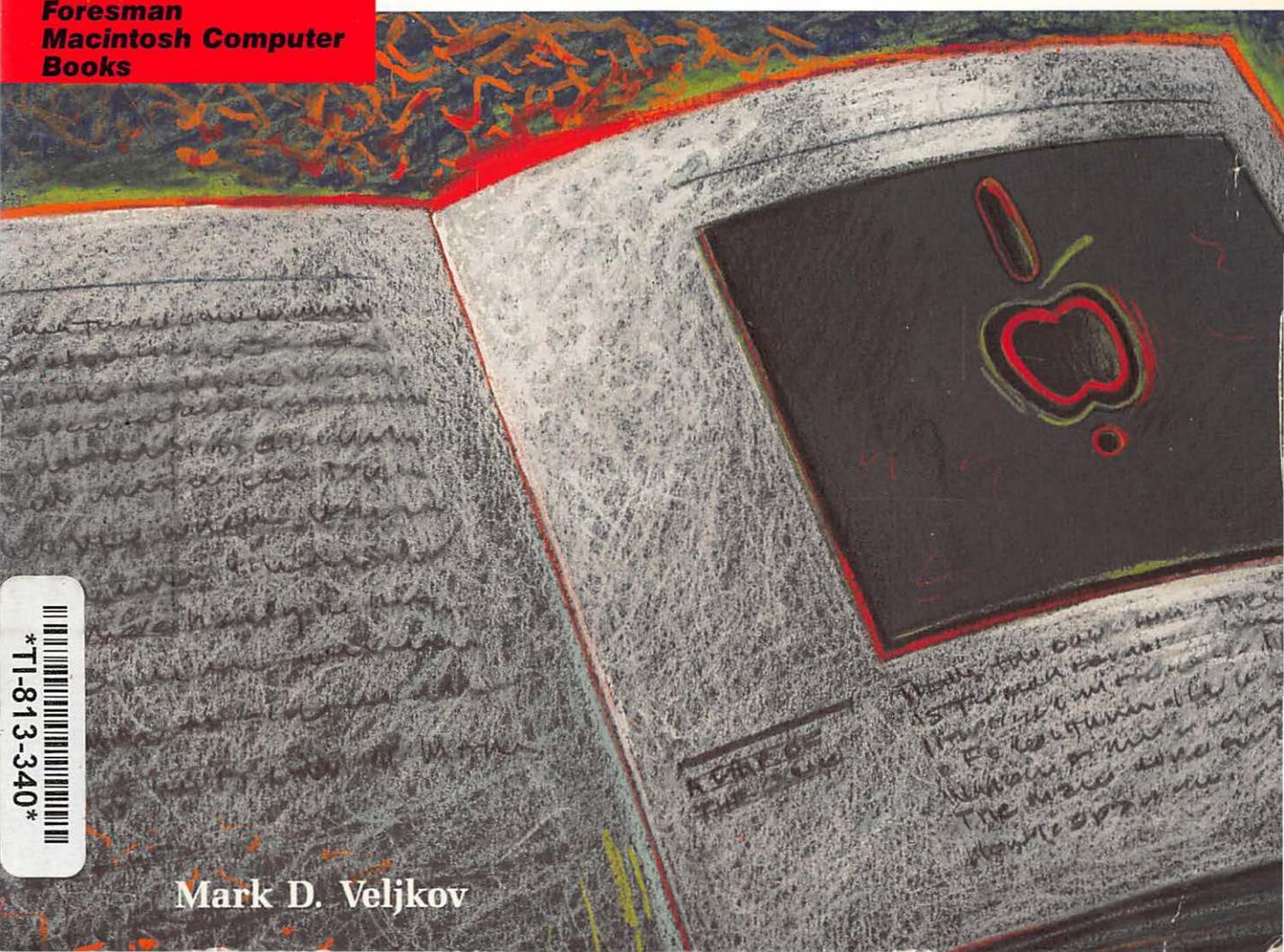


The Macintosh II Reference Guide

With
Troubleshooting
Guide

Scott,
Foresman
Macintosh Computer
Books



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Well, that should about do it. Now if I could just afford to buy a Mac II. . . .

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Contents

INTRODUCTION 1

Enabling Technologies	1
New Features, New Markets	3
A Guided Tour	5
Developers' Role	12
Conclusion	14

CHAPTER 1

The Hardware	15
Inside the Mac II	15
The Logic Board	16
The Video Interface Card	21
The Power Supply	22
NuBus	22
Slot Arbitration	25

CHAPTER 2

Firmware	27
Expansion Cards—Power Requirements	29
The Products	31
Video Cards	31
Apple	31
SuperMac	32
RasterOps	32
Monitors	34

Contents

Ready, Set, Go 4.0	96
Quark XPress 2.0	97
Interleaf Publisher	98
Spreadsheets	99
Excel	99
Wingz	100
Software Wrap-Up	100

CHAPTER 4	A/UX	102
	What is UNIX?	103
	A/UX Installation and Setup	107
	Basic A/UX Configuration	108
	Keyboard Equivalents	109
	A/UX Installation	109
	Hardware Installation	110
	A/UX Components	124
	System Setup	124
	A/UX Command Structure	128
	File System	132
	A/UX Text Editing	146
	A/UX Text Formatting	155
	A/UX Shells	161
	A/UX Communication System	162
	A/UX Wrap-Up	164
	Common A/UX Commands	164
	Text Editor Commands	168

CHAPTER 5	Troubleshooting	170
	Diagnosis and Treatment	170
	Grounding	171
	Operational Hierarchy	171

Contents

INTRODUCTION 1

Enabling Technologies	1
New Features, New Markets	3
A Guided Tour	5
Developers' Role	12
Conclusion	14

CHAPTER 1

The Hardware	15
Inside the Mac II	15
The Logic Board	16
The Video Interface Card	21
The Power Supply	22
NuBus	22
Slot Arbitration	25

CHAPTER 2

Firmware	27
Expansion Cards—Power Requirements	29
The Products	31
Video Cards	31
Apple	31
SuperMac	32
RasterOps	32
Monitors	34

Network Connection Cards	37	
EtherTalk	38	
EtherPort II	40	
MacIRMA	40	
LANSTAR	42	
Four+One	44	
FastNet II	44	
AST-ICP	45	
Miscellaneous Cards	46	
MacProto	46	
QuickCapture	47	
Pegasus	48	
NuVista	48	
TV Producer	49	
Mac286	50	
Memory Expansion Boards	51	
NS8/16	52	
Dove Computers	52	
Micron Technologies	53	
AST-RM4	54	
CD-ROM	54	
Apple	55	
CHAPTER 3	The Software	56
How Compatible Is the Mac II?		56
The Question of Speed		58
Testing the Hardware		60
Testing the Software		60
Word Processing Tests		64
Spreadsheet Tests		64
Database Tests		65
Operating System Utilities Test		65
Conclusion		66

To Upgrade or Not to Upgrade	67
MultiFinder	69
Software Applications	72
The Products	73
Word Processing	73
Word 3.01	74
WordPerfect	74
NISUS	76
FullWrite	77
WriteNow	78
MacWrite 5.0	79
Communications	80
TOPS	80
InBox	82
3+ for Macintosh	82
Graphics Software—General	83
Modern Artist	83
MacPaint 2.0	84
PixelPaint	85
PhotoMac	86
SuperPaint	86
FullPaint	87
Colorizer	88
Color Sep	88
Graphics Software—CAD/CAM	89
VersaCAD	89
MacDraw II	90
MGMStation	91
Pegasys II	92
VideoWorks II	93
Adobe Illustrator	94
Desktop Publishing	95
PageMaker 3.0	95

Contents

Ready, Set, Go 4.0	96
Quark XPress 2.0	97
Interleaf Publisher	98
Spreadsheets	99
Excel	99
Wingz	100
Software Wrap-Up	100

CHAPTER 4	A/UX	102
	What is UNIX?	103
	A/UX Installation and Setup	107
	Basic A/UX Configuration	108
	Keyboard Equivalents	109
	A/UX Installation	109
	Hardware Installation	110
	A/UX Components	124
	System Setup	124
	A/UX Command Structure	128
	File System	132
	A/UX Text Editing	146
	A/UX Text Formatting	155
	A/UX Shells	161
	A/UX Communication System	162
	A/UX Wrap-Up	164
	Common A/UX Commands	164
	Text Editor Commands	168

CHAPTER 5	Troubleshooting	170
	Diagnosis and Treatment	170
	Grounding	171
	Operational Hierarchy	171

	The Apple Warranty	172
	Do's and Don'ts	174
	Problem/Solution	176
	Startup Mac II Music	176
	Mac II Symptom Chart	178
	Video Trouble	179
	Disk Drive Trouble	181
	Peripheral Trouble	183
	Miscellaneous Trouble	185
APPENDIX A	A/UX Products	188
	Courses	188
	Office Automation	188
	Networking/Connectivity	189
	Hardware	190
	Statistics	192
APPENDIX B	MC 68020 Functional Block Diagram	193
APPENDIX C	Signal Descriptions	195
	Function Code Signals (FC)-(FC2)	195
	Asynchronous Bus Control Signals	195
	Interrupt Control Signals	195
	Bus Arbitration Signals	195
	Bus Exception Control Signals	196

The
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Reference Guide

Introduction

In January of 1984, Apple Computer, Inc., introduced the Macintosh computer. This first Macintosh had 128K of RAM (random access memory), one 400K, 3.5-inch disk drive, and two applications—not much standard equipment, but more than many other computers of the time. From this meager beginning, Apple Computer began to transform their new machine the way they had done with their original Apple II line. After the original Macintosh came the Macintosh 512K. Memory went from 128K to a full 512K of RAM. A year later the Macintosh Plus debuted, signaling a new direction in Apple's marketing strategy. The Mac Plus was loaded with a full megabyte of RAM and an 800K internal disk drive. Even more dramatic was the installation of a new "heart."

The heart of any Macintosh is its read-only memory (ROM). The Macintosh ROMs were developed to contain the heart, soul, and personality of the machine. Within the ROMs are those special ingredients that make the Macintosh the Macintosh. The newer Macs contain an improved ROM and hints of even more wonders to come.

ENABLING TECHNOLOGIES

In creating two new Macintosh computers—the Macintosh SE and the Macintosh II—Apple moved a step further on the evolutionary ladder. Both machines represent a change in marketing direction as well as in operating power. The Macintosh SE,

a variation on the Macintosh Plus, contains a full megabyte of RAM, 256K ROMs, and one expansion slot. It is the 256K ROMs and expansion slot that separate the Mac SE from the Macintosh Plus. The new ROMs contain all of the old QuickDraw routines and then some. The Toolbox ROM now contains Color QuickDraw routines and a greatly improved TextEdit. The new TextEdit allows the retention of text attributes such as color, font, style, text size, and vertical spacing during cut-and-paste operations. This frees up the main processor and on-board memory, thus making text manipulation activities occur much faster.

While the Mac SE is an obvious modification of the Mac Plus, the Macintosh II is the new kid on the block and represents a distinct departure from the small “desktop utility” envisioned by Steve Jobs in 1983. The Mac II maintains all the features that made the Macintosh a new computing standard, but it has abandoned the small desktop footprint of the standard Mac. Not only has the Macintosh concept grown in physical size, but Apple has added so many new features that the Mac II may indeed be an entirely new computer. It offers users a new set of tools aimed squarely at the high-end microcomputer market, a market that until now was dominated by Sun, Apollo, and IBM. What Apple did not change was the “star quality” that has made the Macintosh what it is today—a new computing standard.

For the nonbelievers, simply take a look at the heart of Microsoft Corporation’s new OS/2 operating system for the IBM PS/2 computers. The PS/2s are the new line of IBM personal computers. The very essence of this “new” OS/2 operating system is the provision for a graphical interface based upon pull-down menus and icons. Sound familiar? Most of the current popular MS-DOS-based programs are turning to the graphics standard. It is simply a better way of interacting with the computer. By masking many of the basic functions of the computer, developers are allowing users to gain more control over a machine that until now controlled them! The Macintosh II is everything Macintosh users wanted, asked for, dreamed about, and more.

Besides these changes in the Mac’s ROM, a look at the entire Macintosh line reveals the evolution of the Mac over the past few years.

- **1985 Memory expansion.** From 128K to 512K.
- **1986 New disk drives.** Internal and external 800K disk drives up from 400K.
- **1986 New 128K ROMs.** An increase from the original 64K.
- **1985 New system files.** Improved file-handling and faster disk I/O.
- **1987 Expansion slots.** Mac SE has one and the Mac II has six.
- **1987 Newer ROMs.** Mac 512K ϵ and Mac Plus retain 128K ROMs; Mac SE and Mac II get 256K ROMs. New ROMs allow for color capabilities, faster I/O, and future expansion.
- **1987 Color capacity.** Mac II allows for color monitors and color output.
- **1985–88 MS-DOS capabilities.** Add-on cards and coprocessors add the dimension of running MS-DOS applications.

These features are just the tip of the iceberg and represent the changes the Macintosh has gone through since January, 1984. The Macintosh II represents a complete *physical* reworking of the Macintosh. However, the bottom line is—it's still a MAC!

NEW FEATURES, NEW MARKETS

The new features make the Mac II look and read like a dream machine. It is designed to run all of the existing base of Macintosh software—to a point. In reality about 85–90 percent of existing Macintosh software is able to run on the Mac II. The reasons are varied and technical. Generally, compatibility depends upon the type of application and the developer's skills. Most of the applications that do not run on the Mac II are games and programs written for the older Macintosh File System (MFS). Most of the programs written for the Macintosh after 1985 should run; again the primary exception is games.

Of course the Mac II contains more than new 256K ROMs. The first noticeable difference is the size. The original Macintosh was 13.5 inches tall, 9.7 inches wide, and weighed in at 16 pounds, 8 ounces. The Mac II is considerably larger. Also, unlike the original Mac, the Mac II comes in pieces. The three components are the central processing unit (CPU), video display, and keyboard. The CPU is, of course, the guts of the Mac II. The Mac II supports color and black and white monitors, which range in size from 12 to 24 inches. Monitors can be interchanged according to the user's needs. There are two keyboard configurations to select, either the standard Mac II keyboard of 80 keys or the extended keyboard of 105 keys. The basic Mac II system includes the following:

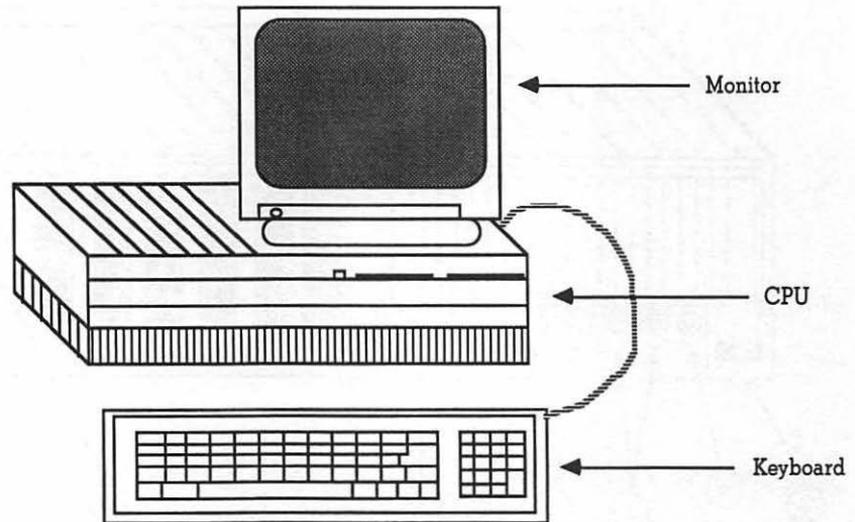
- 68020 microprocessor
- 68881 floating point coprocessor
- Hochsprung Memory Management Unit (HMMU)
- 1 megabyte of RAM
- 1 800K internal 3.5-inch disk drive

As you can see from the list, the basic unit does not offer a monitor or keyboard; these units may be added according to the needs of the user. In addition, Apple offers enhancement kits containing other components for the Mac II:

- Additional 800K internal disk drive
- 40- or 80-megabyte SCSI hard disk
- 68851 Programmable Memory Management Unit (PMMU)
- Additional RAM—up to 8 megabytes

Enhancements can be combined with the basic Mac II system according to user needs.

Figure I.1 shows a basic Mac II configuration. Other chapters will discuss the details on the Mac II hardware and software. From this modest beginning you can expand the Mac II to conquer the universe.

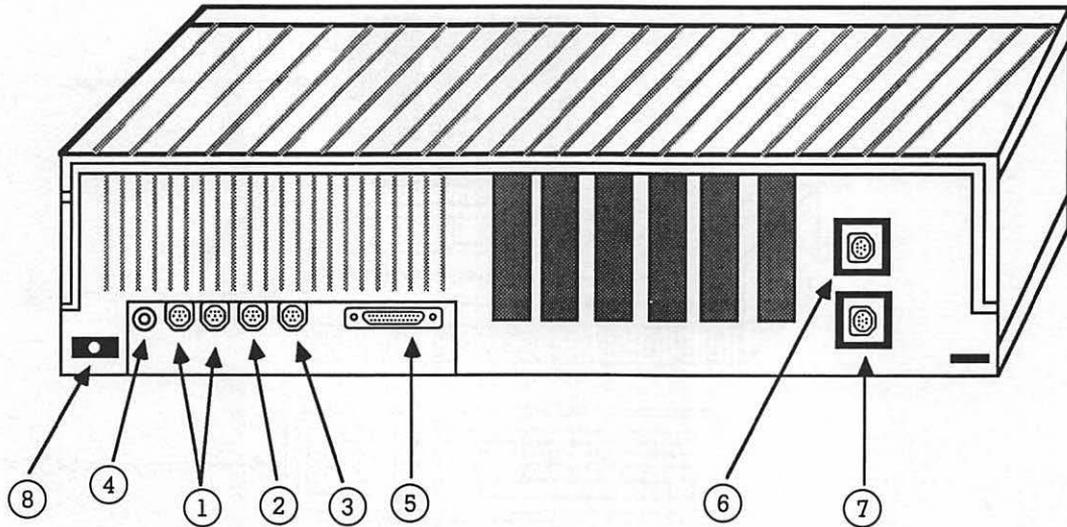
FIGURE I.1 Components of a Mac II system

A Guided Tour

As you can well imagine, the Mac II is a different-looking Macintosh. For example, start with its back panel, which has some of the obvious connections that are found on the back of the original Mac. But the original Macs had only four ports on the back, and the Mac II has six ports, two connectors, a reset switch, and six "slots." It is important to know what each of the ports and connectors is and what can be done with them. Figure I.2 shows these elements. Some of these connections are explained in greater detail in the next chapter. What follows is a brief overview:

1. **Apple DeskTop Bus (ADB) 1 and 2.** The ADBs are serial communication connections designed to connect keyboards, mice, and graphic tablets.
2. **Serial port 1.** This is an asynchronous communications port used for connecting printers or for the AppleTalk network.

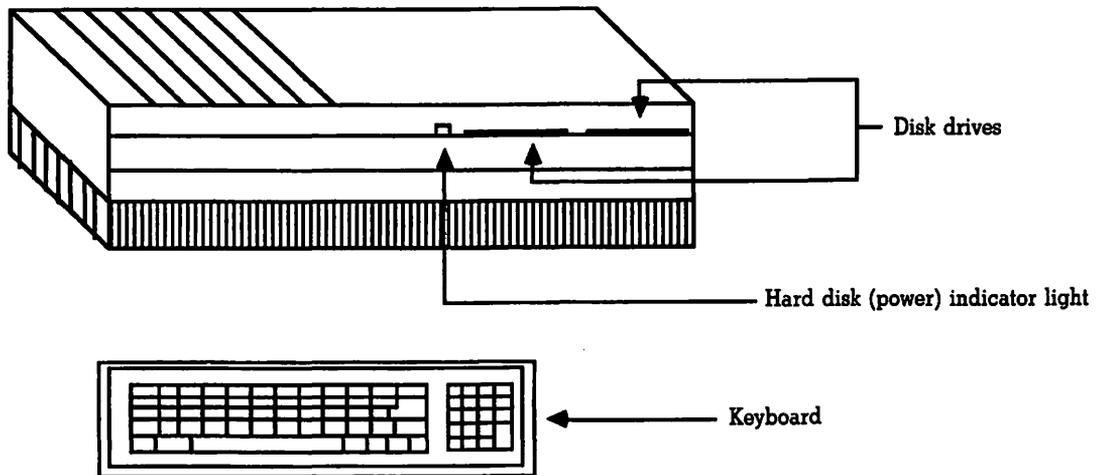
FIGURE I.2 Mac II back panel



3. **Serial port 2.** Another synchronous communications port used for connecting modems or other serial devices to the Mac II.
4. **Sound port.** This is the standard Macintosh “phono jack.” The Mac II can generate an 8-bit digitized stereo/audio signal that finds its way to this external stereo miniphone jack. You can then attach a stereo receiver and/or speakers (see Chapter 3 for more details).
5. **SCSI port.** This port is used for connecting up to seven Small Computer Standard Interface (SCSI) devices. These devices are generally hard disks, but recently optical disks have begun to use the SCSI port.
6. **A/C power connector** This is the place you insert the Mac II power cord.
7. **Monitor connector.** This is the sound port connector and is a mini RCA connector. The user can connect stereo amplifiers, headphones, and MIDI synthesizers, among other devices.

These are the basic ports on the back of the Mac II. Now let’s proceed to the front panel of the Mac II, shown in Figure I.3.

FIGURE I.3 Mac II front panel



At first glance, the front panel doesn't look particularly exciting. However, closer inspection reveals some important items, namely, a disk drive slot, a power indicator light, and a keyboard.

As was mentioned, there are two different keyboard configurations for the Mac II. The *standard Macintosh keyboard* contains the standard Macintosh keys plus a 15-key numeric keypad. Figure I.4 shows the standard Macintosh keyboard. The *extended Macintosh keyboard* contains all of the keys found on the standard keyboard plus 15 function keys, cursor keys and special text-editing keys. Although the extended keyboard was primarily designed for use with mainframe connections, many newer Macintosh applications have been designed to take advantage of the additional keys. Figure I.5 shows the extended Macintosh keyboard.

