintosh, all your running application windows can clutter up the screen. Apple response: Macintosh System 7.0 will allow you to hide an application's windows. In addition, System 7.0 will allow you to hide all windows except the application you're working with.

Some additional direct manipulation. OS/2 has some direct manipulation that the Macintosh doesn't have. You can drag a file on top of the printer icon to print; you can drag a file on top of the application that created it to open that file.

Miscellaneous advantages.

- Advanced find file facilities. After you have searched for a file under Presentation Manager, you can double click on it to launch that file from the Search window (this is better than our Find File). Apple response: System 7.0 will add this capability and make it even more functional.

- Advanced Task List. You can end any application from the Task List. On the Macintosh, you need to go into each application to quit out of it.
- 3D effects. By using shading, Presentation manager icons have a more 3D look than the Macintosh. Some of Presentation Manager's icons also have color. Apple response: System 7.0 will include color icons.

## THE FUTURE

The following sections discuss future releases of OS/2 and Windows and predicts which operating environments will be most popular. We expect Windows' popularity to grow over the next two or three years, especially for price sensitive markets. OS/2 should eventually become the standard in large business. However, we believe MS-DOS will continue to be the most popular operating environment for PC compatibles in all markets for the next few years.

### OS/2 2.0—Designed for the 80386

Overview of OS/2 2.0. IBM and Microsoft are working hard on a version of OS/2 that will take advantage of the 80386 processor (the current version of OS/2 was written for the 80286 processor). We expect IBM/Microsoft to begin shipping OS/2 2.0, or whatever it is named, in 2H90.

OS/2 2.0 is written for the 80386 processor and will only run on 80386 machines. However, Microsoft officials have stated many times that the 32-bit features of OS/2 will appear incrementally, and that the initial release will not be completely rewritten to use the 386 processor's 32-bit architecture.

Microsoft has indicated that existing OS/2 1.2 applications will run under OS/2 2.0 without change. However, to take full advantage of OS/2 2.0, developers will have to rework their application to some degree. Depending on the nature of the application, the amount of rework could be significant.

Enhancements to OS/2 2.0. Since OS/2 2.0 has not yet been officially announced, we cannot be certain what features it will have. However, we expect OS/2 2.0 provide the following advantages over OS/2 1.2:

- Faster performance. Supporting 32-bit registers and addressing will add speed improvements.
- Run multiple DOS applications. OS/2 2.0 will have the ability to run as many as 16 DOS applications in separate 640 KB virtual machines. These DOS compatibility boxes can be multitasked, and they will have protection

between them and OS/2 native applications. This is in contrast to the current compatibility box which can only run one DOS application at a time and if that application crashes the whole system is frozen.

- Better Windows compatibility. It is speculated that Windows applications will be able to run better under OS/2 2.0. It is unclear what this will mean. It could mean that Microsoft will provide tools to let developers port Windows applications over to OS/2. Or it could mean that Windows 3.0 applications can run under OS/2 in a 16 MB compatibility box, rather than the current 640 KB compatibility box.
- Support for segments up to 4 GB. Applications written for OS/2 1.2 can only allocate a block of memory up to 64 KB in length. Performance suffers when applications deal with memory blocks that occupy multiple segments because the program must contain special code that hops between segments. An OS/2 2.0 application could allocate a block of memory up to 4 GB, thereby improving performance.
- Improved device driver support. More device drivers should be available by the time OS/2 2.0 ships.

Look and feel similar to Windows 3.0. We expect that OS/2 2.0 will have a look and feel similar to Windows 3.0 (see below). Therefore, it will be much more appealing visually.

### Windows 3.0—A Major Step Forward

Windows 3.0 is a huge improvement over the current Windows 2.1. We expect Windows 3.0 to be available in 2Q90. Competitive Analysis has written a ROM on Windows 3.0, which describes its features in detail. Here is a brief overview of its enhancements.

Supports up to 16 MB of memory. Windows 3.0 gives applications direct access to up to 16 MB of memory when running on 286- or 386-based machines. This will allow much larger and more functionally rich programs to run under Windows.

Visually appealing. Windows 3.0 has one of the most attractive interfaces on the market. It has a 3D effect and very good-looking color icons.

Graphical file manager. Windows 3.0 offers a graphical File Manager which provides direct manipulation. The File Manager looks and works similar to the one in OS/2 1.2. This is a huge improvement over Windows' current file manager which does not provide direct manipulation; however, it is still inferior to the Macintosh Finder.

## Which Environment Will Win?

Various operating environments will probably be popular on PC compatibles in the future. In contrast to the past, when DOS was the standard for all PC compatibles, we expect different environments to be popular to different customers.

