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Why OS/2 2.0

October 1992

IBM Personal Systems

Preface

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Contents

Executive Summary

WHY OS/2 SURPASSES BOTH WINDOWS 3.X AND WINDOWS NT

Most people agree that, as an operating system, IBM's OS/2 2.0 is superior to Microsoft's Windows 3.1. To compete with IBM's OS/2, Microsoft has announced another system, Windows NT. Windows NT is not yet available and Microsoft says the first version may ship in late 1992 or in 1993.

When it finally arrives, Windows NT is expected to address some of Windows 3.1's shortcomings. However, based on the preliminary beta release and Microsoft's public comments, Windows NT will only partially close the gap with OS/2 2.0.

For example, the state of the art in user-friendly interfaces today is the object-oriented graphical user interface, an example of which is the Workplace Shell in OS/2 2.0. Only recently has Microsoft begun to talk about releasing a similar user-friendly interface -- sometime in 1994.

Today, OS/2 2.0 surpasses Windows 3.1 in the following areas:

- Superior crash protection
- Greater number of applications supported
- Superior multitasking
- Object-oriented graphical user interface
- Superior file system
- More memory available for applications

Today, Windows NT is NOT available. In the timeframe that Microsoft is expected to complete Windows NT, OS/2 will have moved forward significantly. The following enhancements are planned for OS/2 later in 1992:

- Additional performance improvements, especially for the minimum hardware configurations
- Support for more displays, printers and other devices
- Improved graphics engine
- Support for Windows 3.1 applications

When the first version of Windows NT finally arrives, IBM is confident that OS/2 will still surpass it in the following areas:

- Compatibility with DOS and Windows

applications
- o Greater number of applications supported
- o Object-oriented graphical user interface
- o Less expensive hardware requirements (memory and disk)

So, a customer can choose to live with the shortcomings of Windows 3.1 and wait for Windows NT to arrive. However, when they are finished with this wait, they may face a hardware upgrade and a conversion of Windows applications.

Or, a customer can enjoy the benefits of OS/2 2.0's superior operating environment, avoid the upgrade and the conversion, and still have a superior operating environment in the future.

WHY DO ANYTHING ELSE?

Why OS/2?

THE BEST OF BOTH WORLDS

In the new PC environment, both personal productivity and line-of-business applications are essential. OS/2 can satisfy both needs. It provides a better DOS than DOS itself, and it runs a wide range of DOS and Windows applications. In addition, OS/2 2.0 is a superior platform for running in-house mission critical applications with industrial strength, robust protection, and powerful multitasking. Users don't have to choose between different systems for their different needs - OS/2 can do both.

FREEDOM OF CHOICE

Today's computing environment can be confusing; the variety of options can be overwhelming. When making choices about hardware and software platforms, it is difficult to follow a path which keeps a wide range of options open. Too often choices are constrained by compatibility issues or by a limited growth path. OS/2 2.0 aims to simplify the decision by providing a choice; the widest range of applications on a wide range of hardware.

OS/2 2.0 runs DOS, Windows and OS/2 16-bit and 32-bit applications, the widest range of applications available on an Intel-based platform.

In fact, OS/2 2.0 is such a superior environment that even if users only run DOS applications on a 386-based machine, OS/2 2.0 is the best environment in which to run them.

Furthermore, applications running under OS/2 2.0, whether they are DOS, Windows or OS/2 based, provide added value by working together; sharing information and running from the common Workplace Shell. This not only protects your current investment in DOS, Windows and OS/2 applications, but adds value by integrating them.

In addition, OS/2 2.0, and Extended Services and OS/2 LAN Server are supported on a wide range of IBM-compatible hardware as well as IBM PS/2s. This means the user can run OS/2 2.0 with confidence on machines from vendors like Compaq, Olivetti, Dell, Hewlett Packard, Toshiba, and others, and IBM support can be included. In fact, IBM has certified over 260 configurations from 71 hardware vendors so it is highly likely that your PCs equipped with an Intel 386SX or above processor are supported.

A PRODUCTIVE ENVIRONMENT FOR THE USER

OS/2 provides an object-oriented user interface, the Workplace Shell, which allows business users to focus on the information they want to work with, not the application that needs to be loaded. This business-oriented way of working helps users to become more productive, by concentrating more on what they want to do, and less on how to do it. It also provides a single consistent environment in which multiple applications can be loaded from different sources. Additionally, it is an extremely easy environment to learn, since once a user knows how to drag a file's icon with the mouse to put it into a folder, he can use the same operation to print it, and to copy it to another disk or erase it. In addition, companies can derive the benefits of a standard interface which complies with IBM's Common User Access (CUA) definition for user interface design.

Also, since many applications can be loaded and running at the same time, users can be more productive, especially in work that involves much interruption and switching from one task to another. OS/2's true multi-tasking means that long-running processes can simply be switched to run in the background, while the user continues

with something else - resulting in less 'wait time' for the user. At the same time, more can be done with the existing set of applications by allowing them to share information easily through consistent interfaces like the Presentation Manger clipboard.

A PLATFORM YOU CAN RELY ON

When the PC becomes the center of information processing, as it often is in today's environment, then the PC platform must show the stability and reliability of the host environment. Today, DOS and extensions to DOS, like Windows, do not provide the protection that OS/2 2.0 offers. OS/2 HAS BEEN DESIGNED TO PROTECT APPLICATIONS FROM ONE ANOTHER and delivers today the stable platform required for full multitasking and greater protection from system crashes. It is little use having the most fault tolerant server or host if the client workstations are not fault tolerant. And many users of productivity applications, like word-processors and spreadsheets, consider their PCs to be "mission critical". For this reason, reliability is a requirement for every PC.

SUPERIOR CONNECTIVITY

OS/2's strong multitasking and robust protection make it the best operating system available for connectivity applications such as client/server and distributed processing. In addition, OS/2 has Extended Services for OS/2, which provides communications and database functions, and OS/2 LAN Server, which provides a full client-server environment. This allows networking to be an integral part of the operating system, and provides high functionality at a much more economical cost than buying many separate packages.

OS/2 is not only a superior server platform, but also the most functional and stable client. It provides a consistent platform for both server and client, can handle multiple concurrent communications protocols (e.g. NETBIOS, APPC, IPX, TCP/IP) with ease, and even provides a LAN-independent user interface to mixed vendor networks. In addition, it is enabled for automated LAN-based installation. Most importantly, OS/2 offers the stability and reliability in a client to match the reliability of the server or host.

The result is that "mission critical" applications which depend on communications with various systems can be implemented much more safely in OS/2 than on DOS or its extensions.

THE INTEGRATED SYSTEM

OS/2 allows DOS, Windows and OS/2 applications to run together while providing a GUI, and the database, communications, and LAN support included in Extended Services for OS/2 and LAN Server. For developers, this means the APIs and services have been designed to work together, eliminating the need for the systems integration of a variety of DOS-based packages, a process which often presents incompatibilities or problems.

Instead, the OS/2 function has been designed and tested to work together - IBM has already done the integration work. In addition, the Workplace Shell environment integrates DOS, Windows and OS/2 applications and allows them to work together, even though they may have been written by different vendors. That's why OS/2 is THE INTEGRATING PLATFORM for the 1990s.