Apple developed the extended keyboard for a number of future products, the most prominent being Apple's version of the UNIX operating system. This system is aptly named A/UX (**A**pple **U**NIX). Chapter 5 covers A/UX in more detail. Users of A/UX will need the additional function keys and text-editing keys found on the extended keyboard. Deciding which keyboard to use depends upon your needs. If you are connecting to mainframes *and* using A/UX, the extended keyboard is the only way to go. For standard Macintosh use (if there is such a thing), the standard Macintosh keyboard is more than adequate.

FIGURE 1.4 Standard Mac keyboard

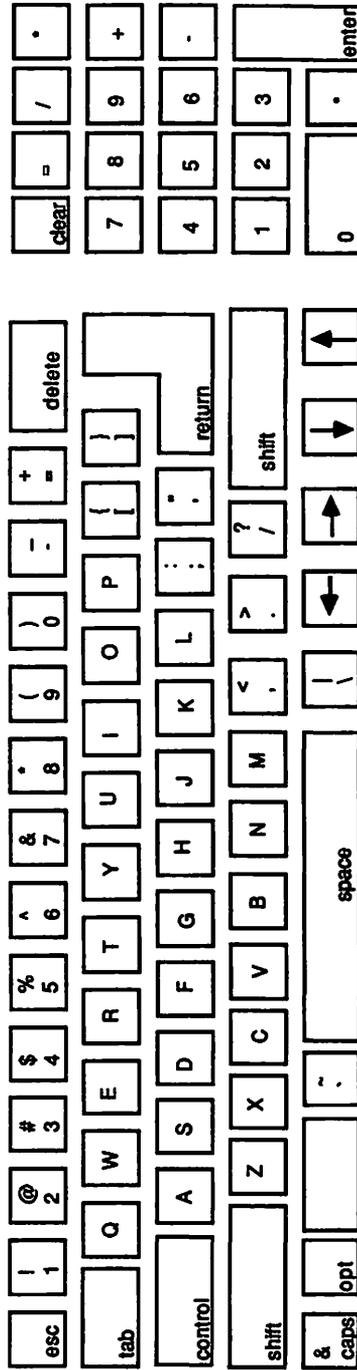
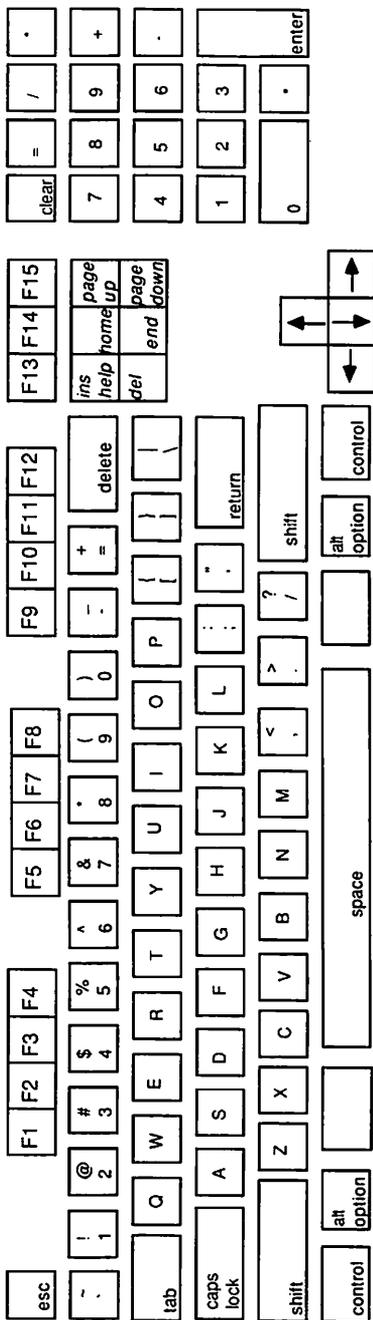


FIGURE 1.5 Extended keyboard



Market Niches of the Mac II

The different keyboards bring up the modular nature of the Mac II. Unlike previous Macs, the Mac II provides the “enabling technology” to legitimize the Mac in more market niches than ever before. Mac maniacs have contended that the Mac has always been a legitimate computer for *any* industry. The Mac II is now modular enough to become a “vertical market” solution. Basically, users decide what they need to do, then configure the Mac II to meet these needs. The Mac II provides the enabling technology. Here are some of the vertical markets in which the Mac II is excelling:

Desktop Communications The capability to add multifunction cards opens up new communication avenues not previously accessible by Macintosh. Connections to mainframes and to foreign operating systems like MS-DOS, OS/2, and UNIX are as simple as installing the appropriate add-on card and software.

Desktop Engineering The Mac II encourages creation of schematics and engineering designs. With the advanced graphic capabilities of the Mac II and the power of the Motorola 68020 Central Processing Chip, the Mac II offers engineers the power of a Sun or Apollo workstation at a fraction of the cost.

Desktop Publishing No other market has been affected by the Macintosh more than desktop publishing has. In fact, it can be said that the Macintosh invented desktop publishing. The Mac II has an even greater potential for revolutionizing electronic page layout and other publishing processes. The modular design of the Mac II offers users the ability to expand the Mac II to include ultra-high-resolution graphics (1,024 x 1,024), high-speed connectivity to laser typesetters, increased memory (up to 4 gigabytes), and advanced applications that take advantage of this new technology.

CAD/CAM Market Like desktop publishing, the computer-aided design (CAD)/computer-aided manufacturing (CAM) market has received the Mac II enthusiastically. The CAM market is still quite new for any microcomputer system. CAD operators, however,

have discovered the power and ease of use of the Macintosh. Advanced graphics, faster processing speed, and modular design make the Mac II a perfect option to consider for CAD professionals.

Education Market The education market contains most of the elements found in other markets and then some. In 1984, Apple started a marketing program called the Apple University Consortium (AUC). The AUC was made up of 18 colleges and universities from across the country. Apple offered these schools special opportunities to purchase Macintosh computers and then resell them to students and faculty at a reduced rate. Apple hoped that students and faculty would embrace the Macintosh and develop wonderful products. They also anticipated that students would eventually influence the computer-purchasing decisions of the companies they would work for. To some degree, the seeds that Apple planted are beginning to bear fruit. The higher-education market accounted for nearly 50 percent of all Mac sales. As of November, 1987, Apple was cranking out 40,000 Mac IIs per month, and the majority of these were going into institutions of higher learning (colleges and universities).

One area of development that is taking place on college campuses is interactive videodisc development. Interactive videodisc (IVD) authoring systems are applications that integrate computer-aided instruction with videodisc technology. Of the three levels in interactive courseware, the most exciting is Level III, which combines computer, student, and videodiscs into one integrated course.

Graphics Generation The mainstay of the Macintosh has been its graphic capabilities. The Mac II offers the same graphic potential as other Macs with some extras. For those math-oriented readers, a simple equation illustrates the point. The original Mac graphic formula was described as Graphicsⁿ. This translates as "graphics to the nth degree." The Mac II's graphic formula would be: (Graphicsⁿ) x 100! Currently, Apple offers two different video cards for generating graphics, the standard 4-bit video card, and the 8-bit expanded video card. The difference is more than a few hundred dollars. With the expanded 8-bit video card, you can have 256 colors on your screen at one time. These colors

can be selected from a palette of 16 million! To go a step further, SuperMac Technology in Mountain View, California, has created a **24-bit video card**. When the card is used with an ultra-high-resolution monitor, a user should theoretically obtain better color separation and distinction than that produced by television. Of course this type of resolution and graphics quality is generally reserved for those who need it. CAD users, engineers, desktop publishers, architects, graphic design specialists, and interactive courseware developers will all benefit from the advanced enabling graphics technology offered by the Macintosh II.

Developers' Role

Third-party developers continue to be the key to the success of the Mac II. The open architecture of the Mac II opens the doors to both hardware and software development. Developers now have the opportunity to pursue products that once had no market for the "closed" Macs. Some developers may wish to develop both hardware and software. Others may want only to develop one or the other. Whatever the situation, there is money to be made in the Mac II market—two major areas for developers to concentrate in are hardware and software.

The Hardware Market

Add-on Cards These might include network connections, printer cards, video cards, external hard-disk cards, cards for connecting WORM (**Write Once Read Many**) optical disk drives, and many others.

Memory Expansion The Mac II uses SIMMS boards for adding memory. SIMMS stands for **Single In-line Memory Modules**. The Mac II's RAM could be expanded as high as 4 gigabytes (4 billion)!

Video Expansion The addition of expanded video abilities is one of the features that really separates the Mac II from other Macintosh models. Video boards come in 4-bit, 8-bit, or 24-bit varieties. The more bits, the more distinct the colors.

Musical Interfaces The Mac II is capable of producing 8-bit digitized sound. The Mac II could do 16-bit digitized sound, but Apple doesn't want to compete against the audio compact disk (CD) market.

Keyboards Apple offers two versions of the Macintosh keyboard. Look for more vendors to introduce IBM-style keyboards and keyboards specific to graphic applications.

Hard Disks Hard disks have always been a mainstay product for third-party developers. Users currently have a choice of hard disks ranging in size from 20 megabytes up. Developers have already begun to create bigger and better disks. Look for developers to create internal and external CD-ROMS and WORM drives for the Mac II.

The Software Market

Productivity With the speed of the Mac II and improved TextEdit routines in ROM, word processing, spreadsheets, and database applications will never be the same. Larger screens and color displays, ability to address more memory, and add-on cards will push current products well beyond what they are today.

Graphics The heart of any Macintosh is graphics. The Mac II can take graphics to the limit. Graphics software written to take advantage of the Mac II offers high-resolution, full-color (16.8 million of them) graphics.

Communication The Mac II is the personification of Apple's marketing strategy of creating an enabling technology. At the present time, the Mac II connects to IBM PCs, mainframes, VAX/VMS, IBM System 36, Northern Telecom's LANSTAR, Ethernets, and more.

Games Mac games will never be the same. More memory and advanced graphics and sound go a long way toward creating the most powerful game machine on the market. Then again, the Mac II is positioned as a "serious" computer, and, as we all know, serious computer users never play games.

CONCLUSION

By now it should be clear that the Mac II is a great computer, endowed with features that place it well above any micro on the market today. The Mac II's open technology offers developers a blank canvas to work with. So many options are possible. This reference guide is designed to provide insight into the operations and potential of this unique machine. Readers, users, one of you may become the Michelangelo of the Mac II.

The Hardware

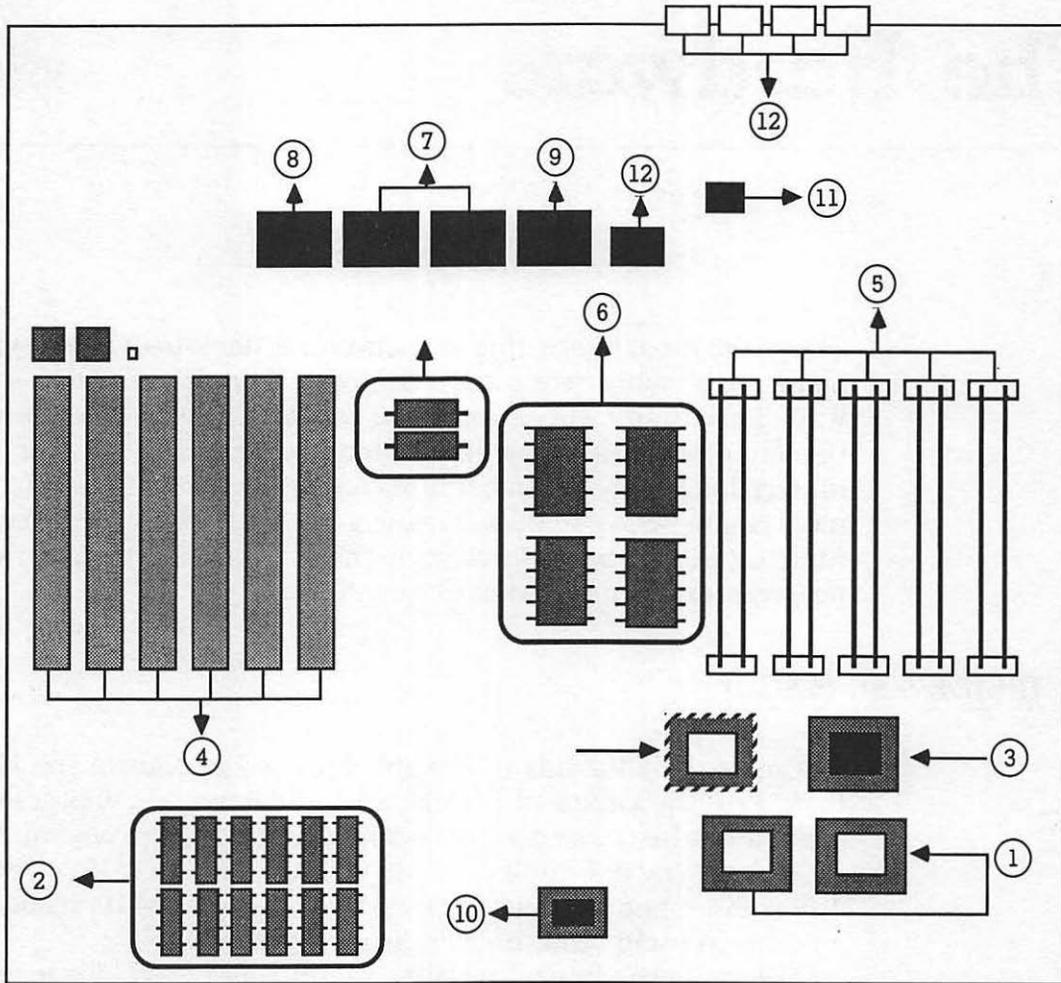
One of the most interesting aspects of the Macintosh is the symbiotic relationship between the computer's hardware and its software. Essentially you cannot have one without the other. Since this chapter takes a look at the Mac II's hardware, some of the material is highly technical in nature. If wading through technical jargon gives you the willies, feel free to skip over those parts. Starting at the basic level with the technical overview, we'll progress to the motherboard and NuBus.

INSIDE THE MAC II

NuBus is the CPU bus that Apple selected to control the Mac II. At first the choice of NuBus, a little-known bus technology from Texas Instruments, was seen as a major faux pas on Apple's part. Why did Apple select it as the bus for their Mac II over other, more popular, bus architecture? Apple had its reasons, and, as you will read, these reasons have paid off.

Before proceeding to the NuBus level, it is a good idea to take a more in-depth look at the basic technical structure of the Mac II's insides. Figure 1.1 shows a schematic of the Mac II. It may be a good idea to open your Mac II up and actually locate the various elements that make up the three basic units of the Mac II. Refer to the figure and the list that describes each numbered element.

FIGURE 1.1 The hardware



The Logic Board

The logic board, by far the most complex of the three units, controls all of the various inputs and outputs (I/Os) associated with computing. The logic board consists of the following primary elements:

1. **Microprocessor.** The Mac II uses a Motorola 68020 microprocessor. The 68020 operates at 15.6672 MHz and supports both 24- and 32-bit processing modes. In addition to the 68020 central processor, there is the 68881 math coprocessor. This coprocessor is an IEEE P754 standard floating-point math processor. The 68881 takes over many of the mathematical processing chores of the 68020. The result is faster processing speeds, most noticeable when the user is performing extensive mathematical computations.
2. **NuBus.** NuBus is the basic underlying data transportation system. It is responsible for ensuring that signals between the CPU and the various expansion slots, memory management chips, RAM, and ROM take the right paths. More on NuBus in the next section.
3. **HMMU/PMMU.** These are option chips. You can use one or the other but not both. Deciding which to use depends upon your needs.

HMMU stands for Hochsprung Memory Management Unit. It is responsible for allowing Macintosh software to use the 24- or 32-bit processing modes of the 68020. When existing 68000-based Mac software is used, the HMMU uses the 24-bit processing mode. This ensures compatibility with the 24-bit address line mode of the 68000-based software. New Mac software written expressly for the Mac II and the 68020 processor can use the faster, more powerful 32-bit mode. The HMMU is the standard memory management chip in the Mac II.

PMMU stands for **P**aged **M**emory **M**anagement **U**nit. The PMMU is used when connecting the Mac II to a **multitasking** operating system like UNIX. Note *multitasking*, not *multiuser*! The PMMU also supports both the 24- and 32-bit processing modes but provides the additional component of paged memory management for UNIX. You must use a 68851 PMMU chip if you intend to use Apple UNIX (A/UX). (See Chapter 5 for more details about A/UX.) The reality is, Apple needed the PMMU to run A/UX with the original release of the Mac II. This is due to the Mac II's using the 68020 as

the CPU microprocessor. The 68020 does not have the necessary memory management code built into it. However, both the 68030 and 68040 microprocessors have memory management built into their internal code and should not need the addition of a secondary memory management chip. Since the current 68020 chip is not soldered onto the motherboard (it is socketed), it can be pulled out and another microprocessor (68030 or 68040) put in its place. If this all sounds confusing, don't worry. If you are going to run A/UX, you probably need a PMMU chip. If you have any microprocessor other than the 68020, check with Apple.

4. **NuBus expansion slots.** There are six slots designed for Mac II expansion cards. However, one slot *must* be used for the video interface card if you want a monitor. If you use the Mac II as a network server or an A/UX host, you might get by without a monitor.
5. **RAM.** If you look closely, you can see that the Mac II's RAM is in small packs known as SIMMS (Single In-line Memory Modules). Each SIMMS pack consists of eight surface-mounted dynamic RAM (DRAM) chips totaling 256K per SIMMS. There are two banks of SIMMS, and each bank can contain four 256K SIMMS. The Mac II comes standard with 1 megabyte of RAM. This means that bank A contains four 256K SIMMS. Actually, SIMMS are available in two sizes of RAM, 256K and 1 megabyte. You can combine 256K and 1 megabyte SIMMS in bank A and bank B to a total of 8 megabytes. The following chart illustrates the various configurations of RAM:

<u>RAM</u>	<u>BANK A</u>	<u>BANK B</u>
1M	Four 256K SIMMS	Empty
2M	Four 256K SIMMS	Four 256K SIMMS
4M	Four 1M SIMMS	Empty
5M	Four 1M SIMMS	Four 256K SIMMS
8M	Four 1M SIMMS	Four 1M SIMMS

WARNING: Any other configurations of SIMMS, such as a single SIMM or SIMM pairs differently sized, will not function.

Even though there are several speeds of 256K SIMMS, only two speeds can be used with Macintosh. These are SIMMS made with 120-nanosecond (ns) chips and 150ns chips. The Mac II can only use SIMMS made with 120ns chips. The way to identify 120ns SIMMS is by the number 12 that is printed on the back. Several third-party developers make SIMMS for the Mac II. Be sure to choose a reliable manufacturer and use 120ns chips.

SIMMS installation does not generally require any special tools, just some patience. If you look closely at the SIMMS on the motherboard, you will see two clips at each end of the slots holding the SIMMS. These clips hold the SIMMS in place. The SIMMS themselves have small holes at either end. Some service technicians use a special tool to pry the clips back so that the holes on the SIMMS fit with the clips. However, a fingernail or small screwdriver also works.

6. **ROM.** The Macintosh II ROMs, like the Mac SE, are a departure from the ROMs found in the Mac Plus. The Mac II ROMs are 256K ROMs, compared to the 128K ROMs found in the older Mac Plus. The ROMs contain the routines for the Toolbox, the basic operating system, and other system routines..
7. **Versatile Interface Adapters.** You have to look closely to see the chips that are identified as 65C23 Versatile Interface Adapters (VIAs). It is these two chips, identified as VIA1 and VIA2, that provide the maximum compatibility with most of the existing Macintosh software. They also control communications with modems, LANs, mainframes, sound chip, HMMU, and the NuBus slots. Specifically, the VIAs are set up as follows:

- **VIA1.** Assists the 68020 microprocessor with handling applications that were written for the 68000. Of course this includes about 95 percent of all the existing Macintosh software. The VIA1 is also responsible for dealing with your modem and LAN connections.
 - **VIA2.** This chip controls access to the NuBus slots and the sound chip.
8. **SCSI Interface.** This is the Small Computer Standard Interface (SCSI) chip that controls any SCSI compatible device that might be connected to your Mac II. Devices include hard disks, printers, plotters, and some LAN connections. The Mac II can attach to and communicate with up to seven SCSI devices. The Mac II SCSI differs from the industry standard SCSI interface in two distinct ways:
- The Mac II SCSI interface is not equipped with power for termination resistors. If the attached SCSI devices do not have terminating resistors, then an Apple-manufactured terminator block must be installed on the last SCSI device. If you are not sure that your SCSI device has a terminating resistor, check with the manufacturer.
 - The Mac II uses a DB-25 connector instead of the industry standard 50-pin. Your Apple dealer can supply you with an adapter if necessary.
9. **Serial Communications Controller.** The Mac II has two serial ports that are controlled by the Serial Communications Controller. These two ports handle synchronous and asynchronous communications channels. These are used for communicating with your printer(s), modem(s), and network(s). The Mac II serial ports conform to the EIA standard RS422.
10. **Apple Sound Chip.** The Apple Sound Chip produces an 8-bit stereo/audio signal. The signal is capable of processing and producing 8-bit digitized sound. What this means for the user is an unusually high quality of computer-generated sound. As a means of comparison,

audio compact disks (CDs) use 16-bit digitized sound to produce their high sound quality. The sound chip is capable of 4-voice, 1- or 2-channel stereo sound production. It is compatible with most of the existing Macintosh applications that use the Macintosh sound chip. Products such as Farallon's MacRecorder can digitize sound for later reproduction.

11. **Real-time clock.** The real-time clock is used to maintain the internal Mac II clock. This clock is used for the alarm clock desk accessory, control panel, and time and date stamping.
12. **Apple Desktop Bus and Chip.** The Apple Desktop Bus (ADB) is the mechanism that the Mac II uses for the connection of keyboards, mouse, and graphic tablets. The ADB uses a mini 4-pin connector. The 68020 (or any other future 680XX) uses the VAI2 chip to test for each of the new devices that might be attached to the ADB. Any device except a mouse that is connected to the ADB must be a "smart" device; that is, ADB devices should contain their own microprocessors. As you can see, the mouse can plug into the side of the keyboard because both the standard and extended keyboards contain a smart microprocessor.