Windows' popularity will grow for two years. We think that Windows 3.0 will be successful to small business, higher education, and home customers. Windows' popularity has grown over the past year. And Windows 3.0 should accelerate that growth. We believe that, for business customers, Windows 3.0 will be the dominant graphical operating environment through 1991.

However, in 1992, Presentation Manager should become more popular than Windows for PC compatibles selling to large businesses as hardware prices decrease and as new OS/2 applications appear. OS/2 should eventually become more successful than Windows (at least in large businesses) because it offers features—such as multithreading, advanced IPC mechanisms, and long filenames—that are difficult, if not impossible, to add to DOS.

OS/2 will eventually become the standard in large business. Looking out to 1992, OS/2 will probably have its greatest penetration in large corporations. OS/2 Extended Edition requires expensive hardware and so will probably find its greatest acceptance in large IBM shops, since they are not too price sensitive and since they require communications between PCs and hosts. However, since both Standard Edition and Extended Edition of OS/2 require high-end hardware, they will probably not sell well to price sensitive customers (such as K-12 and home) for the next few years.

MS-DOS will dominate for years. MS-DOS will probably continue to be most popular operating system for PC compatibles across all users for the next couple of years, especially to price sensitive customers.

Following is a chart that attempts to depict the relative popularity of these three environments in 1992:

This chart shows that we expect MS-DOS to remain the most popular PC compatible environment in 1992.

The PC compatible market is fragmenting. Operating environments for PC compatibles are proliferating (DOS, various versions of Windows, OS/2 Standard Edition, and OS/2 Extended Edition). The PC compatible market is fragmenting, with consumers and education running DOS applications on 8086 machines, small businesses running Windows applications on 80286 machines, and large businesses running OS/2 applications on 80386-based systems.

Macintosh is a stable environment. The uncertainty about which operating environment will become the standard has left PC compatible users and developers confused. They aren't sure where to commit their resources. We believe that some customers are delaying purchases until they know what environment will be successful in the long run. Apple has an opportunity to take advantage of that confusion by promoting the relative stability of the Macintosh platform. The fact that Macintosh today has one operating system for its complete product family and provides an excellent software migration path could be used to sway these frustrated customers and developers into looking at Macintosh systems.

#### Appendix: IBM/Microsoft's Positioning of OS/2

Microsoft and IBM are positioning OS/2 differently. IBM is attempting to position OS/2 as the strategic operating system for most personal computers because OS/2 is part of its SAA strategy for tying together incompatible IBM hardware. Although Microsoft supports IBM's positioning of OS/2 officially, it is becoming evident that Microsoft actually wants Windows to increase its popularity in the short term, even at the expense of OS/2. One of the key reasons Microsoft is now pushing Windows may be that it suspects that only Windows—and not OS/2—can gain significant market share against the competing environments (DOS and Macintosh). And Microsoft deeply wants one of its graphical interfaces to succeed. Another reason Microsoft wants Windows to succeed is that it offers applications for Windows (Excel and Word) but its key competitors don't. Lotus and WordPerfect have instead been developing for OS/2. Therefore, if Windows succeeds in the short term, then Microsoft's applications will face less competition and are likely to become dominant applications. This will provide Microsoft with increased revenue, as well as giving its applications momentum if and when the market finally moves to OS/2.

#### IBM/Microsoft's COMDEX announcement

The COMDEX announcement is an example of IBM/Microsoft promoting the importance of OS/2 very heavily.

Windows vs. OS/2—the winner is OS/2. At the start of Fall Comdex, Microsoft and IBM released a statement clarifying the relationship between OS/2 and Windows, and giving more details on the future of OS/2. The statement strengthens the position of OS/2, assigning Windows to price-sensitive users and those with limited hardware. Implicitly, OS/2 is also now a 386-only operating system.

The most important element of the announcement is that Microsoft and IBM have now formally split the PC operating environments into two incompatible segments. Some PC customers, especially business purchasers of 286 systems, may feel betrayed by the change in positioning. Other customers, in the low-end markets assigned to Windows, may feel left behind. In contrast, Macintosh is a graphically-based machine with a single OS ranging from low end to high end.

### The Niche for Windows

- Windows is for use on systems with less than 2 MB RAM and less than a 30 MB hard disk. Microsoft said future releases of Windows will not include advanced OS features such as threads, 32-bit flat memory, distributed processing, or long file names.
- IBM and Microsoft will make graphically-based applications available on OS/2 before Windows, after mid-1990.
- Software developers who are not currently working on Windows applications are urged to develop for OS/2 first.