32-BIT POWER

OS/2 2.0 is a 32-bit system. It gives users the advantages of a 32-bit system, which include superior application performance and the opportunity to fully use the 386 and 486 hardware that runs OS/2. It provides users with a 32-bit system NOW - eliminating their need to wait for other alternatives with uncertain delivery dates.

The 32-bit API also allows developers to create richer, more sophisticated applications. Applications like multimedia require an advanced 32-bit interface to exploit their full potential and power. Additionally, moving to the OS/2 32-bit API gets developers ready for future developments in OS/2.

PLATFORM FOR GROWTH

OS/2 will be the base of new developments for many of the features that will be requirements for the workstations of the mid-90's. These include multimedia, object-oriented systems, support for

the Distributed Computing Environment (DCE) and portability across different processors. These applications will require a robust, architected and powerful 32-bit system, and that system is OS/2.

IBM plans to enhance OS/2's capabilities for object-oriented application development in distributed environments by advancing the function provided by the System Object Model. IBM intends to leverage a subset of Taligent's object services and frameworks to benefit OS/2 application development and enable future compatibility with Taligent's environment.

VALUE FOR MONEY

OS/2 2.0 offers a "3 in 1" environment, allowing users to run DOS, Windows and OS/2 applications so there is no need to buy DOS or Windows separately. It also includes a series of productivity applications, utilities and games at no additional cost. OS/2 also provides scalable font support for both Windows and OS/2 applications with Adobe Type Manager. OS/2 offers all this functionality at a list price which is less than the combined list prices of DOS and Windows 3.1.(1) Upgrading from DOS or Windows makes the cost of moving to OS/2 even less.

PROTECTS TODAY'S INVESTMENT, AND IS A BASE FOR THE FUTURE

Today, OS/2 supports the widest choice of existing applications while meeting the needs of current client-server and networked environments. OS/2 also provides a strong base for future technologies and a very reliable migration path. OS/2 currently offers what other environments can only promise for the future - so why wait?

What are some alternatives to OS/2?

WINDOWS 3.X

Microsoft Windows 3.0 and 3.1 are good attempts to work around some of the architectural limitations of the 10 year old, 16-bit, single-tasking architecture of DOS. They offer the user a more attractive interface and provide an environment in which programs can be written to do limited

multitasking. The underlying architectural limitations still remain and it is these limitations that will prevent Windows 3.x from fully satisfying the demands of most in the 90's. Let us review these demands:

1. Reliability
2. Pre-emptive multitasking
3. Application support
4. Networking support
5. User interface
6. 32-bit

Reliability

DOS was written to run on the Intel 8086/8088 processors available at the beginning of the 1980s. These processors ran in "Real Mode", that is any program could address and change any part of memory. Therefore any program which made a mistake could overwrite itself or the operating system. In any case the program would fail. This might be irritating to the user if it led to lost work, but the impact was likely to be small.

Windows enabled more than one program to run, but still sometimes ran the processor in Real Mode. In this situation, one failing program could necessitate the shut-down of the whole system. This was the well-known "Unrecoverable Application Error" (UAE). In Windows 3.1, Microsoft reduced the frequency of the UAE in Windows 3.1 (and renamed the remaining UAEs to General Protection Faults or "GPF".) However, AS LONG AS A PROGRAM RUNS ON TODAY'S DOS, THE POTENTIAL FOR THESE FAILURES REMAINS. These failures can be very irritating to end-users and can represent a real impact to their productivity. For businesses that want to run "mission-critical" or higher-speed communications applications on PCs, it can be potentially disastrous.

From the beginning, IBM designed OS/2 to be a "protected" operating system. This means the operating system and the hardware cooperate to prevent failing applications from impacting any other part of the system. For the user, that means fewer problems and less inconvenience. For the business, it means lower risk and greater productivity.

Multitasking

Windows 3.x is built on the foundation of a single-tasking operating system, DOS. Therefore, multitasking of Windows applications must be done within the applications themselves. Programmers of Windows applications must explicitly include "yield points" to enable other applications to get a share of the processor time. This is called "cooperative application multitasking" and results in inefficient use of available resources and unsatisfactory and uneven response to users when multiple programs are running.

IBM designed OS/2 to be a multitasking system by basing multitasking in the operating system, not the applications. For this reason, OS/2 can outperform Windows 3.x in many multitasking situations. In practice, this advantage is felt by the end-user in the increased smoothness of response. For example, an OS/2 user can continue to type into a word processor while formatting a diskette.

Application support

OS/2 runs more Windows applications than Windows 3.1 because it enables users to simultaneously run applications written for Windows Real Mode (Windows 2.x applications) and Windows 3.x applications. (Windows 3.0 can run these applications but not simultaneously with Windows 3.x applications.) OS/2 will also run OS/2 applications written for OS/2 2.0 and all previous releases of OS/2. An independent estimate put the customer investment in OS/2 applications at 2 billion dollars, in addition to the 2 billion dollars invested by software vendors.

OS/2 is the first mainstream 32-bit operating system for the Intel hardware architecture. Many software vendors and companies are developing applications that take advantage of the investment made in Intel 386 and 486 processor based machines over the last several years. The second edition of the OS/2 Application Solutions Directory published by Graphics Plus, Inc. lists 1100 32-bit OS/2 applications available or in development as of July 1992. OS/2 has the widest applications portfolio of any operating system in the market.

Networking

The role of the Personal Computer is changing; fewer business PCs are now stand-alone machines and highly connected client-server architectures will provide the Information Technology (IT) systems of the 90s. The original PCs were not designed to manage the demands of networking, which always required compromises for DOS-based PCs. The limited memory available for programs in DOS often meant that certain, larger applications were mutually exclusive with networking. Networking with Windows 3.0 was not always easy because of the various techniques used to circumvent the memory restrictions.

Windows 3.1 has helped ease these difficulties but has not completely eliminated the restrictions. In addition, the implementation of networking programs as Terminate and Stay Resident (TSR) programs (which ran in the Real Mode of the Intel processor) further compromised the reliability of the system. Networking is fundamentally a multitasking activity and the limited multitasking in Windows was sometimes inadequate to manage high-speed communications tasks running in the background.

Networks are increasing in size and effective network and systems management is becoming more important. A sophisticated multi-tasking system is required to ensure these tasks can be safely performed in the background at any time without the intervention or knowledge of the user. OS/2 was designed to be part of a network and consequently, is an ideal choice for a client workstation.

User interface

Windows introduced many users to the benefits of a Graphical User Interface (GUI). Research shows that the underlying conceptual model presented by a software system is as important as the actual look of the program. Windows is still harnessed to the same underlying organization as DOS. This necessitates users understand the structure of the file system, the distinction between program and files, and so on.

The OS/2 user interface (the Workplace Shell) is a second generation GUI and presents an interface modelled on the real world. Users interact with the system by manipulating "objects"; dragging a file to a printer for instance. IBM has conducted

thousands of hours of usability research to ensure OS/2 is easy to use, not just easy to learn.