The Video Interface Card

There are two variations to the Apple Video Interface Card—**standard** and **enhanced**. The standard video card comes with 256K of video RAM and supports two, four, or 16 colors or shades of gray simultaneously. The video expansion kit upgrades the standard video interface card to 512K of RAM and allows you to display up to 256 colors or shades of gray. Of course with both the standard and expanded video card you may select your screen colors from a palette of 16 million different colors! However, I imagine someone will complain that 16 million variations of colors is not enough. There is just no pleasing some people.

The Apple Video Interface Card is based upon a custom chip called the Toby Frame Buffer controller. This means that the card can support any RS170-compatible monitor. This compatibility opens the door for many manufacturers of color monitors to

enter the world of Macintosh, a world that has been virtually closed for the past three years. If you expect this additional competition will drive down the price of monitors, think again. Amazing as it seems, Apple's color monitor is not only an excellent RGB (**R**ed, **B**lue, **G**reen), high-resolution device, but it is moderately priced! SuperMac Technology also makes one of the best high-res color monitors. In addition, SuperMac manufactures its own video board. Other third-party developers are also selling monitors and video interface cards. See Chapter 3 for more details.

The Power Supply

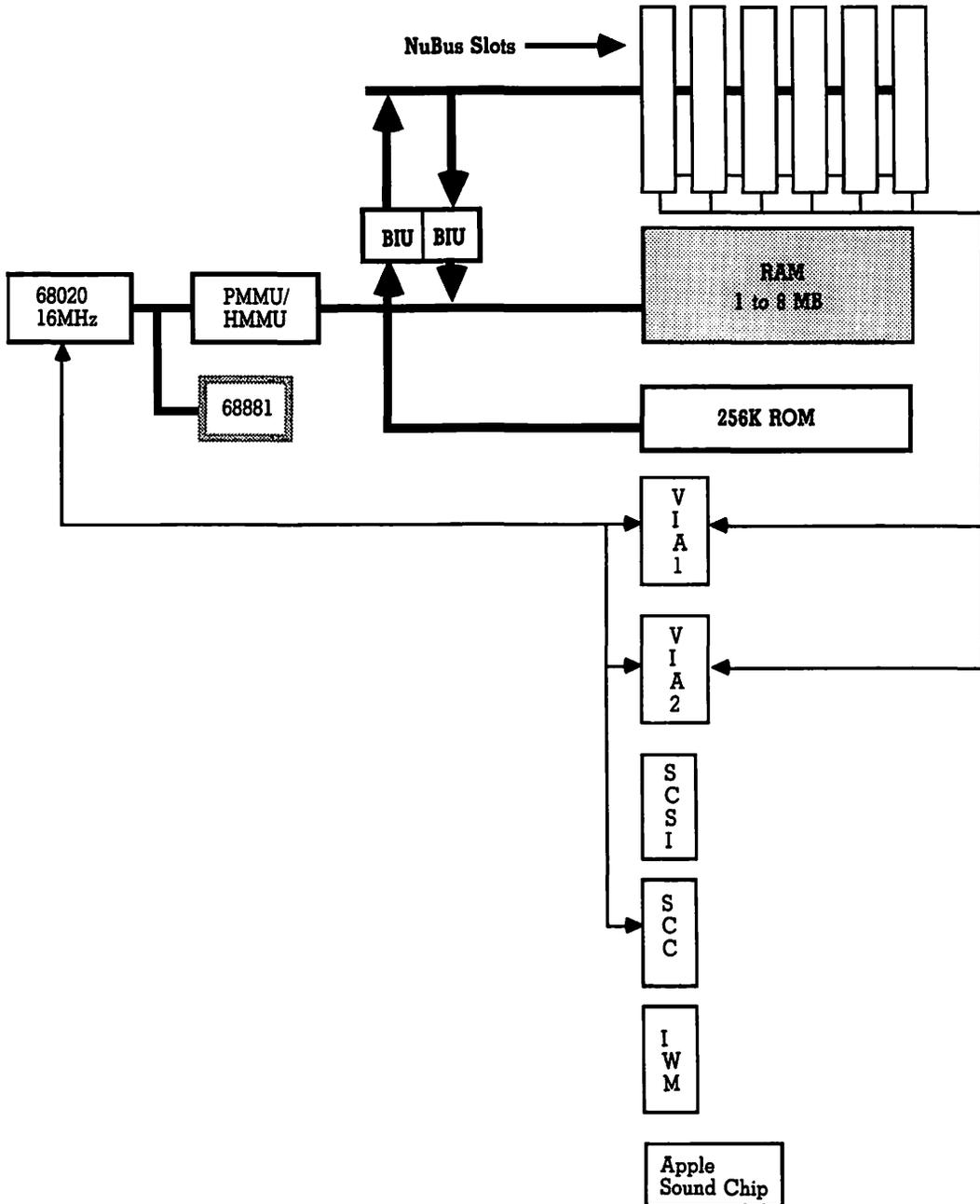
The Mac II power supply is a standard 220-watt power supply. The power is used by the logic board, the internal devices, and the NuBus slots.

NuBUS

The modules described make up the insides of the Mac II. However, one of the modules, NuBus, has far more importance to the overall operation and function of the Mac II. The heart of the Mac II has nothing to do with the latest and greatest software program. The heart of the Mac II is an input/output (I/O) bus called—NuBus! NuBus was selected by Apple to control the new expansion slots. (Older Mac buses simply controlled the communication ports at the back of the Mac.) NuBus is used to expand the Mac II beyond the basic communication ports on its back panel. Before we begin discussing the pros and cons of NuBus, take a closer look at the bus itself, shown in Figure 1.2.

NuBus is not Apple's idea (as much as they would like you to think it is). The Apple NuBus is based upon Texas Instruments' NuBus. NuBus is synchronous; all bus signals are synchronized to a single system clock. However, NuBus can also act asynchronously, giving users the flexibility of adding communication peripherals and cards that take advantage of asynchronous communications. Not the least of the reasons for the

FIGURE 1.2 NuBus



selection of NuBus was its ability to use slots for various I/O cards. The Mac II NuBus has six slots that can be used for any type of add-on cards. These might include the following:

- **RAM.** Up to 4 gigabytes.
- **Video cards.** Capable of supporting up to 24-bit video displays.
- **Coprocessors.** Most notably MS-DOS coprocessors. Why anyone would really want to do this deserves a spot in Ripley's Believe It or Not.
- **Additional SCSI ports.** This would increase the number of SCSI peripherals you could use.
- **Modems.** Look for "modems-on-a-card" before long.
- **Network connection cards.** Included might be Ethernet, IBM Token Ring, and Novel Netware.
- **Graphic overlay boards.** For advanced video interfacing. Look for firmware and software products to enhance and advance interactive video with the Mac II.

Of course there will be other, more unique add-ons for the Mac II. This is by no means a definitive list.

As I mentioned, Apple had numerous reasons for selecting the NuBus architecture in the Mac II. Apple realized that there was a need for creating a new Macintosh that was capable of expanding and taking the Macintosh into the far reaches of the future. The bus architecture of the then-current Mac system did not conform well to expansion. Apple needed something that was expandable yet did not lock developers in. One of the chief complaints about the Mac was not so much that it was a closed system, but that the system did not offer hardware developers much flexibility for developing hardware add-ons. Apple made some changes and came up with the Macintosh SE: one slot, not much expansion, but more than was available with the Mac Plus. The Mac II with the NuBus architecture was the answer to most of Apple's requirements. There are three main reasons why Apple selected NuBus over other architectures.

1. **Independence from system architecture.** NuBus is not dependent upon the microprocessor for control of the machine. This feature allows for the development of

coprocessor boards and cards with their own microprocessor for control. NuBus also allows for easy upgrading of the microprocessor without incompatibility with current cards. This means you can add the more powerful 68030 or 68040 or 680XX whenever they become available without having to replace your add-on cards. Developers can now concentrate on creating enabling technologies to add on to the enabling technology of the Mac II.

2. **Simple protocol structure.** The only protocols that NuBus has are read and write. This means that each card accessing the bus has equal rights to the microprocessor and other I/O facilities. I/O are also memory-mapped. This means users don't have to worry about certain cards being incompatible with other cards.
3. **Ease of system configuration.** There are no DIP (Dual In-line Processor) switches or jumpers to set your cards or in the Mac II. This is accomplished through a technique called "geographical interfacing." The cards in the slots are considered by NuBus to be "peers," that is, no card or slot is a default slot or a "special slot."

These three features are the most important reasons Apple selected the NuBus architecture. As you can easily see, there is a hierarchical structure to Apple's concept of enabling technology. The more open and free the main architecture is, the more open and innovative the third-party products can be. As I am sure you begin to see, Apple's enabling technology creates a hierarchy of possibilities.

Slot Arbitration

One of the ways NuBus maintains this hierarchical freedom is through a process called **arbitration**. Arbitration is important for several reasons. First, it decides which board in any slot gets to talk to the 68020. Second, arbitration determines how other cards that need to access the 68020 are accommodated. Cards with the highest ID number generally get first access to the bus. During arbitration one or more cards will make a request for control of NuBus. Cards that desire control send out a line of code

called a /RQST (**Re**que**ST**) line. This code is then placed in a NuBus line called the arbitration line (/ARBx). Any and all cards that send out a /RQST line send out information about the card's ID code. After two clock periods, the arbitration logic of NuBus determines which card has won arbitration and gets first crack at the bus. The card with the highest ID code wins ownership and may make a transaction with NuBus. When the winning card gets permission to access the bus, it is given a start code (/START) and is removed from the arbitration line. Then the process starts up again for the next cards in line. Of course this is an oversimplification. However, the basic premise is the same.

If this all sound very confusing, think in terms of a political system. For example, many people want access to the President of United States. In order to meet with the Chief Executive, one must get in line and submit a request. Since there are very long lines (figuratively speaking), the staff must have a way of deciding who gets to see the President. As we all know, only those with high political rank, celebrity status, or economic pull (high ID codes) are admitted to the Oval Office. Fortunately, add-on cards do not have to wait as long we would to see the President to get their chance at NuBus.

Firmware

Firmware—another name for add-on cards. Actually, it is the software generally contained within a ROM chip on the card or on the motherboard that is firmware. It is these cards that really make the Mac II sing. Without add-on cards (firmware) the Mac II would simply be a bigger and very expensive Macintosh. Add-on cards offer the options that take the Mac II beyond the boundaries of any Mac yet introduced.

All cards must be 4 inches in height and between 12.87 and 7 inches in length. Any slot can be used for any card. The fact that there are no special “master” slots offers users flexibility not found in other buses. Cards available for the Mac II fall into five main categories.

1. **Video cards and monitors.** These cards come in many different varieties. There are 8-, 16- and 24-bit video cards. Deciding which card to use depends upon your needs. Apple provides you with a standard 8-bit video card and expansion chips that provide for up to 256 colors on your screen at one time. The 24-bit cards offer extremely high resolution and color selection, making them an excellent choice for individuals working in CAD (computer-aided design) professional graphics, video production, and so on. Look at cards from SuperMac Technology and RasterOps for some examples of high-resolution cards. Included in this section is a discussion of video monitors. After all, what good is a video card without a monitor to show it off?

2. **Monitors.** So these aren't add-on cards—however, you cannot really talk about video cards without mentioning the monitors they operate. Also, most monitors are sold with someone else's video interface card. Monitors and video interface cards have enjoyed the most symbiotic relationship in the computer industry. After all, what good is your monitor without a video card to provide the interface to the computer? Likewise, video interface cards by themselves do no good without a monitor to view your wonderful creations.
3. **Extended memory cards.** More memory has always meant more power. In some ways this is true. However, with the Macintosh, additional memory can significantly increase your application's speed and efficiency. The Mac II comes standard with 1 megabyte of random access memory (RAM) on the motherboard. Through various configurations of SIMMS, the Mac II can be expanded to 8 megabytes on the motherboard. With the addition of extended memory cards, the Macintosh II's RAM is theoretically expandable to 4 gigabytes! Most of the memory cards contain additional features besides the extra memory. There may be RAM caching, additional video attributes, or other functions. Look at AST and SuperMac to provide some outstanding products.
4. **Network connection cards.** One of Apple's primary marketing strategies has been to create an enabling technology with the Mac II. Apple hoped the Mac II could be used to connect the Mac II to any network and any computer. Network connection cards allow the Macintosh II to accomplish this feat! The Macintosh II can connect to virtually any network and any other computer on the market. Networks includes Ethernet, Token Ring, fiber optic networks, Novel Netware, Northern TeleComm's LANSTAR, DECNet, and of course AppleTalk. In addition to network connections, many of these cards also offer Mac II-to-mainframe connections. Among the many computers the Mac II can connect to are IBM PC/XT/AT and PS/2, Prime, Sun, Apollo, Cray, Tandem, IBM System 36 and 3270 mainframes, and DEC VAX/VMS, just to name a few.

5. **Miscellaneous cards.** In this catch-all area are cards that perform functions you never even thought of. Video frame grabbers, graphic overlay cards for interactive video, and data acquisition cards fit into the miscellaneous category. Another type of card that fits into this group is the coprocessor card. Coprocessor cards currently provide you with an Intel 8088 or 80286 microprocessor and MS-DOS software that provides MS-DOS coprocessing capabilities on the Mac II.

This chapter on firmware will explore each of these areas and some available products. Technical information will be kept to a minimum. This is not meant to be a definitive listing of Mac II products. Rather these products are an idea of the amazing potential and versatility of the Mac II. Each section offers descriptions of the type of cards available and some specific products being sold. The product descriptions include the name of the company, its product(s), and the most current manufacturer's suggested retail price. Again, the list does not contain all the firmware there is. Rather these products represent the tip of the iceberg and let you know what can be done. Knowing your potential is often the first step in the creative process.

EXPANSION CARDS—POWER REQUIREMENTS

Before going into depth on the various expansion cards for the Mac II, it is a good idea to mention some of the limitations the Mac II has with expansion. These limitations are concerned with the amount of electrical power used by expansion cards. If you plan on loading your Mac II with a lot of expansion cards, you cannot exceed the power requirement limits.

There are three types of power that expansion cards draw from:

1. +V bus current
2. +12V bus current
3. -V bus current

WARNING: Installing a group of cards that make excessive power demands can cause damage to one or more expansion cards and to the Mac II itself.

Each expansion card draws power from these sources in varying amounts. Most cards will have pertinent power-usage information packed with them. You should add up all of the power requirements of your cards and then compare them to the limits chart. This power limit chart sets the **maximum** power limits for each type of current that cards can draw from.

Power Limit Chart

TYPE OF CURRENT	RECOMMENDED TOTAL POWER (all six slots)
+5V bus	12.8 amps
+12V bus	1.3 amps
-12V bus	1.0 amps

You need to check the specifications for each card you are adding to figure the total power requirements. As an example, suppose you have five cards with these power requirements:

TYPE OF CURRENT	TOTAL POWER REQUIRED
+5V bus	11 amps total (5 cards)
+12V bus	1.0 amps total (5 cards)
-12V bus	1.3 amps total (5 cards)

The first two currents (+5V and +12V) fall within the the power requirements. The last current (-12V) falls over the power limits. You will have to choose which cards stay in and which ones go in on a rotating basis. The other option is to locate another card requiring less power.

The Products

Video Cards

Next to network connection cards, video cards for the Mac II are enjoying the most popularity. Mac II video cards are designed to take Macintosh video output to the highest levels. For those of us that first marveled at the original Mac's video output, high-resolution video cards and the Mac II are even more impressive. Most Mac users have never had to worry about which video card would give them the required resolution or desired output quality. With the "old" Macs, you had your choice of a wonderfully compact 9-inch black-and-white screen, or a larger black-and-white screen that often cost more than your Mac. The Mac II, with its open-architecture concept, forces you to make some decisions regarding your video output.

Apple

Company: Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Product: Video Interface Card

Price: Standard 256K—\$499
512K Expansion Kit—\$149

Product Description

The Video Interface Card is the standard Mac II video card sold by Apple. It is, at best, an adequate video card. Apple's Video Interface Card is based upon a custom chip called the Toby Frame Buffer controller, or TFB for short. This basic card comes with 256K of video RAM that is expandable to 512K. The standard 256K Video Interface Card provides 1 to 4 bits-per-pixel and up to a maximum of 16 colors or shades of gray on your screen

at a time. Colors are selected from a palette of 16.8 million colors. With Apple's Video Expansion Kit, you get an additional 256K of video RAM. This expansion provides for 256 colors or shades of gray on your screen at one time and 8 bits-per-pixel. You still have 16.8 million colors to choose from. The Apple Video Interface Card is capable of supporting any RS170-compatible monitor. This compatibility opens the door to many companies offering excellent monitors for the Mac II.

SuperMac

Company: SuperMac Technology
295 N. Bernardo
Mountain View, CA 94043
(415) 964-8884

Product: Spectrum/24

Price: \$2995

RasterOps

Company: RasterOps
10161 Bubb Rd.
Cupertino, CA 95014
(408) 446-4090

Product: The ColorBoard 1/104

Price: \$2795

Product Description

Both of these boards offer full 24-bit color graphics for your Mac II. It may be a good idea to discuss what a 24-bit video display card can do for you (besides put you in debt). A good way to appreciate the difference between 24-bit video cards and the

standard 8-bit cards is to examine the quality of color photography. A color photo can have 5000 to 10,000 different colors. Most 8-bit video boards utilize a look-up table that assigns 256 colors from the Mac II's palette of 16.8 million to the screen. To get the "true color," 24-bit cards do not use look-up tables. Instead they write directly to the screen, thus accessing as many of the Mac II's 16.8 million colors as they need. In conjunction with high-resolution monitors, 24-bit video cards offer *very* near photographic quality on your computer screen. This quality is not so much in terms of resolution, but rather in terms of the number of colors that can be placed on the screen at any time.

Most 24-bit cards should also support video graphics in an 8-bit mode. The reason for this is simple: there is very little software written that can take advantage of 24-bit video cards. RasterOps offers a development tool call TrueColor™ with which software developers can write applications that take advantage of their 24-bit board. To date, this software has been slow in coming. Part of the hold-up is price: the 24 bit cards are not cheap. They cost anywhere from \$2000 to \$5000. However, for those who need the quality of picture that these cards are capable of producing, the high price tag is not too difficult to swallow.

The RasterOps ColorBoard 1/104 is a high-end 24-bit add-on color video board. The board is built around Texas Instruments' 34010 graphics processor and provides full 24-bit graphics along with 2.4 megabytes of on-board RAM. Additional RAM can be added to a total of 14 megabytes. The ColorBoard 1/104 can provide graphics display in either the 24-bit or 8-bit mode. In the 8-bit mode, the ColorBoard 1/104 is suitable for use with the majority of Macintosh applications.

The ColorBoard 1/104 uses a single slot in the Mac II and provides a full 24 bits-per-pixel color plane. This offers you 16 million colors simultaneously on your computer screen (sounds like a Timothy Leary dream come true). The ColorBoard 1/104 also offers a resolution of 1024 × 768 color pixels. The combination of the 24 bits and high resolution makes the RasterOps ColorBoard 1/104 an excellent example of the graphics the Mac II is capable of.

SuperMac is another company that is offering a 24-bit video card for the Mac II. The Spectrum/24 has 2 megabytes of on-board video RAM and supports 1, 2, 4, 8, or 24 bits-per-pixel.

The Spectrum/24, in conjunction with its monitors, supports a resolution of 1024 × 768. The Spectrum/24 uses one NuBus slot and, like the RasterOps board, provides a full 24 bits-per-pixel color plane. Much like its RasterOps counterpart, the Spectrum/24 supports 16 million simultaneous colors on your screen.

These three cards (Apple's Video Interface Card and Enhanced Video Interface Card, RasterOps, and SuperMac) represent the spectrum, from low end to high end, of video cards for the Mac II. Of course there are other companies offering video interface cards for the Mac II. It is important to remember that you now have a choice. Your decision depends upon your specific needs. For those who need photographic quality in their output, the 24-bit cards should do the trick. For those who need ultra-high resolution, the 8-bit cards with a high-res monitor should fill the bill.

Monitors

The lack of a standard video display with the Mac II has opened up a new world for some Macintosh users. Users who began their computing life with the Mac have never had to worry about selecting a video monitor. The screen was standard equipment. Now that Mac II requires you to add a monitor of your choice, quite a few companies have jumped on the monitor bandwagon. This includes companies who were IBM PC-only companies. Sony, Monitorm, and NEC are good examples. Figure 2.1 shows the various monitors, the selling company, the price, the screen sizes offered, and the resolution in pixels. If any of the monitors listed in Figure 2.1 meet your specifications, you can contact the respective companies for more details.

Several important concepts must be kept in mind when purchasing a monitor for your Mac II. The first is your interface card. You *must* have a video interface card that works with your monitor. Many of the monitor companies listed here sell their own, or someone else's, interface cards with their monitors. If the monitor does not come with an interface card, be sure to find out whose video interface card it is compatible with. Sometimes the cost of the monitor does not include the interface card, so you have to figure in the cost of the video interface card when budgeting for your Mac II monitor.