The injured groups. Although the announcements did not break a lot of ground, they clarified a number of important gray areas. IBM and Microsoft had left some of these gray areas alone because clarifying them would anger some customers and developers, including these

- People who bought 286-based PCs. When IBM and Microsoft announced OS/2 two and a half years ago, they said it would be optimized for the 286 processor. Now it is clear that the long-term direction of OS/2 is to the 386 chip. Some customers who bought 286-based machines like the IBM Model 50z may feel betrayed.
- Windows developers. Microsoft had a choice between upsetting small third-party developers of Windows software, and upsetting IBM and the big software developers who did not work in Windows. Microsoft chose to jettison the small developers. Although we still think Windows will be successful for some time, IBM/Microsoft have said that it is not as strategic as OS/2. This could discourage customers from choosing Windows, thereby reducing the returns to Windows software vendors.

The Apple Advantage. Apple is maintaining a consistent architecture. Macintosh does not force customers through the sort of disruptive transitions now being faced by PC buyers. In particular, the evolution of Macintosh does not abandon entire classes of customers the way the OS/2 will abandon the 286. System 7, which will ship at about the same time as OS/2 2.0, has a compelling advantage over OS/2 2.0. System 7.0 will run on all Macintoshes, and is compatible with existing software.

## Microsoft changes its message, promotes Windows

When IBM made its announcement at COMDEX that OS/2 was a much more strategic operating environment than Windows, Microsoft endorsed that announcement publicly. However, since that announcement, Microsoft has downplayed many of the things that were announced, and has indicated that Windows is, and will continue to be, a very strategic operating environment.

In one example, after COMDEX Steve Ballmer, Microsoft's senior vice president of systems, told Computerworld: "We haven't capped Windows in any way, shape, or form." This directly contradicts the COMDEX press release in which Microsoft stated that "Windows is not intended to be used as a server, nor will future releases contain advanced OS/2 features such as distributed processing, the 32-bit flat memory model, threads, or long file names."

Recently, Microsoft has begun positioning OS/2 as a very high-end solution that competes with UNIX, rather than DOS. For example, Steve Ballmer said that "OS/2's success today is coming in mission critical applications at large companies—not replacing DOS [but] rather in place of Unix...We won't see a phenomenon where there is a wholesale switch to OS/2 from DOS. We now see DOS and OS/2 as a family" (InfoWorld, 2/12/90, p. 8).

Thus, Microsoft is giving two conflicting messages. When expedient, it claims that Windows will not be enhanced in certain areas and that OS/2 is the way that most customers should go. However, we suspect that Microsoft is giving its real opinion when it says that Windows is not being limited, and that OS/2's primary market is competing with UNIX on the very high end.

## What does this mean to Apple?

The confusion in the PC compatibles world continues. The codevelopers of OS/2 have different desires for what operating environment they want to succeed. IBM wants OS/2 to be the winner, as soon as possible. Microsoft wants Windows 3.0 to be the winner in the short term.

IBM and Microsoft continue to confuse customers and developers by giving them different messages. Apple can take advantage of this confusion by reminding customers about Microsoft's conflicting statements and by promoting the single software environment of the Macintosh.

Here is a description of OS/2 Extended Edition's components: the Communications Manager, and the Database Manager. We also discuss LAN Server, which is an optional product running on OS/2 Extended Edition. OS/2 Extended Edition 1.1 is currently available; version 1.2 should be available by the end of March.

**Communications Manager.** Communications Manager is IBM's set of protocols, interfaces and emulations that enable a PC to communicate with other systems. Communications Manager's communication capabilities can be separated into two groups: host connectivity and PC networking.

The Communications Manager protocol that is most strategic for IBM is APPC (Advanced Program to Program Communication). APPC is the protocol IBM wants its customers to develop sophisticated distributed applications on for both PC to PC and PC to host networking. APPC allows programs on different intelligent machines to communicate without host intervention and without concern for the medium connecting them.

**Database Manager.** The Database Manager is a SQL-based database program. It is designed to allow systems running OS/2 Extended Edition to coexist in a distributed database environment.

Version 1.2 of the Database Manager adds significant functionality to previous versions. A Presentation Manager-based GUI replaces the text-based user interface. Application development and database administration tools are enhanced and numerous database functions are added. The most significant addition to Database Manager are the Remote Data Services that permit client/server database processing on a LAN. Still missing are LAN-to-LAN and LAN-to-IBM host distributed database processing functionality, which IBM promised in a statement of direction.

**LAN Server.** LAN Server is IBM's LAN operating system which runs on OS/2 Extended Edition. LAN Server is a separate product, costing \$1,040. It provides file and print sharing, file locking, security, audit trails, etc. Version 1.2, which is scheduled to ship on March 30, 1990, includes built-in Ethernet and Token-Ring support.

LAN Server is based on technology licensed from Microsoft, the same technology Microsoft used in LAN Manager. LAN Server is typical of LAN operating systems in that not every machine on the network needs to run a LAN Server, only those that will be making resources available to others. The LAN Requester (client) part of LAN Server is part of the OS/2 EE Communications Manager.