In addition, the Workplace Shell acts as a unifying layer for applications. No matter for what system they were originally designed, they are used in the same way and information can be shared between them using the same techniques. Printing is easier in OS/2, enabling users to forget about the mechanics of the system and simply accomplish their tasks. OS/2 is designed to work the way users work, not force them to work the way the computer works. Finally, OS/2 removes from many users the responsibility for understanding and controlling such things as extended memory management (provided by add-on products to DOS like QEMM) and enables them to concentrate on their jobs.

32 bit

For the end-user, the internal design of the system is probably not important. However, for the decision maker, the architectural basis of the product is significant because it dictates the range of future possibilities.

Microsoft has announced a 32-bit API for Windows 3.1 (Win32s), but it is important to understand the limitations inherent in this approach. As the full name (Win32 subset) implies, Win32s implements only some of the API calls in the full Win32 API which Microsoft states is supported in Windows NT. This means that developers may have to make a choice; They can write an application common to Windows 3.1 and Windows NT (which cannot exploit the additional functions in Windows NT), or develop separate applications for Windows 3.1 and Windows NT. In the latter case, the benefits of the Win32s API will be limited to the flat 32-bit memory model (which a Win32s Dynamic Link Library will map back to the native 16-bit segmented memory model of Windows 3.1). The performance implications of this are unknown.

OS/2 implements a complete 32-bit API with advanced features today. The benefits of this increase as developers ship more advanced, high-performance applications for OS/2. The requirements of the 90's are already here and OS/2 can satisfy them today.

WINDOWS NT

Microsoft has announced it will provide a completely new operating system called Windows NT. It will share the Windows name and provide some compatibility to existing Windows programs. It has been announced for availability at the end of 1992 or early 1993. At this time, only pre-beta code is available and this discussion is based on the functions present in this code and stated by Microsoft representatives to be in plan. It must be stressed that WINDOWS NT IS NOT AN AVAILABLE PRODUCT.

Windows NT will implement a number of subsystems on a newly written kernel that borrows elements from different operating system models.(2) Microsoft states that important features of Windows NT will be:

- o Preemptive multitasking and multi-threading
- o Protected architecture
- o 32-bit system
- o Support for DOS and existing (i.e. 16-bit) Windows applications

IBM agrees that these features are important, which is why they are already available in OS/2 2.0. Other features that Microsoft claims that Windows NT will have are:

- o Improved security API
- o Support of symmetrical multiprocessing (SMP)
- o Portability (easily migrated to different hardware architectures)
- o POSIX

IBM agrees that these features are likely to be of increasing importance in the future and intends to add these features to a future version of OS/2. However it is unclear to what extent these features are required by customers today, or whether they will be more important than other technologies on which IBM is also working. In particular, the first version of Windows NT will not include any object-oriented user interface technology (unlike OS/2 which incorporates and uses the Workplace Shell / Systems Object Model (SOM) as the basis of its object-oriented user interface).

When considering the value of a new operating system it is better to take a business-oriented viewpoint rather than concentrating on the technology. In particular users should consider two vital points: the resources required to run an operating system and its compatibility with the existing application portfolio.

Windows NT system requirements

The recommended minimum configuration for Windows NT will be a fast Intel 386 with at least 8Mb of RAM and 100Mb of disk space.(3) However, PC Week has reported, "Many observers say that the practical recommendation will probably end up closer to a 12Mb system. Others predict even higher memory requirements."(4) Gartner Group has also told its customers it believes "a mainstream platform for Windows NT will be a 486DX with 12 to 16 megabytes of RAM (and up) on the workstation."(5)

Since Windows NT is not generally available, it is unclear how much memory will be required to run a typical networked application.

Windows NT compatibility

Windows NT will be a break with previous PC operating systems and may not offer full compatibility with existing DOS or Windows applications.

In its July 27, 1992 review of Windows NT, PC Week stated, "Rather than provide compatibility for all DOS and Windows applications, Microsoft Corp. officials have stated their intentions to focus support on 'major' DOS and Windows 3.1 applications." Paul Muglia, a director of Windows NT at Microsoft, was also quoted, "We'll look at what are the top 100 Windows applications and the top 100 DOS applications, and focus more on those than on those that haven't sold well."(6)

In addition, the operating system design is processor independent and so if code written for the Intel 16-bit processors is to run on other processors, a software emulation of the underlying hardware may have to be provided. This technology is familiar from the UNIX world. It enables a basic level of compatibility but has a number of

potential drawbacks:

o Performance

The software emulation of hardware processes may cause applications to run slower

o Hardware dependent programs

These may often not run. In particular, many DOS device drivers may have to be rewritten. This means that fax, scanner, file backup and even 3270 emulation programs may not run. Many software vendors will only undertake the work of rewriting device drivers if they are assured of a significant marketplace. The hardware requirements of Windows NT are likely to mean that it will not be a mass-market product.

o Usability of DOS programs may also be compromised

Microsoft has acknowledged that, in the first release of Windows NT, DOS programs using VGA (or higher mode) graphics will not be able to be windowed onto the desktop.(7) This is not a problem for OS/2. Microsoft's plans to support clipboard and DDE for these DOS programs have also not been made clear.

Windows programs written for Windows 3.x are 16-bit programs and Microsoft has stated that Windows NT will support these programs in a single Virtual DOS machine (VDM).(8) This means that if one program fails other Windows 16-bit programs may fail - just as in Windows 3.1.

Windows/NT market positioning

Windows NT may have a number of compatibility issues that could make it an unacceptable option for many end-users. Add to this the projected higher cost of the hardware needed to run NT and it's clear that Windows NT is unlikely to become the client of choice for most people. Microsoft has also clearly positioned Windows NT as more suitable for a server or high-end workstation operating system.(9)

While Windows NT has many of the features that would make it an attractive base as a server

operating system, the reality is that changing a Network Operating System is a difficult and expensive procedure. Most network managers would choose to run with lower function rather than incur the risk and cost of changing server software.

Because nearly three-quarters of the networks in the world use Novell products that will not even run on Windows NT, it could take a long time for Windows NT to gain any significant acceptance. In addition, it is not clear what effect Microsoft's plans to bundle some basic networking functions with Windows NT will have on other networking product vendor's inclinations to support the platform.

OS/2 users will gain little if any benefit from moving to Windows NT because OS/2 already offers the key features of multitasking and application protection. In addition, Microsoft has stated that Windows NT will not run OS/2 32-bit or OS/2 Presentation Manager programs.

Many RISC-based workstation users are using UNIX because the specialized applications they need are written for UNIX. It is likely to be a large migration job to re-write a UNIX program for Windows NT and, in the absence of a large market acceptance, it is questionable whether software vendors will be willing to make that investment. Some UNIX users have already expressed their unwillingness to move to a new operating system that is inherently single-user when they are used to the flexibility of the multi-user UNIX. Jay Kidd, a director of marketing at Silicon Graphics (the manufacturer of the only RISC-based workstation that Windows NT runs on today), has stated "UNIX, rather than Windows NT, will continue to be the operating system of choice for those who want the absolutely best performance and are willing to sacrifice compatibility to get it."(10)

In summary, Windows NT is at risk of becoming a high-technology white elephant. If it cannot run existing programs and needs more powerful hardware than is widely installed then it should have a limited market and remain an academic solution to niche needs.