FIGURE 2.1 Companies producing monitors

Monitor Name	Company	Address	Price	Card Included	Resolution/Screen Size
Apple Monochrome Apple Color	Apple Computer, Inc.	20525 Mariani Ave. Cupertino, CA 95014 (408)996-1010	Monochrome—\$339 Color—\$999	No—extra	640 by 480 Monochrome=12" Color=13"
The Big Picture	E-Machines, Inc.	7945 S.W. Mohawk Tualatin, OR 97062 (503)692-6656	\$1,995—B/W	Yes	1024 by 808 17"
Definition AutoSync 1019	Microvitec, Inc.	1943 Providence Ct. College Park, GA 30337 (404)991-2246	\$2,195—Color	No—can use Apple's extended video card	640 by 480 19"
AUM 1371A C6922AGK FHF3500K XC-3710	Mitsubishi Electronics	991 Knoy Street Torrance, CA 90502 (213)515-3993	AUM 1371A—\$889 C6922AGK—\$2,880 FHF3500K—\$1,440 XC-3710—\$7,850	No—uses Apple's expanded video card	AUM 1371A— 640 by 480 19" C6922AGK— 640 by 480 19" FHF3500K— 640 by 480 15" XC-3710— 640 by 480 37"
Macsimzer	Comtrex Limt., Inc.	P.O. Box 1450 El Toro, CA 92630 (714)855-6600	\$2,495—Color	Yes	1024 by 768 20"
MultiSync Plus	NEC	4942 W. Rosecrans Hawthorne, CA 90250 (213)978-8363	\$1,339	No—uses Apple's extended video card	640 by 480 13"
PCPC II (Mitsubishi) PCPP II (Sony)	Personal Computer Peripherals Corp.	6204 Benjamin Rd. #205 Tampa, FL 33634 (800)622-2888	PCPC II (Mitsubishi)—\$4,995 PCPP II (Sony)— \$5,295	Yes	1024 by 768 19"

FIGURE 2.1 *Continued*

Monitor Name	Company	Address	Price	Card Included	Resolution/ Screen Size
SuperMac 19" Color Trinitron SuperMac 19" Standard Color SuperMac 16" Color Trinitron	SuperMac Technologies	295 N. Bernardo Mountain View CA 94043 (415)964-8884	SuperMac 19" Color Trinitron—\$3,695 SuperMac 19" Standard Color—\$2,995 SuperMac 16" Color Trinitron—\$2,495	No—card extra	1024 by 768 19" 19" 16"
Ultrascan Color	Mitsubishi, Thompson Information Systems Corp.	5731 W. Slavson Ave. Culver City, Ca 90230 (800)237-9483	\$895 (cable is \$30)—Color	No—uses Apple expanded video card	640 by 480 14"
RasterOps RM 2738	RasterOps	10161 Bubb Road Cupertino, CA 95014 (408)446-4090	\$2,795—Color	No—card extra	1024 by 768 19"
13-inch Multiscan Color	Sony Corp.	Attn: Customer Information Sony Drive Park Ridge, NJ 07656 (800)222-0878	\$975 with stand and cable	No—uses Apple's expanded video card	640 by 480 13"
Viking 10	Moniterm Corp.	5740 Green Circle Drive Minnetonka, MN 55343 (612)935-4151	Viking 10—\$4,795	Yes	1024 by 768 19"
LaserView Display System	Sigma Designs, Inc.	46501 Landing Parkway Fremont, CA 94538 (415)770-0100	\$2,395	Yes	1664 by 1200 19"

The second important thing to remember is your monitor cable. According to Apple, their card is capable of supporting any RS170-compatible monitor. This is supposed to be widespread industry-standard. In reality, not every monitor is an RS170-compatible monitor. RS170 monitors demand some special cabling, and without the proper cable for your monitor you get no video image. Most monitor cables are 9- or-25 pin connectors. The Mac II is a 15-pin connection on the Mac II end. The monitor end is generally a standard 9-pin DIN RGB connector. Salespeople familiar with selling monitors for the IBM often provide the wrong cable for the Mac II. Be sure to order your monitor with a **MAC II** cable.

Another feature to check when purchasing monitors is the scanning frequency. Some monitors claim they can handle the output of the Mac II. You generally do not realize the incompatibility until you buy and attempt to use your monitor. The Thompson Ultrascan is a good example of this. The Thompson claims to be Mac II-compatible. However, when connected, the Ultrascan cannot handle the output of the Mac II. The characters are fuzzy and difficult to read, and the items on the menu bar are skewed (crooked). This represents a monitor that cannot handle either the scanning frequency of the Apple enhanced video card or the standard Macintosh video resolution. To be fair, Thompson does provide an additional interface that corrects the problems.

Network Connection Cards

Apple has made it no secret that network communications is one of the main focuses of their marketing attention. Network expansion cards include not only network connections but also mainframe connections since most Mac-to-mainframe connections take place over some form of LAN. The selection for network connection cards is not so rich as the array of other add-on boards for the Mac II. However, this is misleading. Apple has made it no secret that they want the Mac II to act not only as a central file server, but also as a network gateway. Network and mainframe connection cards in the listings that follow will connect to virtually any network or mainframe being used. What

these cards offer you is the ability to connect to other networks or mainframes via some other type of bridge. This bridge can be a protocol converter or network controller boxes. For the user this generally means additional hardware and expense.

This section covers only the add-on cards that supply the basic connections for the Mac II. For additional information on connecting to specific networks or mainframe, contact the manufacturer. Another source of valuable additional information is the *Apple Desktop Communications Solutions Reference Guide*, published by Apple Computer and Redgate Communications Corporation. It is Redgate that publishes the *Macintosh Buyers Guide*. Ask your local Apple dealer to secure a copy of the *Apple Desktop Communications Solutions Reference Guide*.

For the Macintosh, the main network connection is Ethernet. Most connections to foreign computer systems (MS-DOS, VAX/VMS) and foreign networks (Token Ring, StarLAN) take place through, or around, an Ethernet network. The first two boards, EtherTalk from Apple and EtherPort II from Kinetics, are Mac II-to-Ethernet connectors. At their basic level they provide the physical connection of your Mac II to Ethernet. However, both boards go somewhat beyond this physical connection by providing some mandatory communication software.

EtherTalk

Company: Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Products: EtherTalk Interface Card

Price: \$699

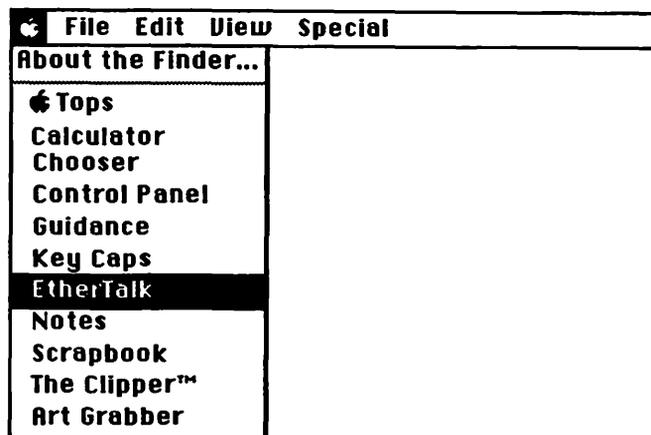
Product Description

The EtherTalk Interface Card is a standard NuBus card. It provides connections for either standard (thick) Ethernet wire (IEEE

802.3 MAU interface) or thin-wire Ethernet (IEEE 802.3 10BASE2). When Apple packaged EtherTalk, they included *no* software. Apple's expectation was for users to use the EtherTalk board in conjunction with their UNIX (A/UX) product. You can send a postcard that comes with the board to Apple to receive some "generic" EtherTalk software. This software allows you to perform standard functions such as E-Mail and file transfers over Ethernet. EtherTalk also works with Ethernet software products from Kinetics. EtherTalk does include some installation software that allows you to install the drivers for the card. EtherTalk is then selected like AppleTalk (see Figure 2.2) from the Chooser window.

Apple's EtherTalk board assumes you are familiar with the inner workings and wiring associated with Ethernet. The board comes with only a 14-page manual that discusses such important issues as how to install EtherTalk into the Mac II and how to connect the Ethernet wires to the card. All of these procedures are about as difficult as installing a light bulb and then plugging in the lamp. Be forewarned, EtherTalk is not a complete package. To be effective, EtherTalk needs the appropriate components for establishing connections over Ethernet.

FIGURE 2.2 EtherTalk Desk Accessory



EtherPort II

Company: Kinetics
2500 Camino Diablo
Suite 110
Walnut Creek, CA 94596
(415) 947-0998

Product: EtherPort II

Price: \$795

Product Description

Kinetics has been connecting Macs to Ethernet longer than anyone. Now they have joined into the Mac II market with their EtherPort II board. This is a full-sized NuBus board that fits into any slot. The EtherPort II provides connections for either thick (standard) or thin Ethernet wiring. Unlike the Apple Ethernet board, EtherPort II offers users some software. The EtherPort II comes bundled with a product called NCSA Telenet. This software provides file transfer and terminal emulation for TCP/IP protocols. In addition to this software, EtherPort II allows a user to run two different network protocols at the same time. For instance, with the EtherPort II board, users could send E-Mail via DECnet while operating under AppleShare.

MacIRMA

Company: DCA, Inc.
1000 Alderman Dr.
Alpharetta, GA 30201-4199
(404) 442-4000

Product: *MacIRMA*

Price: \$1195

Product Description

MacIRMA works with the Macintosh SE and Macintosh II. Like the other Mac-to-mainframe products, *MacIRMA* offers full IBM 3278/3279 emulation. The protocol converters reside on add-on cards for the Macintosh SE and Mac II. *MacIRMA* supplies Mac users with a number of key Macintosh features that set it apart from standard terminal emulators, namely, the following.

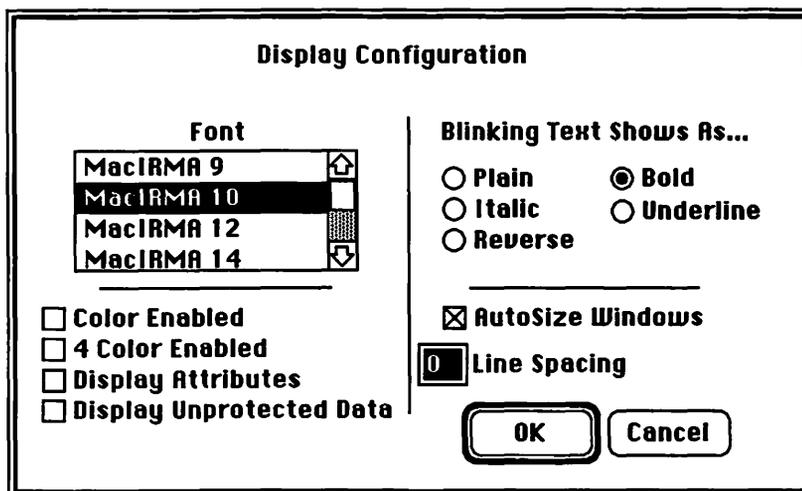
The Ability to Cut and Paste in Blocks This allows for tabular data to be extracted from the screen in "blocks." These blocks retain the tab settings, thus allowing tabular data to be easily pasted into a database or spreadsheet.

Complete File-Transfer Capabilities *MacIRMA* supports IBM's Document Content Architecture (DCA) file-transfer packages along with other transfer protocols. *MacIRMA* is fully compatible with DCA's IRMA™ file-transfer software on the IBM mainframe.

User-Defined Keyboard Configuration *MacIRMA* allows for complete configuration of the Macintosh keyboard to conform to any mainframe application. The keyboard is displayed, and the user simply points and drags the keys to reposition the keyboard as needed. Repositioned keys can then be easily printed on the ImageWriter or LaserWriter.

Alterations of Terminal Display Settings Unlike other emulators where your choice of screen displays consists of Monaco-9 point or Monaco 12-point, *MacIRMA* provides you some options. The display configuration window allows the user to select different fonts in the system. Once selected, *MacIRMA* will automatically resize your display window to accommodate the selected font and font size (see Figure 2.3).

FIGURE 2.3 MacIRMA font window



Company: Northern TeleCom
2305 Mission College Blvd.
Santa Clara, CA 95054
(408) 988-5550

Product: LANSTAR Macintosh Interface Card

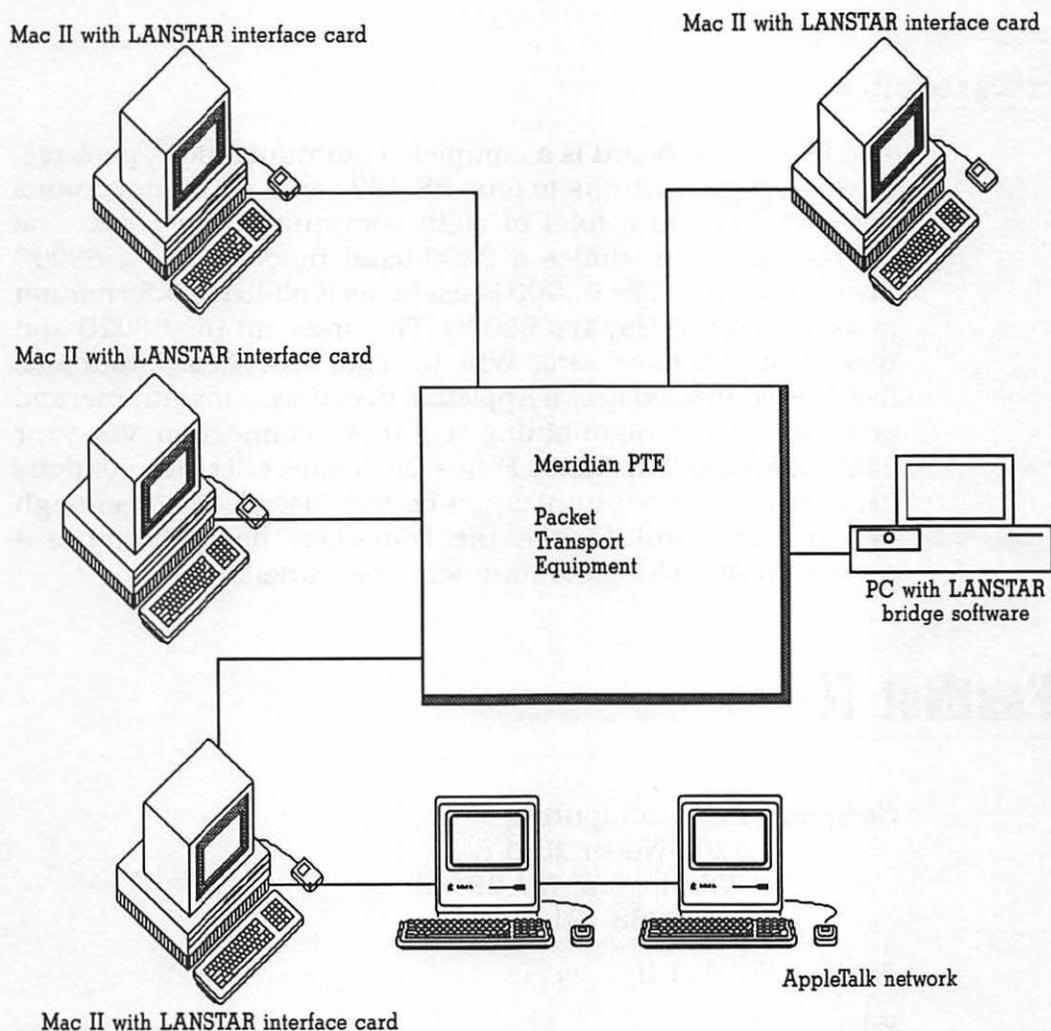
Price: \$295

Product Description

The LANSTAR interface card comes from Northern TeleCom and is used in conjunction with their LANSTAR network. LANSTAR is a high-speed twisted-pair LAN generally used in connection with Northern TeleCom's Meridian SL-1 phone system. With the SL-1 system, LANSTAR, and a Mac II, you can link many Ap-

pleTalk networks together through your Meridian SL-1 phone system and PBX. A possible LANSTAR/AppleTalk network configuration is shown in Figure 2.4. The LANSTAR Interface card comes with installation software and software that allows the Mac II to share files over the LANSTAR network.

FIGURE 2.4 LANSTAR/AppleTalk configuration with Mac II



Four+One

Company: Tara Systems Corp.
912 Santa Hidalgo
Solana Beach, CA 92075
(619) 481-7109

Product: Four+One

Price: \$949

Product Description

The Four+One board is a complete communications package. It expands your NuBus to four RS-422 serial communications ports, giving you a total of eight communication ports. The Four+One also includes a 2400-baud modem and a 68000 microprocessor. The 68000 is useful as it off-loads information to and from the Mac II's 68020. This frees up the 68020 and thereby speeds processing. With the Four+One board, your Mac II can be connected to two AppleTalk networks, a mainframe, and printer(s) while maintaining a remote connection via your 2400-baud modem. Tara's Four+One board offers tremendous flexibility for communication-bound users. With enough memory and MultiFinder, the Four+One board becomes a pseudo multitasking communications workstation.

FastNet II

Company: Dove Computing
1200 North 23rd St.
Wilmington, NC 28405
(919) 763-7918

Product: FastNet II

Price: \$799

Product Description

The FastNet II provides an Ethernet connection and software to connect your Mac II to a DECnet network. The FastNet II comes with up to 1 megabyte of RAM and a 68000 coprocessor. The board is a standard Mac II NuBus compatible board. Once connected, it can use either thin or regular Ethernet cable.



Company: AST
2121 Alton Ave
Irvine, CA 92714
(714) 863-1333

Product: AST-ICP

Price: AST-ICP™/2 connectors—\$949
AST-ICP™/4 connectors—\$999

Product Description

The AST-ICP is an **Intelligent Communications Processor**. The AST-ICP provides two–four additional synchronous/asynchronous serial ports. In addition to the ports, the AST-ICP has an 8Mhz 68000 processor, and 512K of RAM. The primary initial function of the board is to provide multiuser terminal attachments for A/UX, the Apple UNIX operating system. If you are not running UNIX, the ports could be configured for AppleTalk and AppleTalk bridges.

One of the benefits of the AST-ICP board is that it provides developers with a standard for alternative synchronous protocols. These protocols could include SNA (great for communicating with IBM 3278 mainframes), Bisync, and X.25 (a standard communications protocol in Europe). Support for the X.25 protocols opens the door for the Mac II to become a very intelligent workstation in a **Wide Area Network (WAN)**

Miscellaneous Cards

As mentioned previously, there are several type of cards that fall into this category. Graphic overlay cards and other types of data-acquisition cards fit into this miscellaneous category. There are even some cards that defy a descriptive category. What this catch-all category provides is information on the diversity and uniqueness of products available for the Mac II. You can find graphic overlay cards and frame grabbers for MS-DOS computers. However, when you combine these powerful cards with the power and ease of use provided by the Mac II, you can begin to see just how much more the Mac II can offer.

MacProto

Company: ADEX Corp.
105 Albright Way
Los Gatos, CA 95030
(408) 866-2077

Product: MacProto

Price: \$299.95

Product Description

MacProto is an add-on board that assists developers in the development of Mac II boards. Essentially, MacProto offers developers the necessary hardware and software to design, then test, their add-on board prototypes. MacProto offers you an on-board 32-bit-wide Address Latching Register, which allows for 8-, 16-, or 32-bit-wide data transfers. In addition, MacProto has a 30-inch-square wire-wrap prototyping area for both DIP and PGA (**P**aged **G**raphics **A**dapter) integrated circuits. The board itself is of four-layer construction that ensures low-noise operation and offers a large Slot Declaration ROM for custom programming and initialization. For users who want to try their hand at developing their own add-on boards for the Mac II, MacProto offers the necessary elements to assist your development efforts.

 **QuickCapture**

Company: Data Translation
100 Locke Dr.
Marlboro, MA 01752-1192
(617) 481-3700

Product: QuickCapture

Price: \$995

Product Description

Data Translation has been involved with development of data-acquisition boards for MS-DOS computers for several years. QuickCapture is a frame grabber board with software for the Mac II. The board is designed to grab any video image going into your Mac II and then save that image as a graphic element. QuickCapture captures images from one of four video inputs. These inputs—VCRs, video cameras, or videodiscs—can all be connected to the QuickCapture board at the same time and process images on your Mac II in real-time (1/30th of a second). You can then switch between inputs, view images, select the image you like, and save that image as a Macintosh graphic file. QuickCapture supports the following Macintosh graphics formats:

- Bit-mapped (MacPaint)
- PICT (MacDraw)
- TIFF (Tagged Image File Format)
- PostScript
- Encapsulated PostScript

The QuickCapture board contains all of the necessary hardware and software for capturing images. In addition, QuickCapture contains 512K of frame-store memory. This will be expandable with future releases of the QuickCapture board. The QuickCapture board only supports image capture in the standard 640 × 480 resolution mode. This is the board's only drawback. However, once an image is captured, it can then be manipulated and enhanced in a higher resolution.

Pegasus

Company: Data Translation
100 Locke Dr.
Marlboro, MA 01752-1192
(617) 481-3700

Product: Pegasus

Price: \$1495 to \$2495

Product Description

Pegasus is a data-acquisition board and software. Pegasus provides the appropriate hardware for connecting various types of laboratory and scientific instruments to your Mac II. Pegasus includes 512K of on-board RAM and automated configuration and calibration setup facilities.

NuVista

Company: Truevision, Inc.
7351 Shadeland Station
Suite 100
Indianapolis, IN 46256
(317) 841-0332

Product: NuVista

Price: 2 megabytes—\$4250
4 megabytes—\$5995

Product Description

NuVista is a combination graphics overlay board and 32-bit video card. In addition, NuVista has image-capturing capabilities. NuVista contains a 32-bit Texas Instruments TMS 34010

graphics processor. NuVista can be configured with either 2 or 4 megabytes of RAM. This is one reason the board carries a hefty price tag. However, the RAM is essential for image capture and manipulation. The TrueVision people who created the NuVista board are the same group who created the TARGA board for MS-DOS compatibles. For individuals needing advanced graphic overlays for video production along with image-capturing capabilities, NuVista is the most powerful solution on the market today.

TV Producer

Company: Computer Friends
14250 NW Science Park Dr.
Portland, OR 97229
(503) 626-2291

Product: TV Producer

Price: \$799

Product Description

The TV Producer is quite simply a graphics overlay board. The board is designed to overlay Macintosh graphics over standard NTSC video. For users that are involved in interactive video or need to combine graphics and video, the TV Producer is the ticket. It has video keying and both internal and external GENLOCK modes. Video keying allows any of the Macintosh's 16.8 million colors to be transparent to the external video monitor. This allows you to overlay specific colors over the background colors of your video, giving the appearance of graphics superimposed over your video. Because GENLOCK sets the vertical and horizontal synchronization modes, it is important to use it when connecting to a videodisc, VCR, or video camera. Without GENLOCK capabilities your video signal would jitter a great deal.

The TV Producer attaches directly to your enhanced Apple video card. The board has two output modes: with overlay and

without overlay. These two modes allow you to create graphic overlays and to preview NTSC video. The TV Producer also comes with video comb filters. These are filters that allow you to control chromacrawl. Chromacrawl leads to degradation of video quality when producing various generations of the same video. For users with a need to create graphic overlays to video, the TV Producer gets the job done at a reasonable price.

Mac286

Company: AST
2121 Alton Ave
Irvine, CA 92714
(714) 863-1333

Product: Mac286

Price: Price\$1499

Product Description

Believe it or not, the Mac286 board is an MS-DOS coprocessor board for the Mac II. The Mac286 was codeveloped with Apple Computer and Phoenix Technologies and is a self-contained 80286 microcomputer. It comes with 1Mbyte of RAM, a DMA controller, a socket for an optional 80287 math coprocessor, and a controller for a 5.25-inch MS-DOS floppy disk drive. The Mac286 is two full-length boards that occupy two slots in the Mac II. The board allows you to run MS-DOS applications designed for the IBM AT at IBM AT speeds. The Mac286 handles all of the application processing, leaving the Mac II free for other uses and making the Mac286 ideal in a LAN setting.

The Mac286 supports the IBM Monochrome Display Adapter (MDA), the IBM Color Graphics Adapter (CGA), or the Hercules Monochrome Graphics Adapter. As with the Mac86, you

simply load the Mac286 software into the Mac II. The MS-DOS environment appears as an icon on the desktop. This allows you to select which operating system environment you want to work in at the Finder level. When running Switcher™, you can have the best of both worlds. Once loaded, MS-DOS applications have a full 640K of RAM to use. This of course leaves any and all memory of the Mac II free. Once in the MS-DOS mode, you operate an application as if the Mac II were an IBM. Specific functions and configurations are available from your Mac menus.

The Mac286 supports the LaserWriter, LaserWriter Plus, and ImageWriter printers. You print directly to the LaserWriter, while in an MS-DOS application, through a Mac II (or SE). While in the MS-DOS mode, you can also print to an ImageWriter in an emulated Epson™ FX 80 mode. Access to printers is supported over the AppleTalk Personal Network (APN).

Memory Expansion Boards

Memory expansion boards for the Mac II come in two variations. The first is an add-on board with dynamic RAM chips (DRAMs). The other type of memory boards are SIMMS (System In-Line Memory Modules). These boards generally expand your Mac II's 1 megabyte SIMMS. The difference between the two variations of memory expansion is significant. First, SIMMS increases NuBus RAM. While NuBus has the potential of accessing 16 megabytes of RAM, the bus itself can only handle 8 megabytes. This means that to boost your Mac II to the full 16 megabytes, you need the additional RAM on an add-on card. An add-on RAM board can contain anywhere from 512K to 16 megabytes of RAM. The Mac II will first access or use its own bus RAM and then address the additional RAM on an add-on card.

The speed of RAM chips used for the Mac II is also significant. As mentioned in Chapter 1, the Mac II uses 120-nanosecond DRAMs. This is different than the 150-nanosecond chips used by the Mac Plus and Mac SE. The 120-nanosecond DRAMs are identified by the number "12" on the back of the chip. Of course different manufacturers may place the 12 on the

front or hide it within a product code imprinted somewhere on the chip. If you are in doubt, ask the company, or copy the chip's product code and ask an Apple service technician to check the chips out.

NS8/16

Company: National Semiconductor
Building 16
2900 Semiconductor Dr.
Santa Clara, CA 95051

Product: NS8/16 Memory Expansion Board

Price: Contact company for pricing information.

Product Description

The NS8/16 Memory Expansion board provides 4, 8, 12 or 16 megabytes of RAM. The NS8/16 board was designed to be used primarily with A/UX (Apple's UNIX) and Artificial Intelligence (AI) applications. All RAM is located on the board. This frees up the RAM on NuBus for other purposes. In addition to the memory, the NS8/16 also comes with RAMdisk software that allows you to proportion segments of the NS8/16's RAM as a RAM disk.

Dove Computers

Company: Dove Computer Corp.
1200 N. 23rd St.
Wilmington, NC 28405
(919) 763-7918

Product: MacSnap 8H, 4H

Price: MacSnap 8H—\$2990
MacSnap 4H—\$1990

Product Description

Dove Computer has a long history of selling memory add-ons for Macintosh. The two products they have for the Mac II can expand your Mac II RAM from 1-megabyte to 8 megabytes. MacSnap 4H expands the Mac II's memory from 1-megabyte to 4 megabytes using 1 megabyte surface-mounted CMOS SIMMS. The MacSnap 8H increases memory to 8 megabytes using 1 megabyte surface-mounted CMOS SIMMS.

Micron Technologies

Company: Micron Technologies, Inc.
2805 East Columbia Rd.
Boise, ID 83706
(800) MICRON-1

Product: Mac II Memory Expansion Kit

Price: 1 Megabyte—\$249
4 Megabytes—\$1199
8 Megabytes—\$2399

Product Description

Micron sells two types of RAM upgrades for the Mac II. The first are 1-, 4- and 8-megabyte SIMMS. These all use 120-nanosecond DRAMs and come with an installation guide and an installation tool. The tool is mandatory to install the SIMMS. The SIMMS are also warranted for two years. The memory expansion board uses either 256K DRAMs or the newer 1-megabyte CMOS DRAMs. Either way you go, these are high-quality memory expansion products.

AST-RM4

Company: AST
2121 Alton Ave
Irvine, CA 92714
(714) 863-1333

Product: AST-RM4

Price: \$899

Product Description

The AST-RM4 is a memory expansion board allowing RAM expansion to 4 megabytes in 1Mbyte increments. The board uses the standard 256K DRAMs. The memory appears as global memory to the Mac II. The main use of the AST-RM4 is to meet the memory-intensive needs of running multiuser and multitasking applications such as the Apple UNIX.

CD-ROM

One other product that does not fit in the firmware category or in the software category is Apple's new CD-ROM player. The drive's official name is the AppleCD SC. This player along with software provides access to the new technology of CD-ROM. The CD in CD-ROM stands for **C**ompact **D**isk, the same type of compact disk that is now the rage of the audio world. Instead of music, CD-ROMs contain read-only (ROM) digital computer information. A single disk can hold about 550 megabytes of data, which is roughly equivalent to 700 Macintosh disks or 270,000 pages of text. The CD-ROM can contain text, graphics, or photographs. With the appropriate software, any information contained on the CD-ROM can be accessed with your Mac II. HyperCard is leading the way with the software interfacing to the AppleCD SC player.

Some of the current uses of Apple's CD-ROM include MEDLINE, an extensive medical database, Kwiikee INHOUSE, a graphics service for advertising layouts, Real-Scan, which is a real estate management system, and Books in Print Plus, a large database used in bookstores and libraries. You can expect to see more and more "prerecorded" CD-ROMs becoming available for the AppleCD SC in the future.



Company: Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Product: AppleCD SC

Price: \$1295

Firmware Wrap-up

What has been listed here is only a sampling of the boards and add-ons available for the Mac II. These listings should give you an idea of what is out there and how far you can push your Mac II. Even more than the Mac Plus and Mac SE, the Mac II offers multiple solutions to the same problem. Now you have the addition of hardware/software solutions instead of software-only solutions.

The Software

Software is what gives soul to a computer. For the past four years software developers have given a lot of soul to the Macintosh. When the Mac II was introduced, there was a concern about software incompatibility. The Mac II used a 68020 processor, the other Macs all used a 68000. Would existing software run on this new and improved addition? After all, many users had thousands of dollars invested in software programs. If the Mac II was incompatible, then there was no reason to upgrade. Likewise, if huge incompatibilities exist with the Mac, then individuals with a need for the power of the Mac II would lose out on the large base of excellent software applications.

HOW COMPATIBLE IS THE MAC II?

Apple has been keenly aware of compatibility concerns. In the past, Apple has always been sensitive to compatibility with their upgrades. They maintained IIe compatibility when they introduced the Apple IIc and the Apple IIgs. They continued this trend with the upgrade from the Mac 128K to the Mac 512K, Mac 512Ke, Mac Plus, and Macintosh SE. The bottom line is that users have never been left out in the cold with their existing base of software. In fact, Apple has used this fact to great advantage in their advertising campaigns. Rest assured, the Mac II is *very* compatible with the existing base of Macintosh software. One industry analyst even placed compatibility as high as 98 percent.

To be sure, there are some programs that do not run well, or at all, on the Mac II. The causes for the incompatibility are well known, and informed users can circumvent them. Most of us probably think that any incompatibility is the fault of the 68020 microprocessor. In fact, the 68020 has very little to do with incompatibility problems. The main processor routes and controls the information sent to it. The primary incompatibility problems are within the Mac II's new ROMs, the AppleTalk drivers and the custom sound chip. Incompatibility occurs when applications make extensive use of older ROM routines generally found in the older Macintosh ROMs. Applications that use the older Mac sound chip and applications that have not rewritten their AppleTalk drivers will also experience incompatibilities. The only way to avoid this problem is to run the software in question on a Mac II. Read the package to see if it indicates that the application runs on the Mac II. If the package affirms Mac II compatibility, try it out anyway before you buy it! If the package does not indicate that the application runs on the Mac II, definitely try it out. If you cannot "try before you buy" and the application is one you can't live without, call the publisher and ask about Mac II compatibility.

On a positive note, there are still *very few* applications that are incompatible with the Mac II. The main culprits are applications written exclusively for the older Mac 128Ks and *games*. Habadex™ is an example of an application written for the older 128K Macs. Habadex was one of the first productivity applications available for the Mac and simulated a Roladex. Needless to say, Habadex is no longer with us and does not work on a Mac II. This is an example of a product that many of us bought (the author included) and might still be using because we never upgraded our old Macs. The other incompatibility gremlin is *games*. Computer games have historically been key tests for the compatibility of new systems. This is not just within the Mac world. Microsoft's Flight Simulator™ has been one of the key benchmark tests for IBM compatibility with IBM PC clones. For an IBM clone to be taken seriously, it had better run Flight Simulator. For the game enthusiast, the Mac II is an "awesome" game machine. So, if you intend to shell out a good deal of money for a Mac II to play games, watch for compatibility problems.

THE QUESTION OF SPEED

It seems even Mac II users are not immune to making comparisons between IBM and Macintosh. The Mac II of course utilizes the Motorola 68020 microprocessor. The current MS-DOS competitor to the 68020 is the Intel 80386 microprocessor. When the Mac was first introduced, there was the usual question of which was faster, the IBM or the Mac? Several benchmark tests showed the Mac to be, surprisingly, as fast or faster than the IBM PC. Several years after the first benchmark testing was done, new benchmarks compared the then new Mac Plus to the new IBM AT. Once again, the Mac surprised many by outperforming its IBM rival. Now the new crop of fast microprocessors is heating up the rivalry.

Is the Motorola 68020 faster than the Intel 80386? Some CPU-timing benchmark tests have already decided this question. On paper, the 68020 is faster! However, does the 68020 run your applications and manipulate your data faster than the 80386? This new benchmark testing indicates some surprising results. These tests are repeats of those done on the Mac Plus and IBM AT in 1986. However, the Mac II and the new PS/2-80 with an 80386 processor were used for testing.

Since IBM first introduced their personal computer, there have been comparisons with the Apple line. The Apple Macintosh has been no exception. If anything, the "us vs. them" competition has become even more pronounced. Each of the companies wants us to think that their machine is better. IBM has pursued their campaign of conformity. Apple would have us believe that the Macintosh is just right for those of us in pursuit of individuality.

In truth, the bottom line is, What do we want to do, and how are we going to do it? This may sound simple, but implementation can be complex and confusing. After all, IBM has more software, but the Mac is easier to use. The IBM is a "true" business machine while the Mac still "has its place." Too many times unfair comparisons are made. However, the most notable comparison is speed. The common conception is that the IBM is simply

faster than the Macintosh. The IBM has *faster* disk access, *faster* file copying, *faster* operating system functions, etc. Says who? Most reports of how much faster the IBM is comes from people who know only the IBM.

This speed difference is caused by a misconception. This misconception derives from the idea of *perceived speed*. The Macintosh II is powered by a 16-megahertz 68020 chip. With this kind of power it should be *fast!* Really fast. But Mac users have gotten used to waiting while the Mac does its thing. IBM users are different. They turn on their machine, load up their programs, and away they go. No watch icon to tell them that their machine is working. Because of this *perceived* speed difference, it would seem that IBM converts have some legitimate bragging rights. The IBM does seem to be faster.

This benchmark testing was done using a standard Mac II and IBM PS/2-80 equipped with an 80306 microprocessor. A fair comparison. Both machines had 1 megabyte of RAM and 40-megabyte hard disks. These tests were done to illustrate three points. Point one, the Mac II with a 68020 processor is just as fast as the 80386 IBM line. Point two, the Mac II is a viable choice as a high-end business workstation. Point three, it is time to acknowledge that the Macintosh does not need to be continuously compared to the IBM. The two machines should not be seen as competitive enemies but rather as compatible friends, able to coexist in the same business environment.

Throughout the testing, conditions were as close to “real life” as possible. The people chosen to operate each computer were very familiar with the machines and the programs. Three persons were used in the benchmark testing—one person familiar with the Mac II, one person familiar with the IBM PS/2, and a timer. Timing began as soon as the operators started their first keystroke/mouse click. The Mac II user was allowed to use Command key features as opposed to accessing menu options. It was felt that utilizing Command key features would make no discernible difference in the timings. In fact, the difference in time between using the mouse and using a Command key equivalent was less than .3 seconds! Timing was stopped when the testers verbalized that the machine had finished the specific task.

TESTING THE HARDWARE

The hardware selected for the testing was “off the shelf,” that is, there was nothing extra added. The configurations of the two machines were kept as close as possible. A mouse was not used on the IBM PS/2. Since the test was conducted with “as is” hardware, using a mouse would have meant adding an additional component to the IBM.

The IBM PS/2 was an off-the-shelf PS/2 model 80 and came with the following features:

- 1 megabyte of RAM
- One 1.5-megabyte internal floppy disk drive
- One 40-megabyte internal hard disk with controller
- Keyboard
- 12-megahertz 80386 microprocessor.

The Mac II came standard with the following configuration:

- 1 megabyte of RAM
- One 800K internal floppy drive
- One 40 megabyte hard disk
- Mouse
- Keyboard
- 16-megahertz 68020 microprocessor

TESTING THE SOFTWARE

General application software and the basic operating systems for both machines were tested. Word processing, spreadsheet with graphics, relational database manager, and operating system utilities made up the software selected for testing. Operating system software was DOS 3.1 for the IBM, and the standard Mac operating system with MultiFinder was utilized.

The application software was chosen for a variety of reasons, among them popularity (number of packages sold and in use) and cross-system integration. Cross-system integration exists when the same software is available for both machines, or when the software has filters that allow conversions to the other machine formats. Microsoft Word and Excel fall into this cross-system integration category. In all cases the software used was, like the hardware, off the shelf. Nothing special was done with the software, and all applications were run from the hard disk. The applications ran "as is" without interruption of copy protection. In the word processing category, WordPerfect was selected. This popular word processor used by thousands of users is available for both the IBM and the Macintosh. For spreadsheet comparisons, Microsoft's Excel was chosen because of Excel's cross-system integration. In view of Excel's graphing capabilities, it was decided to use this feature for testing the speed of creating graphs from spreadsheet data. Database managers were the most difficult applications to select. Omnis 3 Plus for the Macintosh and Omnis Quartz were the final choices. Both of these programs share cross-system integration. Quartz is essentially Omnis 3 Plus on the IBM. The Omnis products were selected because these database managers have a wide and experienced user base.

Finally, specific operating system functions were tested. The standard Macintosh operating system and DOS 3.1 were used. Operating system utilities were tested because many users spend much of their computing time "housecleaning," that is, copying files, initializing disks, etc.

Figure 3.1 shows the various times, in seconds, of the various tasks that were tested. You can refer to this sheet when necessary. This timing sheet graphically illustrates the difference between the 68020-based Mac II and the 80386 IBM.

FIGURE 3.1 Benchmark

BENCHMARK FORM		
Word Processing		
Programs		
Macintosh—Word		
IBM PS/2—Word		
Tasks	Time/Seconds	
	Mac	IBM
1. Load program	5	9
2. Load file	5.5	13
3. Save changed file	21	7
4. Open saved file	5	11
5. Reformat document	5	18
6. Search and replace/change	43	25
Spreadsheet		
Programs		
Macintosh—Excel		
IBM PS/2—Excel		
Tasks	Time/Seconds	
	Mac	IBM
1. Load program	6	8
2. Load file	4	3.5
3. Save changed file	8.5	9
4. Open saved file	4	3.5
5. Creating a graph	10.5	21.3
6. Changing the graph	11	20

FIGURE 3.1 *continued*

Database		
Programs		
Macintosh—Omnis 3 Plus		
IBM PS/2—Omnis Quartz		
Tasks	Time/Seconds	
	Mac	IBM
1. Load program	12.5	8
2. Load file	4	3
3. Find a record	21	32.5
4. Save the record	2	4
5. Customize a report	123	221
Operating System Utilities		
Programs		
Macintosh—Standard Macintosh operating system		
IBM PS/2—DOS 3.1		
Tasks	Time/Seconds	
	Mac	IBM
1. Start up to DOS/Desktop	16	34
2. Duplicate file	4	5
3. Copy file to hard disk	7.5	3
4. Copy file from hard disk to floppy for backup	5	4
5. Display hard disk directory	1.5	2.5
6. Display subdirectory	1	3.5
7. Print the screen	4.5	2.1
8. Initialize/Format blank disk	58	159

Word Processing Tests

WordPerfect was run from the hard disk of both machines. A 22K WordPerfect file, originally created on a Macintosh, was selected for the test. It was then converted to an IBM format via the WordPerfect file management utility. This WordPerfect file was then transferred to an IBM data disk via a TOPS network. Next, the test files were copied to their respective hard disks for use. Listed are the six tasks tested followed by their respective times, first for the Mac, second for the PS/2.

1. Load the WordPerfect program: Mac—5 secs/PS/2—9 secs
2. Load the file: Mac—5.5 secs/PS/2—13 secs
3. Search and replace/change (172 occurrences): Mac—43 secs/PS/2—25 secs.
4. Reformat entire document (full justification): Mac—5 secs/PS/2—18 secs.
5. Save the changed file: Mac—21 secs/PS/2—7 secs
6. Open the changed file: Mac—5 secs/PS/2—11 secs

There are of course many other functions associated with word processors. The foregoing were selected because they are common tasks done by a majority of users. The Mac II was faster in four of six tasks. The PS/2 took less time to save the change file and to accomplish the search and replace.

Spreadsheet Tests

The spreadsheet selected was Microsoft's Excel because of the program's cross-system integration. Excel offers the user spreadsheet, database, and graphing capabilities. The 15K file created with Excel was saved as a PC Excel file and shipped to the IBM via TOPS. The six tasks timed and the results were as follows:

1. Load the program: Mac—6 secs/PS/2—8 secs
2. Load a file: Mac—4 secs/PS/2—3.5 secs
3. Save the file after it had been changed: Mac—8.5 secs/PS/2—9 secs
4. Open the changed file: Mac—4 secs/PS/2—3.5 secs

5. Create a graph from the test file: Mac—10.5 secs/PS/2—21.3 secs
6. Recreate the graph based on the new data: Mac—11 secs/PS/2—20 secs

Again, the Mac II was faster in four out of six tests. The most noticeable time difference was with creating a chart from test data. It took the Mac II only 10.5 seconds to create a chart and only .5 seconds longer to create a new chart based upon changes in the data. The PS/2 took 21.3 seconds to create a new chart and 20 seconds to create another chart after the data had been changed.

Database Tests

The database tests were the most difficult to set up. Database managers have such a wide variety of functions and features that it was hard to make the decision as to just what should be tested. Six of the most direct and simplistic database operations were finally chosen. A file containing 120 records was created with each application. The tasks tested were the following:

1. Load the program: Mac—12.5 secs/PS/2—8 secs
2. Load the file: Mac—4 secs/PS/2—3 secs
3. Find a record with three search criteria: Mac—21 secs/PS/2—32.5 secs
4. Save the record after it was changed: Mac—2 secs/PS/2—4 secs
5. Sort the records A—Z on one field: Mac—25 secs/PS/2—44.5 secs
6. Customize a report: Mac—123 secs/PS/2—221 secs

The Mac II was faster in four out of six categories.

Operating System Utilities Test

This is the section where the two computers could be judged on their own capabilities without the added subjectivity of an application program. It seemed that it was at this operating sys-

tem level that the Macintosh received criticism for its slow processing speed. There were eight timed tests. The Mac II used the standard Macintosh operating system version 6.0, while the PS/2 used DOS 3.1. The eight tasks were the following:

1. Start up to DOS/desktop (from a cold boot): Mac—16 secs/PS/2—34 secs
2. Duplicate a file on the hard disk: Mac—4 secs/PS/2—5 secs
3. Copy a file to the hard disk: Mac—7.5 secs/PS/2—3 secs
4. Copy a file from hard disk to floppy: Mac—5 secs/PS/2—4 secs
5. Display hard disk directory: Mac—1.5 secs/PS/2—2.5 secs
6. Display subdirectory/open a folder: Mac—1 secs/PS/2—3.5 secs
7. Print the screen: Mac—4.5 secs/PS/2—2.1 secs
8. Initialize/format floppy disk: Mac—58 secs/AT—159 secs

The file used for copying was the 22K Word file used in the word processing tests. In this operating system utilities category, it was expected that the Mac II would be slower. As it turned out, the Macintosh II system was a surprise. Of the eight tests, the Mac II was faster in five of them. The most subjective task was printing the screen. Since the printers were not being tested, printing the screen was timed from the start of the printing procedure to the time the printer started the printing process.

Conclusion

The conclusions that can be gained from this testing are subjective to say the least. If nothing else, the testing does point up the concept that speed is a relative issue. The Macintosh has been perceived as being slow. Because we expect a computer with a 68020 CPU to be fast, when the Mac has to go through its paces to process, the machine appears to slow down. If nothing else, test results should dispel the myth that the IBM is the fastest micro in town and should also slow down the us vs. them controversy. Although some comparisons are inevitable, this testing shows that the Mac II has a place in the business environment alongside the IBMs.