Microsoft has a two operating system strategy. Today, the company recommends DOS and Windows for the client AND OS/2 FOR THE SERVER.(11) When Windows NT is delivered, it says that customers should migrate their OS/2 servers to Windows NT servers. IBM believes that the reason Microsoft proposes two separate and different operating systems for the client and server roles is because Microsoft does not offer a product that provides the reliability and efficient multitasking for clients with more limited hardware requirements. IBM PROPOSES ONE OPERATING SYSTEM FOR BOTH THESE ROLES: OS/2. This reduces administration workload and training overhead for support staff while making better use of software developers' skills.

The dominant system design of the 90's will be client-server. The flexibility, development speed and cost advantages of this architecture increase the requirements for systems and network management. A reliable client is a must (why pay for fault-tolerant servers if the clients are not fault-tolerant?) but true multitasking is also vital to enable effective and non-intrusive management. OS/2 IS AN IDEAL CLIENT. LAN Server with OS/2 on the server provides the highest performance server in the industry.

Windows Myths

Some claims and beliefs about Windows have gained popularity. They often do not stand up to closer examination.

MYTH #1: THE MARKETPLACE HAS CHOSEN - WINDOWS IS THE STANDARD.

Windows has been an impressive sales success with Microsoft claiming to have shipped 10 million copies. However, the independent consultant groups, Creative Strategies and IDC, estimate that only 55% or 30% (respectively) of Windows licenses are in use. Windows magazine has also questioned Microsoft's number and estimated the number of copies of Windows in real use at about 4.5 million.(12) Any of these independent estimates reveal 5% or less of the close to 100 million installed base of PCs are using an installed copy of Windows, far from being a standard.

MYTH #2: EVERYONE IS USING WINDOWS APPLICATIONS.

Many software vendors have invested a lot of money developing Windows applications, and, as a result, much attention has been focused on these products. However, in 1991, the Windows applications market was smaller than the Macintosh applications market (according to the Software Publishers Association). In the nine months to June 1992 there were never more than 5 Windows applications in the "Top 20" best selling applications(13)

Personal Computer Magazine in May 1992 said "Companies that have invested a lot of money in developing Windows applications are battling for a small share of what is a small pie".

Users continue to use, and buy, the tried and trusted DOS applications making compatibility with DOS applications a key requirement for any personal operating system. That is one of the things that OS/2 excels at and this DOS compatibility is one of the areas that should be of most concern to users considering Windows NT in the future.

MYTH #3: WINDOWS IS FASTER AND LEANER THAN OS/2

OS/2's design is optimized for multitasking, making OS/2 better than Windows in most multitasking scenarios. What is not well known is that OS/2 can also outperform DOS and Windows when running some DOS applications individually. OS/2 has a superior file system that gives a significant performance advantage to programs that do a lot of I/O for instance, database programs. Microsoft has drawn considerable attention to the different minimum hardware requirements of DOS/Windows and OS/2. However, Windows can run in more than one "mode". The Windows mode with the smallest hardware requirements offers the fewest benefits to users (more limited multitasking of DOS applications, for instance).

What Microsoft is saying about OS/2 2.0

Microsoft has published a number of documents that compare Windows 3.1 and Windows NT to OS/2 2.0. Some of the titles include:

- "A Guide to Evaluating Microsoft Windows Operating System Version 3.1 for The PC Desktop With Comparisons to OS/2 2.0"

- "Microsoft Windows NT Operating System - A Technical Comparison With OS/2 2.0"

- "Microsoft Windows or OS/2 2.0"

These documents from Microsoft contain many statements regarding OS/2 that are incorrect or could mislead users. To help IBM's customers make a more informed choice of operating systems, the following are clarifications to some of Microsoft's statements:

- OS/2 WILL RUN ON LESS THAN 2% OF THE WINDOWS CAPABLE-MACHINES, CITING INFOCORP AS THEIR DATA SOURCE.

  According to Microsoft's data, approximately 200 thousand (1.38% of 18 million) machines are capable of running OS/2. Microsoft's information is obviously incorrect since there have been over 1 million copies of OS/2 2.0 shipped in the first 120 days of availability.

  IDC has stated that at least 28% of the installed base of PCs are OS/2 capable. Almost 50% of machines shipping in 1992 and 66% of machines to be shipped in 1993 are OS/2 capable signaling a trend in the marketplace. In addition, OS/2 can run on many of today's notebook and laptop computers.

- OS/2 IS NOT SUITABLE AS A NETWORK CLIENT BECAUSE OF THE "RELATIVELY FEW NATIVE DESKTOP APPLICATIONS AVAILABLE."

  OS/2, as the Integrating Platform, runs DOS, Windows and OS/2 applications. No company has more experience and capability in networking than IBM. IBM believes OS/2 is the industry's best desktop client for connecting to complex enterprise networks. It is an ideal solution for mission-critical networked applications.

- OS/2 HAS LIMITED HOST CONNECTIVITY BASED ON THE NUMBER OF NATIVE COMMUNICATIONS PACKAGES.

  That is not correct. The OS/2 Communications Manager has a very comprehensive set of host connectivity options and current DOS and Windows based packages work on OS/2 as well.

- WINDOWS HAS MORE DEVELOPMENT TOOLS THAN OS/2

  OS/2 has a full complement of more than 250 development tools, although Windows has more native development tools. Many of today's leading edge tools originated on OS/2 which is why OS/2 is the preferred development environment for many vendors.

- THE DOCUMENT "MICROSOFT (R) WINDOWS NT (TM) OPERATING SYSTEM - A TECHNICAL COMPARISON WITH OS/2 (R) 2.0" CONSISTENTLY USES THE PRESENT TENSE, "WINDOWS NT IS... "WINDOWS NT SUPPORTS...", "WINDOWS NT MEETS..."

  Windows NT has not been shipped for general availability, therefore the use of the present tense is inaccurate. The actual ship date of the first release is not certain. In addition, Microsoft expressly does not guarantee that all of the function that has been described as part of Windows NT will be delivered in the first release.

- MICROSOFT STATES THAT OS/2 RUNS MULTIPLE DOS APPLICATIONS BY STARTING A VIRTUAL DOS MACHINE OR VDM. MICROSOFT GOES ON TO SAY THAT THIS IS A FEATURE OF THE 386 DESIGNED TO SUPPORT OLDER REAL MODE APPLICATIONS AND THAT THIS FEATURE HAS BEEN USED FOR SOME TIME BY A NUMBER OF DOS EXTENDERS. THE READER MIGHT INFER THAT THIS IS A LIMITATION OR SHORTCOMING IN OS/2.

  This misses the point and could be misleading. It is precisely because OS/2 uses the hardware isolation VDMs provide that OS/2 can offer superior crash protection. HARDWARE protects each application in a VDM from taking down an application or operating system in another VDM. Since Windows does not use this feature, the Windows Unrecoverable Application Errors (UAE) and General Protection Faults (GPF - a UAE by another name) can and sometimes do crash the operating system and other applications.