The bottom line to all the testing, network software, etc., is still, What do you want to do, and which computer will do it best for you? Lack of software for the Macintosh is not a question any more. Benchmark testing shows that speed is not an issue either. And third-party developers are creating programs that integrate the Mac and IBM on the same network. So which computer should you buy? The answer is simple: *yes!*

TO UPGRADE OR NOT TO UPGRADE

As I have mentioned, the Mac II is compatible with about 95 percent of the existing software. Games and graphics programs seem to have the most difficulty. Most notable are the older versions of MacPaint and MacDraw. Notice I said "older versions." The new versions, now published by Claris, Inc., are quite compatible. In fact, Apple has added enhancements to each of these programs. The new MacPaint does not have support for color, but MacDraw does. However, MacPaint does have a full-screen drawing feature that was absent in the original version. MacPaint and MacDraw are not the only Macintosh applications to experience upgrades. Upgrading current applications to be compatible with the Mac SE and the Mac II is one method companies are using to tackle the compatibility issues. MORE from Living VideoText is another application that was upgraded to take advantage of everything the Mac II has to offer. In all, most companies are either upgrading existing applications or creating new versions expressly for the Mac II.

Graphics programs on the Mac II are interesting. Some may appear not to run on the Mac II. In fact when you first open MacPaint (and other graphics programs written for the other Macs), your screen might look like the one shown in Figure 3.2. This is caused by the Mac II being in the 8-bit-per-pixel or 256-color mode. When you first set up your Mac II, you used the Chooser to set your monitor to 256 colors. Graphic applications written for other Macs (Mac Plus/SE) expect graphics to be 1-bit-per-pixel graphics or two basic colors, black and white. The expectations of a specific application on the Mac II causes what you see in

FIGURE 3.2 Graphics screen in the wrong mode

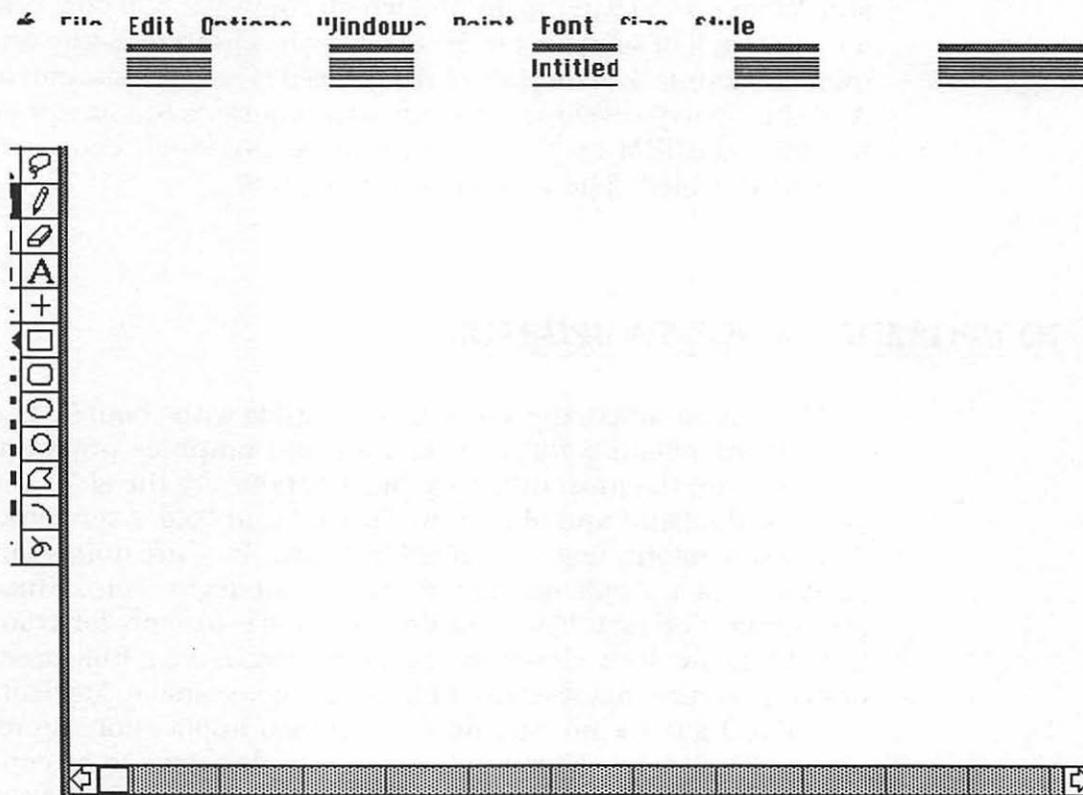
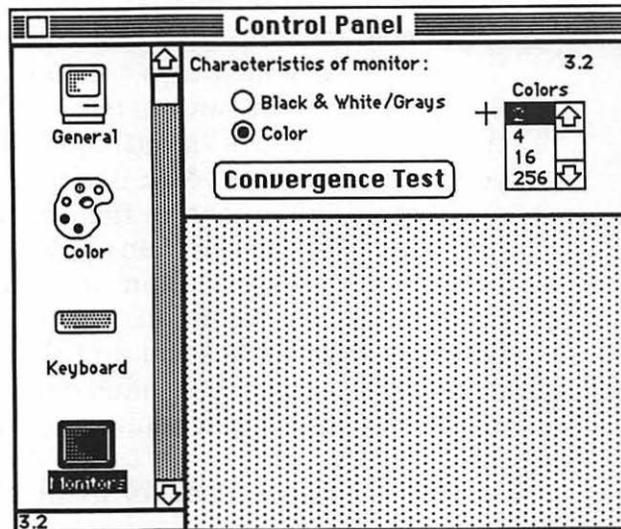


Figure 3.2. To correct this problem, select Control Panel from the Apple menu. Then select the Monitor and change your colors from 256 to 2 (see Figure 3.3).

Once you have reconfigured your monitor, all should work well. Making this change is also necessary if you intend to dump a screen image to the printer. In the 256-color mode, your printer creates some interesting designs when you attempt a Command-Shift-4. Change to the two-color mode if you want to do screen dumps. There is a shareware utility called fKey that allows you to specify keys as *function keys*. A preconfigured fKey file called Switch allows you to set up a specific key that will automatically switch your Mac II system in and out of the 256-color mode.

FIGURE 3.3 Control panel window



MultiFinder

No discussion of Mac II software would be complete without discussing Apple's MultiFinder, proclaimed the answer to the problem of multitasking. Multitasking is the ability to run more than one application at the same time. MultiFinder is an alternative finder system that will soon become the standard finder system for future Macs. MultiFinder is *not* a multitasking utility. It simply creates the illusion of running more than one application at a time. When you use MultiFinder, it sets aside a specific amount of memory for specific duties. You can, in theory, jump from one application to another or immediately switch to the desktop. MultiFinder is similar to an older program called Switcher.

A large drawback with MultiFinder is memory. MultiFinder is worthless with only 1 megabyte of memory. For example, once you load up a simple application such as Microsoft Word, there is only 70K left for another application. Not even MacPaint 2.0 will fit. If you intend to use MultiFinder, you need a minimum of 2 megabytes. The more megabytes the better!

MultiFinder Startup

Starting up MultiFinder is a relatively simple matter. Once you are at your desktop, select Set Startup from the Special menu. You will be presented with a screen like the one shown in Figure 3.4. This screen allows you to turn MultiFinder on and off. Click the button that says "MultiFinder Only." Click OK, then restart your Mac. Once your Mac has been restarted, you will see the small MultiFinder icon in the upper right-hand corner of your menu bar. You can select an application to use with MultiFinder by selecting an applications icon and then selecting Set Startup from the Special menu. Now you can switch back and forth between your application and the desktop by clicking on the icons in the upper right-hand corner of the menu bar. You can also select your applications from the Apple menu (see Figure 3.5).

Here are some ideas for using MultiFinder effectively with your Mac II.

- Make sure you leave RAM space for printing—many applications create a temporary print file in RAM before printing. Without adequate RAM, you cannot print.
- Use the "Get Info" dialog boxes to set the appropriate amount of RAM for applications to use with MultiFinder. MultiFinder provides you a suggested memory size. Make sure your application memory size is set at, or higher than, the suggested memory size.
- If you are working with only 1 megabyte of RAM, turn your RAM cache OFF (part of the control panel).
- Watch out for desk accessories. Most spelling checkers that use the D/A approach do not work with MultiFinder, no matter how much memory you have. Other D/A's will have difficulties if they are primarily RAM-based and larger than the available RAM you have left.
- Load fonts and D/A's *before* you turn MultiFinder on. Once in MultiFinder, fonts and D/A's cannot be added.
- You can do background printing with MultiFinder turned on; however, be sure to turn your RAM cache OFF before turning on MultiFinder.
- Use About Finder under the Apple to get a close check on your available memory.

FIGURE 3.4 MultiFinder

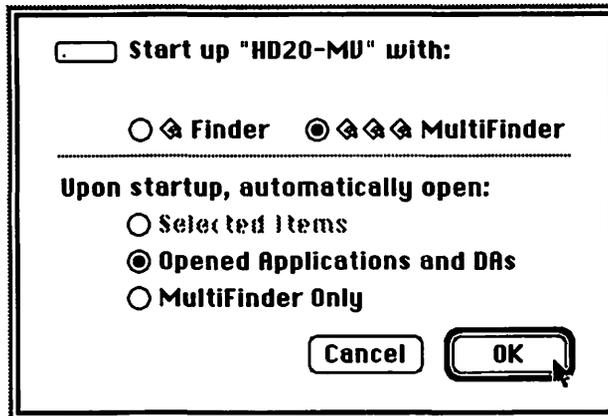
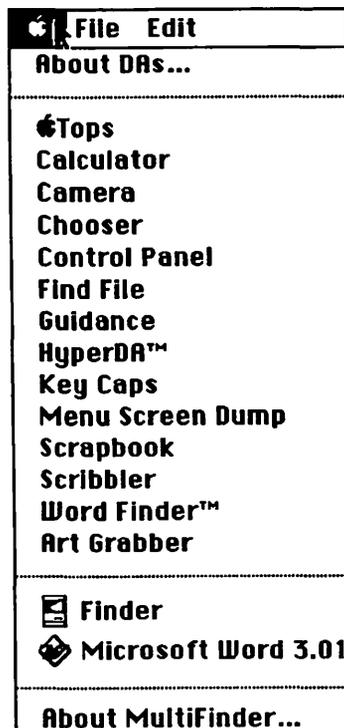


FIGURE 3.5 MultiFinder under the Apple menu



- *Do not* use MultiFinder while communicating over a network. Most local area networks must set aside specific amounts of RAM, and MultiFinder can interfere with network transmissions.

In general, with some fine tuning, MultiFinder should prove to be an excellent intermediate solution to a true multitasking system. As long as you keep in mind the memory constraints of MultiFinder, you should find it better than Switcher ever was.

SOFTWARE APPLICATIONS

The software applications presented here cover the range of programs from word processors to high level graphics. The purpose of these listings is to provide you with an idea of the range of applications available for the Mac II. This is not an attempt to offer these listings as “mini reviews,” or to provide a comprehensive software listing. Some items are new to the Mac II. Many of these applications have been designed just for the power and flexibility of the Mac II. Other applications run with the “other” Macs, but it takes the Mac II to bring out the best in them. Many of these applications should be familiar to you.

The software listings are broken into four general areas and one major area. Many of these applications fit into more than one of these general areas. Once again, the listings and categories are designed to offer you an overview of what applications are available and how they take advantage of the Mac II. The general areas are:

- **Word processing.** This area includes word processors, spelling checkers, thesauruses, and writing utilities.
- **Communications.** This area includes desktop communications such as telecommunication applications, and Mac-to-mainframe communications and local area networking (LAN) applications.

- **Graphics.** The graphics section offers a look at low-to-high-level graphics applications. These range from the simple MacPaint to the more complex VersaCAD™.
- **Desktop publishing.** This area covers such applications as electronic page layout and electronic typesetting applications.
- **Spreadsheets.** There is now a new generation of spreadsheets available for the Mac II. This section describes the spreadsheet products that have taken full advantage of everything that Mac II has to offer.

There is one major area of software that is actually a single software product. This is Apple's implementation of the UNIX operating system, aptly named A/UX (Apple/UNIX). A/UX breaks new ground in the world of mainframe computing. For years the UNIX operating system has been the antithesis of the Macintosh. If the Mac is user friendly, UNIX is user hostile. Now Apple has entered the fray with A/UX. This product was designed specifically for the Mac II. A/UX will not run with a Mac Plus or a Mac SE, nor will it run with a stock (off the shelf) Mac II. In fact, A/UX is such a special piece of software that it has warranted a chapter of its own in this book. Chapter 5 offers a look at A/UX.

The Products

WORD PROCESSING

The market for word processors has heated up, and the Mac II is not about to be left out. From a very sluggish beginning, word processors have begun to flourish on the Mac. With its larger screen, more memory, high-resolution graphics, and the addition of color, the Mac II offers writers and publishers a high-end writing station at a fraction of the cost of other comparable systems.

Word 3.01

Company: Microsoft Corp.
16011 N.E. 36th Way
P.O. Box 97017
Redmond, WA 98073
(206) 882-8088

Product: Word 3.01

Price: \$395

Product Description

Microsoft has really done nothing special with Word 3.01 to take advantage of the Mac II. The primary feature is the ability of Word 3.01 to take advantage of any-size screen display. For Mac II users who are involved with desktop publishing and the use of large screen displays, Word 3.01 works nicely, although it does not take advantage of the Mac II's color capabilities. Many users enjoy the flexibility that a color screen gives them, but there are those who prefer the standard black-and-white screen because they find color distracting and hard on the eyes. Word 3.01 gives no other options outside of black and white. There are no compatibility problems with Word and the Mac II. In fact, Word 3.01 operates up to 40 percent faster with the 68020 processor in the Mac II. With additional memory, Word becomes the fastest high-end word processor for the Mac.

WordPerfect

Company: WordPerfect Corp.
288 West Center St.
Orem, UT 84057
(801) 225-5000

Product: WordPerfect

Price: \$395

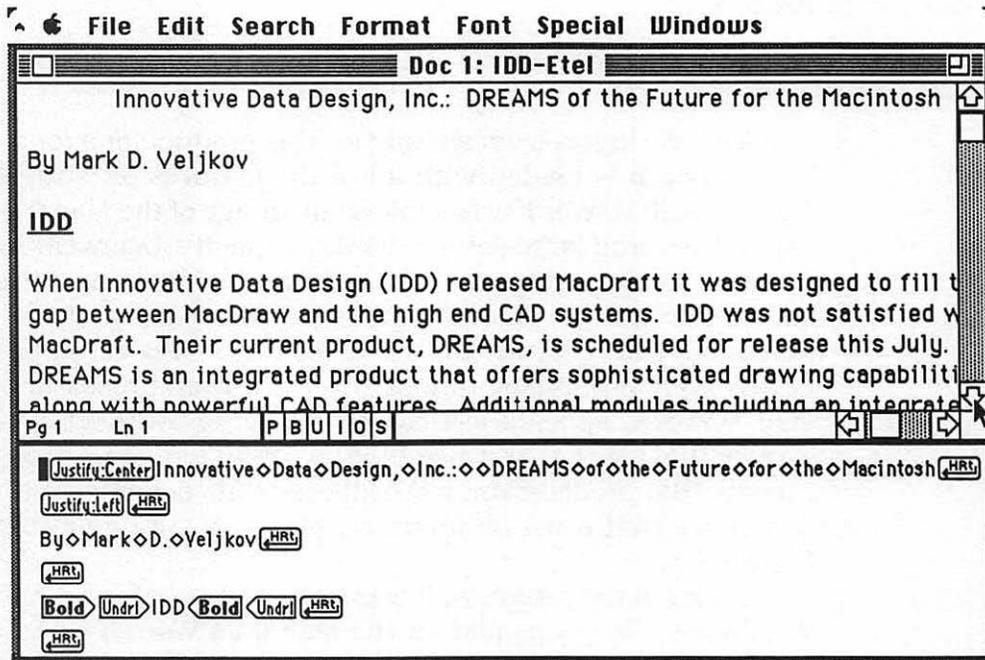
Product Description

The Mac world has been waiting for this product for a *long time!* The program is loaded with all of the features of WordPerfect 4.2 for the IBM. WordPerfect takes advantage of the Mac II's color capabilities and large-screen display capacity. Users can adjust the screen color, text color, and highlight color to any one of the Mac II's 16 million colors. That should keep most of the color freaks busy for a while. On the surface WordPerfect appears to be an excellent implementation of a great word processor on the Mac. However, appearances can be deceiving. WordPerfect is *not* a WYSIWYG (What You See Is What You Get) word processor. Like its IBM predecessor, a WordPerfect file is loaded with hidden codes that must be made visible for accurate editing (see Figure 3.6).

In favor of the program, it was designed with Mac II in mind. WordPerfect is not as fast on the Mac II as Word 3.01 is. Additional memory in your Mac II can be very helpful. The major attractions of WordPerfect are its compatibility and file-transfer capabilities with WordPerfect 4.2 on MS-DOS computers. Mac users have easy two-way file transfer capabilities. MS-DOS WordPerfect files come across *very* clean with little need for reformatting. This includes all formatting codes and columns.

For those users using PageMaker for desktop publishing, you are basically out of luck when it comes to using WordPerfect files. Neither PageMaker 2.0a nor PageMaker 3.0 recognizes WordPerfect files. However, WordPerfect allows you to save a file in Word 3.0 format. Then the file can be read by PageMaker. As I mentioned, WordPerfect has its good points and bad points. The choice, as always, is up to you.

FIGURE 3.6 WordPerfect's hidden codes



Company: Paragon Concepts
 4954 Sun Valley Rd.
 Del Mar, CA 92014
 (800) 621-5640 (wait for beep, then dial)
 P-A-R-A-G-O-N

Product: NISUS

Price: \$395

Product Description

This is one of the new kids on the block. Ever since Apple unbundled MacWrite and MacPaint with every Mac they sold, the market for Macintosh word processors has heated up. NISUS started as an offshoot of Paragon's QUED, a text editor for programmers. NISUS is a full-featured word processing expansion of this program. On the Mac II, NISUS really shines—features include full use of large-screen, monochrome, or color displays, and file-transfer options. NISUS can search unopened files for specific words or phrases. This word processor also contains macro capabilities. More than 50 macros are provided with the number of macros dependent upon your disk size. Macros are created by simply recording your keystrokes. The approach is similar to the macro recorder of Excel™. If these features are not enough, take a look at some others: automatic table of contents and index, line numbers, and full-screen page preview. NISUS contains many more features than listed here. On the Mac II, NISUS offers users everything they could want in a word processor.

One drawback to NISUS is the same problem that WordPerfect has. NISUS files cannot be read directly by most of the desktop publishing programs such as PageMaker or Ready, Set, Go. The files must first be saved as text-only files and then transferred to your desktop publishing application.



Company: Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000

Product: FullWrite

Price: \$395

Product Description

FullWrite is supposed to have it all. The fact that the developers were several years behind their originally announced release date did not seem to matter. FullWrite combines the best of word processing and desktop publishing. Besides the usual word processing functions, FullWrite offers users a mini-MacDraw drawing environment within the word processor. This allows you to draw pictures without leaving your typing. In addition, FullWrite contains the ability to create notes (like those little yellow slips with stickum on them), a spelling checker, and a powerful thesaurus. With FullWrite's capability to integrate text and graphics within the same application, users can use FullWrite not only as a word processor but also as a desktop publishing program. FullWrite works very well with the Mac II. The program supports color and large screen displays.



Company: T/Maker
1973 Landings Dr.
Mountain View, CA 94043
(415) 962-0195

Product: WriteNow

Price: \$175

Product Description

There is a story in the microcomputer industry that the developers of WriteNow originally created it for Apple Computer. Apple was going to use WriteNow as the first word processor for the young Mac. Somewhere along the line, either Apple or the WriteNow developers got off track, Apple went with MacWrite, and the rest is history. When you open WriteNow, it would appear that you are in MacWrite. Indeed, WriteNow bears a great resemblance to the first word processor for the Mac.

WriteNow does use the familiar interface, like MacWrite. Unlike MacWrite, WriteNow offers many more advanced features such as line spacing (leading), multiple on-screen columns, and individual paragraph formats without having to insert new rulers. In addition to these features, WriteNow is a recognized format for both PageMaker 2.0a/3.0 and Ready, Set, Go 3.0/4.0. Unlike the other word processors, WriteNow does not give any support for color or large-screen displays. The page preview feature of WriteNow does fill up an entire Mac II screen, and, unlike the other word processors, a WriteNow's document cannot be altered in the page preview mode.

MacWrite 5.0

Company: Claris, Inc.
440 Clyde Ave.
Mountain View, CA 94043
(415) 960-1500

Product: MacWrite 5.0

Price: \$125

Product Description

The first word processor for the Mac is still the most widely used word processor for the entire line of Macintosh computers. MacWrite 5.0 is the newest revision to MacWrite. Over the past several years, Apple has turned over the job of revising MacWrite to Claris, a new company that has been bankrolled by Apple to handle the development and sales of Apple's software. MacWrite 5.0 does not differ too greatly from MacWrite 4.5. The new features include the following:

- A 100,000 word dictionary
- New keyboard shortcuts for cursor control
- Support for large screen monitors
- Support of full-page display of documents

On the Mac II, MacWrite fills the bill for an easy-to-use, unsophisticated word processor.

COMMUNICATIONS

From the inception of the machine, Apple planned the Mac II as a desktop communication tool. With the speedy 68020 processor and the bus independent slots, the Mac II is a communication dream. Whether it is local area networking, telecommunications, or Mac-to-mainframe communications, the Mac II handles all with the ease of the Mac. The Mac II is rapidly establishing itself as the ultimate communications workstation. It can act as a central file server running AppleShare, or as a bridge into other networks such as Ethernet, DECnet, Novel Netware, or Northern TeleCom's LANSTAR. Once connected to these other networks, the Mac II provides communication with other micros such as MS-DOS based computers, minicomputers like VAX/VMS, or mainframes such as IBM 327X series.

Because the slots in the Mac II are independent from the Mac II's NuBus, board developers are free to develop add-on communication boards that offer either asynchronous or synchronous communications. The standard Mac interface provides the rest.

TOPS

Company: TOPS
2560 Ninth St.
Berkeley, CA 94710
(800) 222-TOPS

Product: TOPS

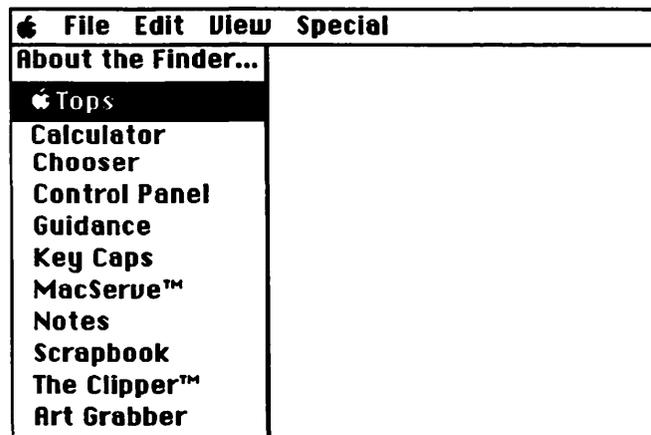
Price: \$149

Product Description

TOPS has become the de facto standard for Mac LANs. The power of TOPS is centered around the fact that TOPS can integrate Macintosh, MS-DOS, and UNIX computers on the same network. TOPS has developed not only software for the Mac but an add-on board and software for MS-DOS computers. Unlike AppleShare, TOPS does not require you to give up your Mac II as a file server. Because TOPS is a distributed file server, any computer on a TOPS network can act as a file server. You simply pull down the Apple menu and select TOPS. Once this is selected, you can choose any folder you want to publish. You will also see any remote volumes that have been published for network access. These folders can then be mounted as logical disk drives on your Mac by simply clicking the Mount button. Figure 3.7 shows TOPS as a desk accessory.

Your Mac II has a great deal of power and many capabilities. To give it up as a file server does not make a great deal of sense. TOPS provides you with the option of not giving up your Mac II.

FIGURE 3.7 TOPS D/A



InBox

Company: THINK Technologies
135 South Rd.
Bedford, MA 01730
(800) 64-THINK

Product: InBox

Price: \$125/Mac

Product Description

InBox is an electronic mail system for an AppleTalk LAN. Such a system permits any person with access to send electronic (E) messages (Mail) and data over the network. InBox allows you to send E-Mail between Macs and MS-DOS computers. One computer must be designated as the message center computer. This does not mean that you have to give up using your Mac for anything else. The original version of InBox (1.0) required a dedicated Macintosh and a hard disk to act as the message center; the newest version (2.0) does not. A Mac II makes an excellent message center. The ease of adding memory and large-capacity hard disks gives the Mac II the additional power needed to route and maintain E-Mail messages for an AppleTalk LAN.

3+ for Macintosh

Company: 3Com Corp.
3165 Kifer Rd.
Santa Clara, CA 95052
(800) NET-3COM

Product: 3+ for Macintosh

Price: Call for pricing.

Product Description

3Com's 3+ for Macintosh may be the most powerful LAN available for your Macintosh. The 3+ system actually installs on a 3Com 3Server3 dedicated network server. However, a Mac II equipped with an EtherTalk card can act as an intelligent bridge between any AppleTalk network and an Ethernet network. Once connected to Ethernet, Macs on an AppleTalk LAN can connect to DECnet, VAX/VMS minicomputers, IBM mainframe, and MS-DOS microcomputers. If you have the need to bridge to foreign networks, a Mac II, 3Server3, and 3+ software makes a great solution.

GRAPHICS SOFTWARE—GENERAL

Graphics programs for the Mac II are special. Many of the applications have to be rewritten or specially written for the Mac II. These applications are exciting: color capabilities, large-screen compatibility, increased processor speed, and add-on cards all add up to one of the most powerful desktop graphics computers.

Modern Artist

Company: Computer Friends
14250 N.W. Science Park Dr.
Portland, OR 97229
(503) 626-2291

Product: Modern Artist

Price: \$199

Product Description

Modern Artist actually started the Color Mac revolution. The program was originally developed at Reed College and was called "ColorPaint." ColorPaint ran on a 512K or Mac Plus which was

connected to a Vectrex computer. It was the Vectrex that provided the color output to a color monitor. At the time the prohibitive cost of the entire system—over \$7000—ruled out its use except as a research tool. With the introduction of the Mac II, Reed was able to convert ColorPaint into Modern Artist for the Mac II. Modern Artist resembles MacPaint in many respects, as it is a bit-mapped graphics application. Modern Artist will run with an off-the-shelf Mac II, but it does need a full 2 megabytes of memory to take full advantage of the features that the application has to offer. With 2 megabytes you get a full screen drawing area. With only 1 megabyte of RAM, your drawing area is quite small, about one-sixth of the full screen. Modern Artist includes a number of other unique and powerful drawing features. Two of the more outstanding are Plotted Curves and Freehand Curves. With the Caps Lock depressed, you select Plotted Curves, a drawing tool (the PaintBrush works the best), and then leave “spots” on your screen. Release the Caps Lock key, and Modern Artist automatically “connects the dots.”

MacPaint 2.0

Company: Claris, Inc.
440 Clyde Ave.
Mountain View, CA 94043
(415) 960-1500

Product: MacPaint 2.0

Price: \$125

Product Description

What can be said about MacPaint that hasn't been said before? This is the program that started it all. Over the years, Apple has done very little to change Bill Atkinson's creation. It is estimated that well over a million computer users have tried MacPaint. The

program itself has spawned many imitators both in the Mac universe as well as in the nongraphic world of MS-DOS. Programs such as PCPaint, PixelPaint, and PC PaintBrush are examples of Mac and DOS programs that made money by imitating MacPaint.

There was actually no need for Apple to change MacPaint until the Mac II and Mac SE came along. The newer Macs were more powerful and flexible. Easy addition of extra memory, advanced graphics cards, and powerful graphic applications that were MacPaint's competitors emphasized Apple's need to make some changes to their mainstay. MacPaint 2.0 has met the challenge. New features include multiple windows, tear-off menus, and full-screen monitor support. MacPaint continues to excel in the area of bit-mapped graphics. Sometimes the first really is the best.

PixelPaint

Company: SuperMac Technology
295 North Bernardo Ave.
Mountain View, CA 94043
(415) 964-8884

Product: PixelPaint

Price: \$595

Product Description

PixelPaint from SuperMac is one of the new generation of bit-mapped graphics application for the Mac. It was created to take full advantage of all of the Macintosh QuickDraw routines. PixelPaint features a built-in color separator, dithered blends to eliminate color banding, full-screen formatting, and expanded memory. PixelPaint is compatible with MultiFinder, AppleShare, and TOPS.

PhotoMac

Company: Avalon Development Group
1000 Massachusetts Ave.
Cambridge, MA 02138
(617) 661-1405

Product: PhotoMac

Price: \$695

Product Description

PhotoMac offers professional color design and separation for the Mac II. PhotoMac is intended for photographers and publishing companies that wish to touch up their color photos or graphics before printing them. Additional features include airbrushing, masking, rotation, and resizing. PhotoMac requires 2 megabytes of memory and a minimum of Apple's extended video card.

SuperPaint

Company: Silicon Beach Software
295 North Bernardo Ave.
Mountain View, CA 94043

Product: SuperPaint

Price: \$99

Product Description

SuperPaint was the first of the "sophisticated MacPaint" clones and was designed to provide what MacPaint was missing. SuperPaint does indeed add many new features for drawing. What SuperPaint offers is actually the best of MacPaint and MacDraw.

Not only can SuperPaint draw in a bit-mapped mode but also in an object-oriented mode like MacDraw. The most powerful feature of SuperPaint is its implementation of the classic "Fatbits." SuperPaint includes the standard MacPaint-type Fatbits along with Laserbits. Laserbits allows you to edit a drawing at 300 dots per inch. This is the output quality associated with the LaserWriter. Laserbits allows users to fine-tune any drawing for perfect LaserWriter printing. On the Mac II there is support for color drawing as well as for large-screen displays.

FullPaint

Company: Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000

Product: FullPaint

Price: \$99.95

Product Description

FullPaint is another of the "higher level" bit-mapped drawing programs. FullPaint's most unique feature is its ability to draw 300 dpi graphics, the same output as the LaserWriter. Drawings can be rotated in 1° increments and even skewed and distorted. For fanciers of MacPaint, FullPaint should be very familiar. All of the traditional MacPaint features are present with some extra added attractions. FullPaint does not offer support for color but does support full-screen displays on the Mac II.

Colorizer

Company: Palomar Software, Inc.
P.O. Box 2635
Vista, CA 92083
(619) 727-3922

Product: Colorizer

Price: \$49.95

Product Description

Colorizer is a nifty accessory that allows you to take full advantage of the 16 million colors available with the Mac II. Colorizer offers Mac II users several utilities that provide color options to existing files created with any one of the Macintosh graphics applications. Colorizer adds color to any existing PICT file. PICT files are graphic files that are created by MacDraw or SuperPaint. Another of the utilities is called Color SaveScreen. This utility allows you to save any Mac II color screen as a PICT file. Color PrintScreen dumps any color screen to an ImageWriter II for a color printout or to an ImageWriter I for a black-and-white print. All of these utilities are for the Mac II only and offer users invaluable tools for a very low cost.

Color Sep

Company: Computer Friends
14250 N.W. Science Park Dr.
Portland, OR 97229
(503) 626-2291

Product: Color Sep

Price: \$99

Product Description

Color Sep is a color separation program for the Mac II. Color Sep creates digital, PostScript-based, four-color separations. These can then be printed on any PostScript-compatible output device. Such devices would probably include the Linotronic 100/300 and Compugraphic typesetters.

GRAPHICS SOFTWARE—CAD/CAM

The CAD/CAM market is one of the most prolific for the Mac II. Major CAD/CAM developers from the MS-DOS are starting to jump on the Macintosh bandwagon. VersaCAD™ was the first and AutoDesk, makers of AutoCAD™, are soon to follow. The Mac II, with its increased processor speed, capabilities of extended memory, ultrahigh-resolution graphics, and general ease of expansion should provide most of the power necessary for CAD/CAM products.

VersaCAD

Company: VersaCAD Corp.
2124 Main St.
Huntington Beach, CA 92648
(714) 960-7720

Product: VersaCAD

Price: \$1995

Product Description

VersaCAD has long been a best-selling CAD/CAM package for MS-DOS computers. In fact, VersaCAD is generally considered the number-two CAD application behind the ever powerful AutoCAD. Now VersaCAD has created a Macintosh version of their CAD

package. VersaCAD was designed to run on a Mac II. At this point, VersaCAD supports only two-dimensional drawings, but this is scheduled to change. VersaCAD's entry into the Macintosh CAD market signifies that the Macintosh is being taken seriously as a CAD-based computer. VersaCAD supports full-color drawing and full-screen displays.

MacDraw II

Company: Claris, Inc.
440 Clyde Ave.
Mountain View, CA 94043
(415) 960-1500

Product: MacDraw II

Price: \$195

Product Description

Like MacPaint, this is one of the programs that started it all. MacDraw set the standards for object-oriented drawing on the Mac. Most other object-oriented drawing programs are based upon the groundwork set down by MacDraw. Now MacDraw II has added even more features that make it one of the more powerful drawing programs around. When MacDraw was revised, the Mac II was already in the process of being introduced. Apple, in conjunction with Claris, made sure that MacDraw II took full advantage of the Mac II's features. MacDraw enhancements include the following:

- **Zoom capabilities.** You can zoom both up and down. The zoom feature allows you to enlarge the drawing up to 32 times normal size or down to 3 percent of normal size.

- **Object rotation.** Any object can now be rotated to any angle from 0 to 360 degrees in variable increments.
- **On-screen color.** MacDraw II supports on-screen color and color output for color separations to any PostScript output device.

In addition to these features, MacDraw II supports additional memory and large-screen displays.

MGMStation

Company: Micro CAD/CAM
3230 Overland Ave.
Suite 105
Los Angeles, CA 90034
(818) 376-6860

Product: MGMStation

Price: \$1400 (color version)

Product Description

MGMStation is fast becoming one of the most powerful CAD applications for any microcomputer. Features include unlimited zooming, auto dimensioning, multiple layering, and IGES (**I**nternational **G**raphics **E**xchange **S**tandard) translation. On the Mac II, MGMStation also includes support for on-screen color and full-screen displays.

Pegasys II

Company: IGC Technology Corp.
305 Lennon Ln.
Walnut Creek, CA 94598
(415) 945-7300

Product: Pegasys II

Price: \$1795

Product Description

The Pegasys II system is a high-end, powerful, CAD package for the Mac II. Pegasys II includes such standard CAD features as zoom in or out, full range of graphic primitives including circles, squares, rectangles, fillets, chamfers, splines, and more. In addition, Pegasys II offers perimeter and distance calculations. Some of the special Mac II features include the following:

- Associative dimensioning (Dimension values change automatically whenever you change the dimension size.)
- Macros
- On-screen color support
- Support for full-screen displays

VideoWorks II

Company: MacroMind Inc.
1028 W. Wolfram St.
Chicago, IL 60657
(312) 871-0987

Product: VideoWorks II

Price: \$195

Product Description

VideoWorks II is a graphics animation application. For users interested in creating “moving” storyboards for video production, or any type of animated graphics presentation, VideoWorks II fills the bill. On the Mac II, VideoWorks II supports on-screen color, large-screen displays, and extra memory and can create fairly complex animated graphics. Besides animation, you can add the sophistication of digitized sounds and music to your animated movies. Since the Mac II is capable of creating 8-bit digitized sound, the sound track of your films can become quite professional. The TV Producer board from Computer Friends (see Chapter 2, Firmware, for a description of this card) would fit in well with VideoWorks II. When used together with the Mac II, these two products offer users a truly professional graphics overlay system for video production.

Adobe Illustrator 88

Company: Adobe Systems, Inc.
1585 Charleston Rd.
Mountain View, CA 94039-7900
(415) 961-4400

Product: Adobe Illustrator

Price: \$495

Product Description

Adobe Illustrator may be the most powerful graphics program available for any microcomputer. Adobe Illustrator was created by the same folks who gave us the PostScript language for the LaserWriter. On the Mac II, you can create on-screen color images. To enhance these images and to take advantage of the Mac II's 16.8 million colors, Adobe has added a color utility called Pantone™ Matching Systems colors. This utility allows for very precise control over any color generated by the Mac II. In addition to seeing on-screen colors, Adobe Illustrator can create color separations for output to a PostScript typesetter such as the Linotronic or Compugraphic.

Besides color, other specialized visual effects can be created with Adobe Illustrator 88. You can now use a blending tool to create such effects as highlighting, contouring, shading, and even airbrushing. This same tool can also interpolate (bend) shapes and line heights. Another tool allows you to create "Windows." A Window is any desired shape and/or color drawn or placed over an existing object that allows the object to show through.

Of course Adobe Illustrator 88 supports high-resolution color monitors and 8- to 24-bit-per-pixel graphic cards and displays. All of these features and many others make Adobe Illustrator 88 a premier graphics program for the Mac II.

DESKTOP PUBLISHING

The desktop publishing (DTP) market has been *the* biggest marketing coup since Lotus 1-2-3. PageMaker led the way followed by a parade of challengers. The ability to easily do electronic page layout opened up the world of publishing to individuals who never dreamed of doing it themselves. All of the desktop publishing programs are significantly enhanced when running on the Mac II.

PageMaker 3.0

Company: Aldus Corp.
411 First Ave. So.
Suite 200
Seattle, WA 98104
(206) 622-5500

Product: PageMaker 3.0

Price: \$495

Product Description

PageMaker is another standard in the Macintosh world. "Way back" in 1985, it was PageMaker that really started the DTP snowball. To be fair, MacPublisher from Boston Software was actually the first DTP application available for the Mac. Unfortunately it suffered many bugs, and the 128K Macintosh operating system was not quite ready to handle the programming sophistication needed for a successful DTP program. When PageMaker hit the scene, it was far more costly than MacPublisher (\$495 for PageMaker, \$99 for MacPublisher), but PageMaker provided the power and sophistication that professionals were looking for. Aldus also supplied support for the now

famous PostScript. This provided PageMaker the function of speaking the same language as Apple's new LaserWriter. The rest, as they say, is history.

PageMaker 3.0 now offers over 35 new features. These features include better graphics handling, longer documents, automatic text flow through successive pages, user-defined style sheets (with the ability to import style sheets from MS Word), support for on-screen color, extended memory, 1- to 24-bit-per-pixel graphics, spot color overlays, and controls for special effects created by scanned images in TIFF (Tagged Image File Format). With all of these features *and* the Mac II, the market for electronic desktop publishing has taken a quantum leap forward.

Ready, Set, Go 4.0

Company: LetraSet USA
40 Eisenhower Dr.
Paramus, NJ 07653
(201) 845-6100

Product: Ready, Set, Go 4.0

Price: \$495

Product Description

Like PageMaker and MacPublisher, Ready, Set, Go was one of the original DTP applications. Since its introduction, Ready, Set, Go has undergone many changes and revisions. The current version, 4.0, offers you advanced features not found in the earlier versions. Ready, Set, Go 4.0 differs from PageMaker in the way the page is defined. With PageMaker, a page is defined in terms of equally spaced columns, whereas Ready, Set, Go defines a page in terms of blocks. These blocks can be moved, resized, and reshaped to fit your design. Ready, Set, Go 4.0 offers you the ability to have very precise runarounds (when text "runs around"

a graphic) and high-resolution graphics support, namely TIFF. In addition, Ready, Set, Go 4.0 provides you with interactive facing pages and customized page sizes up to 99 × 99 inches. On the Mac II, Ready, Set, Go 4.0 supports large-screen displays and extended memory. So far there has been little support for on- or off-screen color output.

Quark XPress 2.0

Company: Quark, Inc.
300 S. Jackson St.
Suite 100
Denver, CO 80209
(800) 543-7711

Product: Quark XPress 2.0

Price: \$695

Product Description

Quark XPress is one of the newcomers to the Macintosh DTP market. Among its impressive array of features is an 80,000-word dictionary and support for TIFF graphics and Pantone color. The usual DTP features are also present. These include the ability to snake text around graphics, automatic or manual leading (the space between lines) and kerning (the space between characters), automatic hyphenation, and the ability to read files from Word 3.01, MacWrite, WriteNow, MS Works, and of course standard ASCII files. What Quark XPress offers that is different from some of the other DTP applications is advanced support for typesetters. This allows you to send your final electronic document to several types of electronic typesetters. Quark XPress 2.0 was enhanced for the Mac II and supports large-screen displays, on- and off-screen color output, and extended memory.

Interleaf Publisher

Company: Interleaf
#10 Canal Park
Cambridge, MA 02141
(617) 577-9800

Product: Interleaf

Price: \$2495

Product Description

Interleaf sits at the high end of DTP applications and was created for the Mac II. The program is designed to process very long and complex documents. Book publishers and companies that edit and lay out book manuscripts are beginning to use Interleaf. Unique page layout features include hyphenation, indexing, and automatic continuous repagination. In addition, Interleaf offers a cross-referencing feature that makes it much easier to create technical manuals, financial reports, and directories. This feature is especially useful when creating an index. In addition to its electronic page layout functions, Interleaf offers an integrated graphics program and automatically generates charts from data transferred from spreadsheets or databases. These charts can be produced in a variety of styles.

Interleaf's word processing feature offers an impressive array of features including automatic spelling verification, generation of indexes and tables of contents, outlining, and revision tracking. Of course Interleaf makes use of all the power a Mac II has to offer. There is support for full-screen display and color. The color support includes both high-resolution on-screen and color output to an appropriate color output device.

In addition to all of these features, Interleaf for the Mac II is compatible with Interleaf's Technical Publishing Software for SUN, Apollo, and DEC workstation computers. This means that your Mac II can be networked to, and communicate with, these different computer systems.

All of these features add up to a very powerful DTP application, and the price reflects this fact. Interleaf is not an application for the nonprofessional; it was designed with the professional publisher in mind.

SPREADSHEETS

Excel

Company: Microsoft Corp.
16011 N.E. 36th Way
P.O. Box 97017
Redmond, WA 98073
(206) 882-8088

Product: Excel

Price: \$395

Product Description

Excel is the premier spreadsheet for the Macintosh. Excel combines traditional spreadsheet functions along with a database and charting. Excel has been around for a long time, but the Mac II expands its capabilities and speed. For example, a 45K spreadsheet takes 16.7 seconds to open on a Mac SE. On the Mac II, that time is cut to only 8.45 seconds. The size of the Mac II screen(s) also enhances the capability of Excel. The traditional Mac screen shows 7 cells by 20 cells for a total of 140 cells. On the Mac II with a standard 13-inch Apple color monitor, the spreadsheet size increases to 8 cells by 31 cells for a total of 248 cells. Speed of recalculation has always been an issue with spreadsheets. Recalculating an Excel spreadsheet is 20 to 40 percent faster on a Mac II than on a Mac Plus or Mac SE.



Company: Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000

Product: Wingz

Price: \$395

Product Description

Imagine a dream spreadsheet that allows you to create complex financial model like Excel, 3-D full-color charts like CricketDraw, and then integrate all of it into a letter written on a word processor. Wingz is this spreadsheet! Wingz has been specifically created for the Mac II. In addition to the four basic functions of spreadsheet, word processing, database, and 3-D graphics, Wingz has been designed to take full advantage of MultiFinder. The Mac II will require a minimum of 2 megabytes of RAM to run effectively with MultiFinder. Wingz is also being designed to work under the A/UX operating system, giving it the potential to become one of the first multitasking integrated applications available for the Macintosh.

SOFTWARE WRAP-UP

Now that you have read about all these software products, you should have a better idea of what makes the Mac II such a special computer. Even applications that run on any of the Macs take on special qualities when run on the Mac II. The screen is

bigger, there might be color, applications zip along, and disk access is faster. Many of these applications were created specifically for the Mac II. As the Mac II grows in popularity, and the street price comes down, developers will turn their attention to creating applications just for the Mac II. As this happens, you will begin to see what Apple means when they say the Mac II incorporates an enabling technology. Look to Mac II applications to cross the bridge into other systems. Mac II to SUN, Mac II to Apollo, Mac II to DEC are just a few examples of the Mac II's enabling technology cross-pollinating with other systems.