  OS/2 also provides support for more DOS applications than is planned for Windows NT. Microsoft has confirmed that Windows NT will have limited support of DOS applications because it does not plan to support the v86 mode of the hardware the same way that OS/2 does. PC Week reported that many programs that

support fAX, scanner, MIDI, terminal emulator and LAN cards (that today run under OS/2 2.0) will not run unmodified on Windows NT. In addition, DOS programs that support VGA or higher graphics will not run in a window on the Windows NT desktop.(14)

- THE NEW OS/2 WORKPLACE SHELL IS DIFFICULT TO USE. HAVING WINDOWS APPLICATIONS RUNNING ON THE OS/2 DESKTOP WILL CONFUSE USERS AND DRIVE UP SUPPORT COSTS.

  This argument is very difficult to understand, especially in our industry where new innovations are constantly bringing better products to consumers.

  The Workplace Shell represents a second generation of graphical user interface and is a major advance over the Windows and previous OS/2 interfaces. These older generation interfaces basically put a pictorial face on the menus of OS/2 1.x and Windows 2.0. Instead of working with operating systems constructs like File Managers and Program managers, you work with a desktop with pictures (icons) of familiar things such as letters, folders and appointment books. Instead of working with directories, paths and print commands, you just pick up the picture of the letter and put it on the printer. OS/2 also allows users to preserve the command prompt or menu interface. IBM's OS/2 gives you the choice.

  Microsoft has also recently demonstrated a future (1994) Windows NT user interface, codenamed "Cairo", that adds object oriented functions to Windows NT which bears a resemblance to the OS/2 Workplace Shell.

- OS/2 2.0 DOES NOT RUN WINDOWS 3.1 APPLICATIONS, WHICH LEADS TO DEFICIENCIES IN THAT IT WILL NOT USE TRUE TYPE(R) FONTS, HAS LIMITED NETWORKING SUPPORT, PERFORMANCE AND RELIABILITY.

  Support of Windows 3.1 applications in OS/2 2.0 has been demonstrated at various trade shows and is now in beta test with customers. IBM intends to make the Windows 3.1 application support generally available near the end of 1992.

With respect to TrueType fonts, OS/2 2.0 offers built-in Adobe Type Manager (ATM) font technology for both OS/2 and Windows modes. Adobe is widely used in the industry while TrueType is still proprietary. In addition, there are thousands more fonts available for Adobe than TrueType. TrueType support for Windows 3.1 applications will also be included in OS/2 in the near future.

OS/2 currently provides more networking options than does any generally available version of Windows, and OS/2's reliability and performance when performing many simultaneous tasks are hard to match. Several vendors, such as Novell, have networking products available for OS/2 2.0 today, with more coming from other vendors. In addition, OS/2 can run many DOS-based LAN products in its DOS sessions.

With OS/2's entry-level hardware requirements and its superior communications extensions, both from IBM and other vendors, OS/2 is ideally suited for both the client and server ends of communications, thus keeping all systems consistent and homogeneous.

- THE INSTALLATION OF OS/2 2.0 CAN BE DIFFICULT

Installing 15 to 20 diskettes can seem complex at first, but OS/2 does an admirable job of making it easy and of migrating existing applications. The installation process can even be accomplished across a local area network or eliminated entirely by choosing OS/2's remote IPL capability. In addition, many new systems are pre-loaded with OS/2 and a CD-ROM version is planned for availability soon.

- OS/2 2.0 OFFERS LIMITED RELIABILITY WHEN RUNNING MULTIPLE WINDOWS APPLICATIONS IN THE SAME SESSION.

Actually, OS/2 has a big advantage over Windows 3.1 when it comes to reliability. Under Windows, an errant application can disable other applications or even Windows itself. OS/2 provides protection which can prevent a failing application from bringing down another or the whole system.

Under OS/2 2.0, if a user runs several Windows applications in the same session and two or more conflict, the user can simply specify them to run in separate sessions to protect one from harming the other. Of course this may use more memory, but the gain is the reliability that Windows 3.1 does not offer.

- APPLICATIONS RUNNING IN SEPARATE OS/2 SESSIONS DO NOT FUNCTION PROPERLY.

  This is incorrect. Windows applications function just fine when run together in the same OS/2 session or in different sessions. This includes applications that use the clipboard, NETBIOS, Dynamic Data Exchange (DDE), Named Pipes or Object Linking and Embedding (OLE).

- DATA EXCHANGE OF GRAPHICS BETWEEN WINDOWS AND PRESENTATION MANAGER APPLICATIONS DOES NOT WORK.

  This too is incorrect. Dynamic Data Exchange (DDE) and the clipboard functions work fine for graphics.

- OS/2 2.0 HAS LIMITED VIDEO SUPPORT IN THAT A WIN-OS2 WINDOW WILL ONLY RUN IN VGA GRAPHICS MODE.

  In the initial shipment of OS/2 2.0, this is true. However, there are SVGA board makers who have already produced WIN-OS2 window (seamless window) drivers for their SVGA boards and IBM's 32-bit XGA and SVGA high-resolution seamless drivers are also available in the market.

- CONFIGURING OS/2 2.0 IS DIFFICULT BECAUSE USERS MUST CONFIGURE BOTH THE OS/2 AND THE WINDOWS SIDE OF THINGS.

  Some users may want to customize the configuration of their Windows applications but OS/2 is generally self-configuring. Once the user installs fonts and other tools, it runs seamlessly.

- NT WILL BE BETTER IN ITS SUPPORT OF 16-BIT WINDOWS APPLICATIONS. NT WILL RUN THESE APPLICATIONS IN ONE ADDRESS SPACE WITH PARAMETER VALIDATION.

We disagree that this provides better protection. In contrast, it should provide no more protection than the current Windows version and still far less than OS/2 2.0.

Since the applications will only run in one address space, they can still conflict with each other. The parameter validation in Windows 3.1 simply gives users a little more information on what went wrong. Windows can have difficulty recovering from such a situation and users may still have to reboot their system when a General Protection Fault (UAE) occurs. There is no advantage in this.

When a Windows application fails under OS/2, one only need stop and restart the failed session. There is no reason to reboot the entire system. Additionally users have the advantage of running the applications in separate sessions to avoid conflicting with another application.

- NT IS MORE OF AN "ADVANCED OPERATING SYSTEM" THAN OS/2 2.0

  This is a very subjective statement! Both NT and OS/2 2.0 are pre-emptive, multithreaded, prioritized multitasking systems and ONLY OS/2 IS A FULL PRODUCT IN THE MARKETPLACE TODAY.

- OS/2 FALLS SHORT BECAUSE IT DOES NOT HAVE A FULL 32-BIT ARCHITECTURE.

  In the current release of OS/2 2.0, the operating system code contains a mixture of 16- and 32-bit code. Due to the native support for DOS and Windows applications, 16-bit code must be present. The APIs provided however are full 32-bit implementations. This allows developers to write full 32-bit native applications and have total compatibility with OS/2 2.0 as more of the internal subsystems are migrated to 32-bit. In particular, a 32-bit graphics engine which will offer improvements in performance, function and stability is already in beta test. IBM's intentions are to deliver this new graphics engine to end-users later in 1992.

- PRESENTATION MANAGER RUNS IN A SHARED ADDRESS SPACE WITH ITS APPLICATIONS AND THUS CANNOT PROTECT ITSELF.

Presentation Manager does not really "run", it is a set of routines that provide functions to applications which run in their own address space. A failing PM application will only hurt itself, not PM or any other program. PM and the rest of the operating system code remain intact.

- OS/2 CANNOT SUPPORT SYMMETRIC MULTIPROCESSING MACHINES.

  It is true that OS/2 does not yet support symmetric multiprocessing, but very few people have true SMP machines today. What some customers have today are systems that support multiple processors (MP) and IBM plans to ship, in the near future, an extension of the LAN Server (LS) that will support up to five loosely coupled processors. This LS/MP extension will support IBM's new PS/2 Model 295.

  It is IBM's intention to also support multi-threaded SMP applications in the future.

- OS/2 FALLS SHORT BECAUSE, AS A MIXED 16/32-BIT SYSTEM, IT CANNOT BE PORTED TO RISC PROCESSORS.

  This is incorrect. It is part of IBM's strategy to port OS/2 to the RISC platform and maintain compatibility with existing OS/2 32-bit applications. Only sections of OS/2 required to maintain compatibility with existing 16-bit DOS and Windows applications will remain 16-bit.

- OS/2 DOES NOT HAVE A DESYNCHRONIZED INPUT MODEL.

  OS/2 has a mechanism to interrupt "ill-behaved" applications that might "hog" the message queue and inhibit user input. Most OS/2 applications are written so that this is not a problem.

  With OS/2's modular design, a desynchronized message queue can be implemented as a replacement subsystem and added to the system in the future.

- OS/2 FALLS SHORT BECAUSE IT HAS LIMITED ASYNCHRONOUS I/O.

OS/2 has full support for asynchronous I/O and with its enhanced FAT and HPFS file systems, along with device drivers for communications and other peripheral ports, it is a very powerful and efficient system for synchronous and asynchronous I/O.

- OS/2 SUPPORT FOR WINDOWS APPS IS MORE LIMITED IN THAT IT RUNS MODIFIED WINDOWS 3.0, NOT 3.1 AND WILL NOT RUN 32-BIT WINDOWS APPS. THESE ARE SHORTCOMINGS GIVEN THE SIZE OF THE INSTALLED BASE OF WINDOWS

  First, there are no 32-bit Windows (Win32) applications today. OS/2 can add this support if there is demand for it. As stated earlier, OS/2 has been demonstrated running Windows 3.1 applications. The code is in beta test now and is planned for availability before the end of 1992.

  Finally, there is a fairly large Windows application install base and OS/2 2.0 runs virtually all of those Windows applications today.

- THERE ARE ONLY ABOUT 300 GRAPHICAL APPLICATIONS FOR OS/2 AVAILABLE.

  Since OS/2 can run all the OS/2 and the majority of the DOS and Windows applications, most of the 6500 Windows applications should be added to the list of what OS/2 will run.

  While these applications were not written to take advantage of OS/2's native protected mode, they will run well under OS/2 nonetheless. Windows 3.1 cannot run a number of these applications without changes. In addition, Microsoft has published a compatibility list describing more than 30 applications written for Windows 3.0 that will not function properly on Windows 3.1 but run on OS/2 2.0.

  Following Microsoft's logic, Windows NT will be in the same situation as OS/2, in that the 6500 Windows and thousands of DOS applications were not written for its native mode. Microsoft has also stated recently that it will only focus on support efforts on "major" DOS and Windows 3.1 applications for Windows NT.(15)

o THERE ARE SIGNIFICANT ADVANTAGES TO CODING FOR THE WIN32 SUBSET (WIN32S) FUNCTIONS, TO HAVE CODE THAT RUNS AND IS PORTABLE UP TO WINDOWS NT ONCE WINDOWS NT SHIPS.

While this may appear to be a sound technical idea, there are some severe shortcomings in this approach.

Applications coded only to the Win32s API will not exploit many advanced operating system features (multi-threading, preemptive multitasking, etc) on either Windows 3.1 or Windows NT. On the other hand, applications coded only to the full Win32 API may not run on Windows 3.1 at all.

Essentially, the Microsoft strategy forces developers to make a choice:

- Sub-optimize either the Windows 3.1 clients or the Windows NT servers
  ...or...
- Maintain separate source libraries for each, significantly increasing development costs.

OS/2, however, has a single, consistent 32-bit API for developers to build both client and server applications.

o OS/2'S SCHEDULER WILL NOT PREEMPT A TIME SLICE ONCE IT HAS BEEN STARTED WHILE WINDOWS NT WILL, LEADING ONE TO CONCLUDE THAT OS /2 IS LESS EFFICIENT FOR TIME-CRITICAL APPLICATIONS.

OS/2 is ideal for time-critical applications, and indeed, is being used in many sites today to control plant floors, loading docks and medical equipment. OS/2 was also used at the 1992 Summer Olympic Games to control data and has been used to gather and report real-time data at the Indianapolis 500 car race for several years now.

o WINDOWS NT WILL SUPPORT 2 GIGABYTES OF ADDRESS SPACE PER APPLICATION WHILE OS/2 2.0 ONLY SUPPORTS 512MB.

OS/2's architectural limit per application is 4 gigabytes, the current implementation is 512Mb. Today, there are very few applications that come anywhere near 512Mb of memory and

very few computers that even have 100Mb of real memory.(16)

- WINDOWS DEVELOPERS CANNOT LEVERAGE THE INVESTMENTS MADE IN THEIR WINDOWS-BASED PROGRAMS IN OS/2.

In OS/2, Windows developers can gain great benefits and leverage their investments in Windows code in several ways:

1. Users can continue to run their Windows applications under OS/2 while developers work on OS/2 versions. OS/2 2.0 can run the majority of the Windows applications that Windows 3.1 does not.

2. Windows and OS/2 have a number of things in common. Many of the programming interfaces are similar and in many cases, the structures and APIs are virtually interchangeable. If a user understands Windows programming, he will understand OS/2's Presentation Manager. Dealing with multitasking and multiple threads is something he would have to learn for Windows NT and OS/2 2.0.

3. There are porting tools available today, for the initial port from Windows code to OS/2. Many large applications can be ported in an hour or two. Then developers can begin to optimize the code for OS/2's advanced features.

   Once application code runs on OS/2, it has been able to run on future versions of OS/2. IBM has been able to maintain this commitment to protect customer investment in applications since version OS/2 version 1.0. Microsoft has forced developers to upgrade code with virtually every revision of Windows. Microsoft has already published a document on porting Windows 16 bit applications to the Windows 32 bit APIs.

- WINDOWS NT CAN SHARE PRINTERS AND OS/2 CANNOT.

OS/2 can share printers with any of several network products available. It appears that Windows NT will have some networking features built into the base system. This can have advantages and disadvantages.

The advantage is that users will not have to purchase extra network products to use the most basic of networking functions.

The disadvantage is that users who do not want network functions are bogged down with the extra disk and RAM required to keep this code around. This may also limit compatibility with other vendors' networking offerings.

OS/2 2.0 offers it all... TODAY.

OS/2 2.0 is a fully preemptive, prioritized, multitasking, multithreaded operating system with a superior object-oriented graphical interface, networking and host connectivity support along with compatibility with most other software written for Intel based PCs and compatibles, and best of all, it's available today.

The prioritized, preemptive multitasking of OS/2 utilizes the processor more efficiently than Windows 3.x. The connectivity support along with its entry-level hardware requirements make it an ideal platform for both client and server computing.

OS/2 2.0 provides:

- 32 bit virtual memory, allowing applications up to 512 megabytes per application, limited only by the size of the user's hard disk.
- Multitasking support, allowing many applications to run simultaneously with excellent performance.
- Multithreading to allow those applications wishing to perform many simultaneous tasks to do so.
- An easy-to-use and easy-to-program context-sensitive online help system.
- Protection among applications and protection to enhance operating system integrity. Users have the option of running applications in separate sessions, or combining them as resources and the situation dictate, while the operating system is protected from errant code.

- Extendable subsystems, allowing programmers to add new system services and create custom, enterprise-wide applications while remaining flexible for the small company or home user.

- International language support (currently 17 languages) including bidirectional languages for Hebrew and Arabic.

- A state-of-the-art, object-oriented user shell that integrates applications with the shell, providing consistent interfaces across the entire system.

- Compatibility. OS/2 will run:

  - 16-bit and 32-bit OS/2 applications

  - Most DOS applications

  - Most Windows 3.0 and Windows 2.0 applications; and Windows 3.1 applications soon

  - Connectivity with various network systems along with host environments

OS/2 2.0's compatibility with applications written for previous versions of OS/2, DOS and Windows is unsurpassed. Even Windows 3.1 will not run a number of applications written for Windows 3.0, forcing developers to update their code and users to purchase upgrades. OS/2 will run many of these applications, preserving users software investments.

OS/2's programming interface has not changed from earlier versions. With any new functions that have been added, only minor changes are needed to source code to recompile on OS/2 2.0, and programs that ran on a previous version of OS/2 will run on OS/2 2.0 unchanged. The only need to recode for any upgrade of OS/2 is to take advantage of new features, again preserving programming investments.

IBM Multimedia Presentation Manager/2 (MMPM/2) has been released to provide multimedia capabilities for OS/2 systems for sound, CD-ROM and MIDI support as well as advanced graphics.

Many applications have already taken advantage of OS/2's powerful multitasking and multithreaded

features in their 16-bit versions. Vendors such as Lotus, Describe, Aldus and Novell have 16-bit OS/2 applications. 32-bit applications will, in most cases, run even better and faster due to OS/2's new 32-bit flat memory model along with its other features. There are more than 200 32-bit applications available now and more than 1000 software vendors have committed to delivering 32-bit OS/2 applications in 1992.

OS/2 2.0 offers users and developers alike powerful multitasking features, with limitless possibilities for the future. Best of all, OS/2 2.0 is available on the desktop today.

APPENDICES

Appendix A. OS/2 2.0 compared to Windows 3.1 and Windows NT

The following charts compare key operating system features for Windows 3.1, Windows NT and OS/2 2.0. Some of the entries under Windows NT are marked with an asterisk, "*". This is because Windows NT is a not generally available and therefore IBM does not have the current specifications for all items. For the same reason, the data on Windows NT may change at any time.

Table 1. OS/2 2.0 compared to Windows 3.1 and Windows NT

	Windows 3.1	Windows NT	OS/2 2.0
Available	Today	*	Today
Price (low - high)	$49 - $149	$400 - $500 (estimate)	$79 - $149
Applications Base			
DOS Applications	30,000+	*	30,000+
Windows	5,000+	*	5,000+

Applications			
16-bit OS/2 Applications	0	*	2,500+
32-Bit OS/2 Applications	0	*	600
-- TOTAL --	35,000+	*	38,000+
Hardware			
Processor	286 and higher	386DX (33Mhz) and higher	386SX (16 Mhz) and higher
Minimum RAM	2 MB	8 MB	4 MB
Recommended RAM	4 - 6 MB	12 - 16 MB	6 - 8 MB
Minimum hard drive (approximately)	9 MB	40 MB	13 MB
Hard drive for full install (approximately)	11 MB +	100 MB	28 MB
Largest hard drive	1 GB	17 Billion GB (NTFS)	64 GB (HPFS)
Largest file size	1 GB	*	2 GB
SCSI exploitation	No	Yes	Yes
File System options	FAT only	FAT, HPFS, NTFS	Enhanced FAT or HPFS
Memory			
Virtual Memory Limit	4 x Physical	2 GB per process	512 MB per

	Memory	process
Memory Model	Segmented (64 KB) memory objects	Flat memory objects	Flat memory objects
Multi-tasking		
Multi-tasking - DOS Applications	Time Slicing	Preemptive Time Slicing	Preemptive Time Slicing
Multi-tasking - Windows/PM Apps	Co-op	Preemptive	Preemptive
Priority	Static (set by user)	Dynamic	Dynamic
Dispatchability	Process	Thread	Thread
System Services	Serial	Parallel	Parallel
Reliability/Protection			
Protection between Applications	Limited	Some	Yes
Kernel protection	Limited	Yes	Yes
Remains in protect mode	No - access to real mode possible	Yes	Yes
Application Compatibility			
Multiple Concurrent DOS Applications	Yes (enhanced mode only)	Some *	Yes
Windows 2.x	No	No	Yes

Applications			
Windows 3.0 Applications	Most æ	Some *	Most
Windows 32 Bit Applications	Some	Yes	No (Possible Future)
Clipboard support	Windows and DOS only	Windows and DOS only	Windows, DOS and OS/2
DDE support	Windows apps only	Windows apps only	Windows and OS/2 apps
OLE support	Yes	Yes	Yes
16-bit OS/2 Applications	No	Partial (char mode only)	Yes
32-bit OS/2 Applications	No	No (Possible Future)	Yes
Printing and Fonts			
Print spooling	Limited »	Yes	Yes
Adobe Type Manager standard	No	No	Yes
Network printing support	Some	Yes	Yes ¼
Background printing performance	Unpredict-able	*	Predictable
National Language Support			
Number of Language Versions	12	*	17

Data Interchange	SO8859 (different from DOS)	*	CP850 (consistent throughout OS/2)
Host connectivity	3rd party	3rd party	Included in Extended Services for OS/2
Code Page	Single	Unicode	Selectable
Other Factors			
Full 32-bit APIs	No	Yes	Yes
Concurrent High Speed Comms	Unreliable	*	Yes
Background Comms	Unreliable	*	Yes
OEM Hardware Support	Yes	Some ½	Yes
Development Tools	Yes	Yes	Yes
Command Language	.BAT	.BAT, Basic	.BAT, .CMD and REXX
Installation migration for existing apps	Limited	*	Yes
User Interface			
CUA compliance	Graphical Model ('89)	Graphical Model ('89)	Workplace Model ('91)
Icons representing non-loaded files on	No	No	Yes

| desktop | | | |

| Place icons anywhere on desktop | No ¶µ | No ¶µ | Yes |

| Group windows | Single-layer only | Single-layer only | Multilayer hierarch. folders |

| Customise GUI look | No | No | Yes (Workplace Shell, Windows 3.x, OS/2 1.x) |

| Context Menus | No | No | Yes |

| Object Management | No | No | Yes |

| Graphical Install | Yes | Yes | Yes |

| Intelligent fonts | Windows 3.1 - Yes (TrueType - 650 fonts) | Same as Windows 3.1 | Yes (Adobe Type Manager for PM & Windows - 1200 fonts) |

| Long file names | No | Yes | Yes |

| Applets | Yes | Yes | Yes |

| Consistent GUI logon | No - requires Network vendor utility | Yes | Yes |

| Interactive Tutorial | Yes | * | Yes |

| Command Reference | No | * | Yes |

| | | | |

Advanced Connectivity ¶			
Client and Server platform	No	No ¶ý	Yes
Multiple Concurrent Protocols	Limited	Yes	Yes
SNA LU6.2	3rd party	3rd party	Yes
APPN	3rd party	3rd party	Yes
TCP-IP	3rd party	3rd party	IBM TCP-IP for OS/2
Systems Management	3rd party	LAN Man NT (future)	Various from IBM
SQL Server	MS SQL Server (requires NT OS/2)	SQL Server (future)	SQL Database Mgr	OS/2
SQL Client	3rd party	Yes	Yes
NFS	3rd party	3rd party	IBM TCP-IP for OS/2

Notes:

1. Although Windows 3.1 will run on a 286, doing so limits the features available to the user (multitasking DOS applications, demand paging, 32 bit support.)

2. An additional 50% of the remaining partition is used for the swap file. This is the default.

3. This includes a mandatory 20 MB swap file

4. Windows NT runs existing Windows 16-bit applications in a single address space. If one

of these applications goes down, all of the applications in the address space could go down as well.

5. Windows NT has been shown to have compatibility problems with some classes of DOS and Windows applications. See PC Week, July 27, 1992.

6. Windows 3.1 will not run some Windows 3.0 applications, which will need updates. Compatibility notes are listed in the APPS.HLP file. Several Windows 3.0 applications need updated versions to run on Windows 3.1. OS/2 2.0 runs virtually all Windows 3.0 applications, as well as all the Windows 2.x applications that Windows 3.1 will no longer support (no Real Mode support provided)

7. Print spooling is not provided by Windows 3.1 for DOS applications, only for Windows applications. OS/2 2.0 provides print spooling for DOS, Windows and OS/2 applications. OS/2 2.0 has extensive user print management capabilities (40 APIs vs 12 APIs in Windows 3.1) for querying, holding, releasing and deleting jobs (including a graphical view of job and queue status).

8. OS/2 has been shown to outperform Windows 3.x with background print operations, in multitasking environments

9. Early feedback on Compuserve of the pre-beta SDK is indicates that 386 processors with a B0 or B1 stepping are incompatible with Windows NT. Several common BIOS chips have also been found to be incompatible.

10. In Windows, files only exist in the File Manager, programs in Program Manager, etc. There are no icons for printers.

11. OS/2 2.0's 'Yes' answers here are all using Extended Services for OS/2 except where stated. It is important to note that the Windows column refers to Windows specific programs (i.e. written to explicitly take advantage of Windows GUI, memory addressability, or time-slicing). Although there are many DOS connectivity options, and they may be usable under Windows, the integration of these complex subsystems and any co-residency of two or more options (eg

TCP/IP and SNA) is completely the responsibility of the customer as a custom integration effort.

Moreover, Windows on DOS has architectural limitations (less memory, less protection, and less multitasking support) which make multiple network connections more difficult to integrate than under OS/2. OS/2's base environment provides tools and system support designed to allow this type of multi-connectivity installation. Besides, all the extra software required for these functions under OS/2 comes from IBM, and one can therefore anticipate a greater degree of integration.

12. The projected system requirements for Windows NT may be too large for many of today's client machines.

Appendix B. Windows 3.1 Application Incompatibilities

When a vendor ships new software, minor incompatibilities often accompany the new function. Windows 3.1, for example, has problems running dozens of Windows 3.0 applications, including Microsoft applications. Support for Windows 2.x applications has been removed entirely.

OS/2 2.0 will run Windows 2.0 and 3.0 applications concurrently. It will also run nearly all of the 30+ Windows 3.0 applications that Microsoft warns will not run properly under windows 3.1 and would require upgrades or fixes:(17)
These include:

- Ace Software AceFile
- Adobe Illustrator
- Adobe TypeAlign
- Aldus FreeHand 3.0
- Aldus Persuasion
- Bitstream FaceLift 1.2
- Borland C 3.0 WInsight
- Campbell Services OnTime 1.0
- Central Point Software PC Tools
- Channel Computing Forest and Trees 2.0a
- Claris Hollywood
- Coda Finale
- Computer Support Arts & Letters
- Software Publishing Harvard Graphics for Windows

- o Computer Support Picture Wizard
- o First Byte Monologue for Windows
- o hDC First Apps Memory Viewer 1.0
- o Hewlett-Packard NewWave
- o Lotus Ami Pro
- o Microsoft Bookshelf for Windows
- o Microsoft PowerPoint 2.0c
- o Microsoft Productivity Pack 1.0
- o Microsoft Word for Windows 1.1
- o PowerSoft Powerbuilder 1.0
- o SofNet FAXit for Windows
- o PFS:WindowsWorks
- o NBI Legacy
- o Norton Desktop 1.0
- o (ALL Windows 2.x applications)

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(1) At the time of this writing, the suggested retail prices of MS-DOS 5.0, Windows 3.1 and OS/2 V2.0 are $99.95, $149.00 and $149.00 respectively.

(2) A Grand Tour of Windows NT - Microsoft Systems Journal, Jul/Aug 1992

(3) Microsoft Windows NT - An Overview - April 1992

(4) PC Week - Windows and OS/2 Supplement - August 17,1992 - Page S/1.

(5) Gartner Group - Personal Computer Research Notes, P-230-853, July 31,1992

(6) PC Week, July 27, 1992 - Page 1

(7) PC Week - Windows and OS/2 Supplement - August 17, 1992 - Page S/9

(8) Microsoft Windows NT Operating System - A Comparison with OS/2

(9) Microsoft Operating Systems Directions - Presented by Dwayne Walker at Spring Comdex 1992

(10) Windows Magazine, October, 1992, Page 20

(11) Microsoft Windows Strategy - An Overview - Page 5

(12) Windows Magazine - October 1992 - Page 16

(13) Data from Romtec, Ingram-Micro, Software Unlimited, PC Connection

(14) PC Week, July 27, 1992 - Page 1

(15) PC Week - July 27, 1992 - Page 1

(16) Remember: the virtual memory limit for ANY system is it's real (physical) memory plus all free disk space.

(17) PC Week, March 23, 1992. The article says that these products were taken directly from the Win 3.1 on-line help system.