A/UX

A/UX stands for Apple UNIX. A/UX is Apple Computer's implementation of the UNIX operating system on the Macintosh. A/UX has been one of the most widely anticipated applications for any micro system. The plan behind the A/UX system was Apple's evergreen concept of creating enabling technologies. Apple had Mac-to-Mac, Mac-to-MS-DOS, Mac-to-minis and Mac-to-mainframe communications. One of the last hurdles was Mac-to-UNIX-based computers. Apple approached this hurdle from a purely market-driven point of view.

Apple wanted to position the Mac II as the most powerful workstation, for the money, on the market. A workstation is considered to be an all-purpose computer that can be used for any activity needed. The concept of creating workstations comes from the early days of microcomputers. This was a time when some computers were a cross between the first simple 4- or 8-bit micros and the then-popular minicomputers. The idea was to create a powerful "smart" terminal. This smart workstation (terminal) was used primarily in the scientific and engineering fields. As the popularity and power of the microcomputer grew, so did the power of the workstation. Not too long ago, the common engineering workstation became far more powerful than the minicomputers that had originally promoted and powered the workstation concept.

Now Apple wanted a workstation of their own. IBM, Sun and Apollo had theirs. Apple had opened up the architecture of the Mac II to ensure that developers had the freedom to create whatever was needed. The hardware had been established, but the software side to the workstation was lacking. Although there

were the standard Mac applications and some powerful CAD/CAM, scientific, and engineering applications, something was missing. Something that the best-selling workstations had. That something was an operating system called UNIX! UNIX had been around for more years than micros, but as an operating system, it enjoyed limited acceptance. Most of UNIX's success has been in the scientific, CAD/CAM, and engineering markets. A big reason for the narrow range of the market has been UNIX itself. The operating system is so complex that only engineers and scientists can learn how to use it.

So, on the one hand, Apple had the Mac II, complete with their friendly Macintosh user interface. Their competitors had UNIX and the bulk of the market share for UNIX workstations. To be successful, Apple had to go with their strong suit, the Mac interface itself. In fact, UNIX is the standard operating system on the Cray II supercomputer. If it can be said that the Macintosh operating system is user friendly, then the antithesis of this statement is that UNIX is user hostile. The solution was A/UX. It has been designed to provide users the best of both worlds—UNIX and the graphical, friendly interface of the Macintosh.

We are going to examine the A/UX operating system, see what it looks like on the Mac II, and find out how and why developers should take advantage of this revolutionary new product. First there will be a short historical look at UNIX. From there, the different primary elements of A/UX will be explored—it would be impossible to cover the entire A/UX operating system in this short chapter. The purpose is simply to show the power and ease of use of A/UX. The look and feel of the Mac with multiuser, multitasking capabilities of UNIX. The implications are staggering and the market huge.

WHAT IS UNIX?

A/UX is Apple's implementation of the popular operating system UNIX. A/UX is a version of the industry standard AT&T UNIX System V Release 2. A/UX also incorporates extensions from the 4.2 Berkeley Software Distribution version of UNIX. For

many users, whose introduction to the computer came at the hands of a Macintosh, UNIX is probably not a household word. However, UNIX has been a mainstay in the computer industry for many years. The attraction of UNIX resides in three major features:

1. **Transportability.** UNIX has the ability to be used by many different brands of computers all connected to a UNIX host computer. This ability to cross over hardware makes UNIX very portable and popular.
2. **Multuser capabilities.** UNIX allows more than one user access to applications and/or files. On a UNIX network, more than one user can access the same file, make changes to the file, and then save the file.
3. **Multitasking capabilities.** Multitasking has been a dream of microcomputer developers for a long time. In the current micro industry, multitasking appears to be a new concept. For UNIX users, multitasking has been around for quite a while. Since multitasking allows more than one application to run concurrently, this means that a spreadsheet can be recalculating while database information is downloading.

Because these three components are so distinctive and desirable, users have overlooked the hostile user interface and the complexity of UNIX and UNIX-based applications.

UNIX is an operating system. It is not generally regarded as an application per se. However, many UNIX devotees see UNIX as an application in and of itself. This is a debatable issue that will not be resolved in this book. Suffice it to say that for our purposes UNIX is considered an operating system like MS-DOS or Macintosh Finder. UNIX controls the function of the computers attached to the UNIX host and offers users basic operating system tools such as the following:

- Text editing
- Access to programming languages
- Multiuser access to files
- Multitasking capabilities

These tools, along with UNIX's three major features, are transferred to applications created to run under the UNIX operating system. Examples of some types of UNIX applications available include database managers, full-complement accounting applications, word processors, CAD/CAM, and more. Like the operating system whence they came, these applications enjoy the major attractions of UNIX. A/UX maintains the look and feel of the traditional UNIX operating system. It is important to remember that at this operating system level, A/UX looks and operates like UNIX, not the Mac! However, Apple has opened up their ROM Toolbox to A/UX developers. With Toolbox, A/UX developers can create A/UX applications that have the look and feel of traditional Mac applications while maintaining the powerful features of UNIX.

Before getting into the system setup, it might be a good idea to give a very short (and probably simplistic) overview of the structure of the UNIX operating system (see Figure 4.1). The other standard in high-level, multiuser, networking operating systems is the OSI model. When you compare the two, you can see the differences, as outlined in Figure 4.2.

Apple knew that UNIX was popular. They also knew that UNIX was powerful. When the Mac II was released, Apple almost immediately announced their version of the popular operating system for their new workstation. The trick for Apple was to provide developers access to the powerful features of UNIX, such as transportability, multiuser, and multitasking, with the user-friendly interface of the Macintosh.

FIGURE 4.1 The structure of A/UX

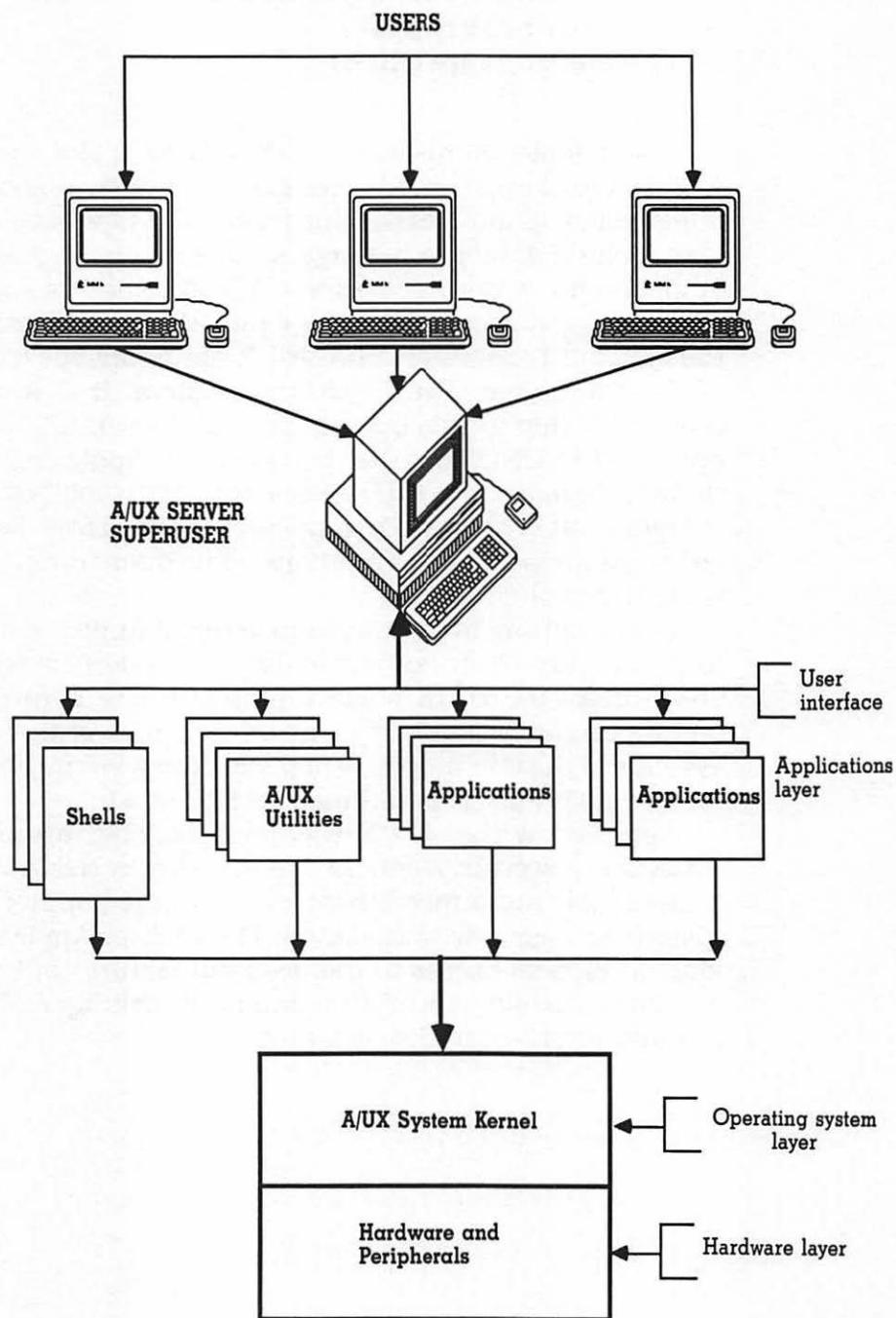


FIGURE 4.2 A/UX and OSI comparison

THE OSI MODEL	A/UX
7. Application	4. User Interface
6. Presentation	3. Applications
5. Session	2. Operating System
4. Transport	1. Hardware
3. Network	
2. Data Link	
1. Physical	

A/UX—INSTALLATION AND SETUP

With the addition of the Mac II, Apple was now able to take a serious look at connecting to the UNIX world. For Apple, the key was to make a Mac running UNIX . . . a Mac! Apple found this task to be a double-edged sword. In order to connect to other UNIX systems, the Mac had to speak the same language as UNIX yet retain the Mac interface. To accomplish this, Apple made many of their proprietary ROM routines available to developers. The ROM code made available was from the Macintosh ROM Toolbox, and the code contained in the Toolbox is what makes the Mac the Mac. These ROM routines had previously been unavailable to developers! The purpose of opening them up was to allow developers to create UNIX applications for the new A/UX operating system. These applications will retain the power of UNIX yet have the look and feel of the Macintosh.

A/UX runs only on a Mac II and is shipped complete with an internal or external 80-megabyte hard disk. When A/UX arrives, you might think someone has sent you an automobile in a box. The manuals alone come in a 50-pound box. This box is accompanied by another large box containing your hard drive with A/UX. In all, ordering A/UX guarantees that your delivery service will hate you. It is not expected that you will wade

through all of the manuals. Some of the manuals shipped are programmer's reference guides for various components of the A/UX system, targeted towards developers. If you are a developer, then the manuals are of importance to you. For those who are users or system administrators, the other 11 manuals contain everything you ever wanted to know about A/UX and more. Actually, when you order A/UX, you specify if you intend to develop A/UX applications or just use the system. The nature of your order and needs determines the number of manuals you get.

Basic A/UX Configuration

A/UX has some basic hardware configuration requirements. As powerful as your Mac II is, A/UX pushes it to the limit. Basically, A/UX poses some heavy processing demands on your Mac II. The following hardware configuration should be considered the minimum. Exceeding these requirements guarantees that A/UX will run as it should.

1. The Mac II with the expanded video card, either a monochrome or color monitor, and the extended keyboard.
2. At least 2 megabytes of RAM. Any users connected to you require an additional 2 megabytes *per user!*
3. 68851 PMMU (Paged Memory Management Unit) chip. Your Mac II comes standard with a HMMU (Hochsprung Memory Management Unit). The HMMU is an address mapping chip and is normally shipped with the Mac II. You must have the PMMU chip in order to run A/UX, so be sure to order it when you order A/UX. Trying to run A/UX without a PMMU chip installed gets you an error message shortly after you attempt to boot A/UX.
4. Macintosh extended keyboard. This is not a mandatory item. If you do not have the extended keyboard, A/UX will still run. However, the extended keyboard makes life with A/UX much easier.

Once again, this is the basic configuration for your Mac II if you intend to run A/UX. Keep in mind such things as extra memory and the PMMU chip when developing your budget for A/UX.

Another thing to remember when you consider buying or using A/UX: the basic A/UX system is “UNIX UGLY”! This means there are no icons or familiar desktop for getting in and around the **basic** system. If you don’t have some familiarity with UNIX commands, you’ll have to keep the A/UX manuals close at hand. However, if you buy an A/UX application (databases, accounting systems, etc.), you are back into the wonderful world of Macintosh. The following procedures are designed to help you get the A/UX operating system up and running on your Mac and to familiarize you with the basic A/UX operating system. You need to understand just how A/UX is set up before you begin installing and using A/UX applications. In Appendix A there is a listing of companies that have A/UX-compatible products and applications.

Throughout the rest of the chapter there will be *regular* words and A/UX words. The A/UX words are words that are typed on the computer to initiate an A/UX function. The A/UX words follow the conventions used in the A/UX manual and will be displayed in `this typeface`.

Keyboard Equivalents

When you first set up A/UX, your Mac II assumes you are using a VT-100 terminal. On the VT-100 terminal there are specific keys that perform special functions. The Macintosh keyboards do not have these special keys. By pressing a series of keys on the Mac keyboard, you can send the standard ASCII equivalent code to the A/UX system. Figure 4.3 shows the A/UX and Macintosh key-names and the equivalent ASCII codes.

A/UX Installation

Installation of A/UX is done in several steps. The first step is the preplanning and organization of your A/UX system for *all* users. Next is the installation of the necessary hardware. This includes either the internal or external hard disk containing A/UX, the PMMU chip, and additional memory. This is followed by a setup process for the A/UX host. Last but not least, the entire system must be booted and tested. Remember, it is recommended by Apple that *all* hardware installation (hard disk, extra RAM, and PMMU chip) be performed by an “Authorized Level 1 Service

FIGURE 4.3 Keynames and their A/UX equivalents

Keyname	Equivalents		
	Console Device	Macintosh	VT=100
CONTROL	Control	Command	CTRL
Escape	esc	'(backquote) or Command-[ESC
RETURN (<CR>)	return	Return	RETURN
<i>interrupt</i>	control-c	Command-c	CTRL-c
<i>quit</i>	control-l	Command-l	CTRL-l
<i>kill</i>	control-u	Command-u	CTRL-u
<i>erase</i>	delete	Backspace	DELETE

Center.” If you feel adventurous, you should have no problem doing these procedures by yourself. There are no expensive tools needed or secret installation procedures associated with any of the following steps.

CAUTION: If you mess up any of the hardware by installing it yourself, you could void your warranty.

Hardware Installation

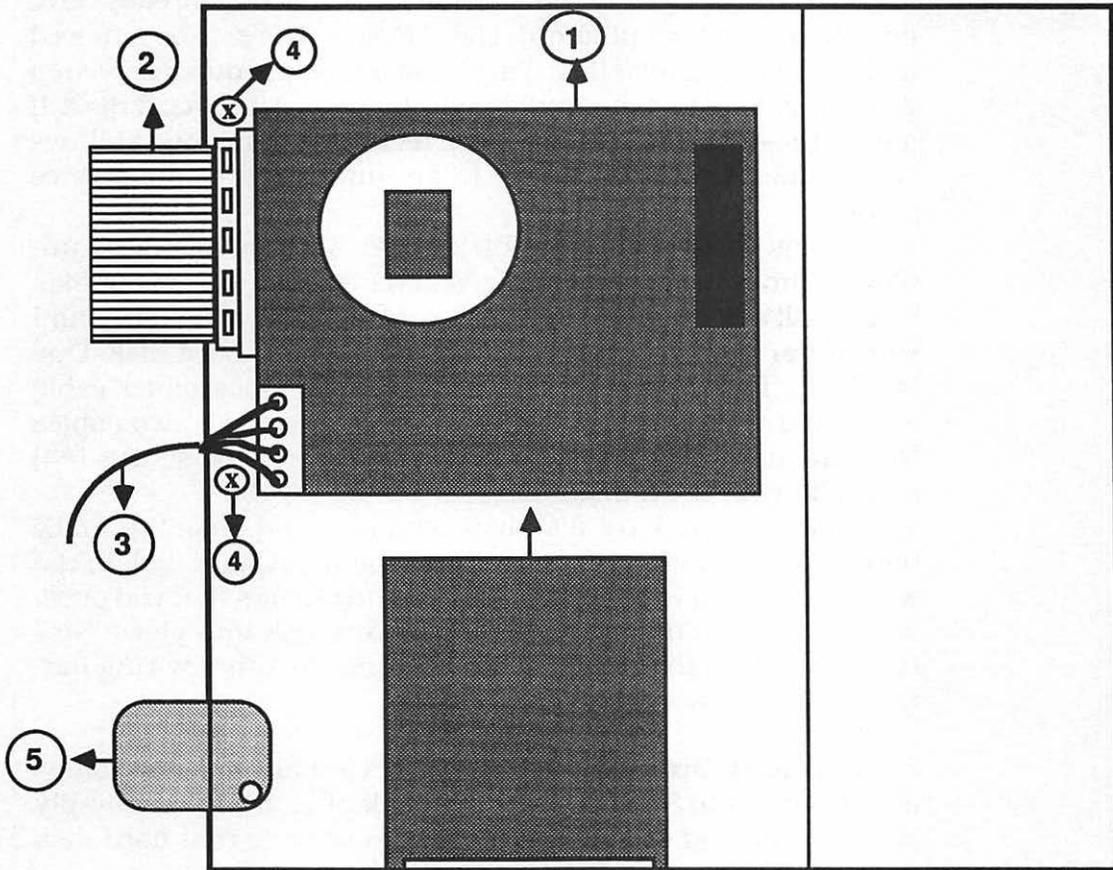
Hardware installation is probably the easiest operation you will do when working with A/UX. Hardware configuration consists of the following installations:

- Internal hard disk
- External hard disk
- Additional memory
- PMMU chip

CAUTION: All of these installations must be done BEFORE you attempt to use the A/UX system.

Refer to Figure 4.4 for exact locations when installing the various hardware components, as described in the following section.

FIGURE 4.4 Inside the Mac II



Internal Hard Disk Installation If you purchased a Mac II, chances are it already has an internal hard disk installed. When ordering A/UX, you need to specify if you want an internal or external hard disk with A/UX on it. This primarily depends upon your needs and if you purchased a Mac II *before* you decided on using A/UX. Deciding if you want to go external or internal is a very relative choice. If you already have a Mac II with an internal hard disk, then you might prefer the external A/UX hard disk configuration. On the other hand, an external disk may take up more room than you have, or you may not wish to expose your A/UX hard disk to any potential external abuse. Adding an internal hard disk when you already have one means you need to find a buyer for your old internal hard disk or install it in another Mac II. If you opt to buy the internal hard disk and already have one, then your current internal hard disk will have to be removed and the new one installed. The following gives you step-by-step directions for removing and installing your A/UX hard disk. If any of these procedures are more technical than your abilities can handle, take your Mac II to an authorized Apple service center.

To remove your old hard disk, make sure the Mac II is unplugged from the power source. Next remove the top of your Mac II. You will see your hard disk (#1) located on the rear right-hand side of the Mac. Two cables are attached to the hard disk. One is a large, flat, ribbon cable (#2). The other is a smaller cable with several multicolored wires (#3). Unplug these two cables from the hard disk. Next, you have to remove *two* screws (#4) and take your hard disk out.

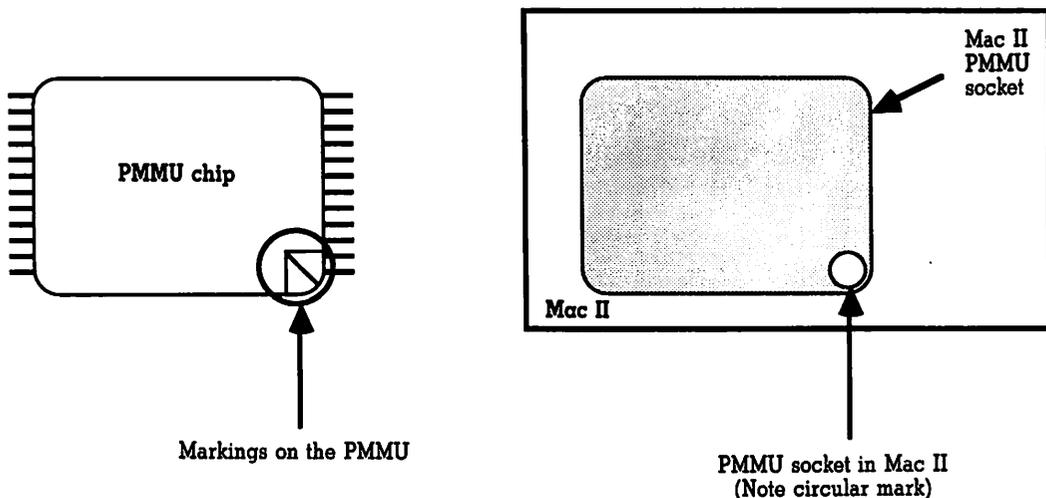
Once your old hard disk has been removed, take the A/UX hard disk out of its packaging. Place the A/UX hard disk in the same location as your old disk. Use the *two* screws that you previously removed and screw the A/UX hard disk into place. Now reconnect both the ribbon cable (#2) and the other wiring harness (#3). Replace your Mac II cover.

External Hard Disk Installation The external hard disk plugs directly into the SCSI port on the back of your Mac II. Simply connect one end of your SCSI cable to the external hard disk and the other end to the Mac II's SCSI port.

Additional Memory Installation As a minimum you must have 2 megabytes of RAM for A/UX. Each user that is connected to your A/UX host requires an additional 2 megabytes per user. Simple math shows that a Mac II A/UX host could require as much as 64 megabytes for 32 users. Refer to Chapter 5, Troubleshooting, for detailed information on removal and installation of SIMMS.

PMMU Chip Installation The PMMU chip must be installed *before* you begin to set up your A/UX system. With the power off, remove the Mac II and look for the HMMU chip socket (Figure 4.4, #5). Remove the black HMMU chip and insert the PMMU chip into the socket. Press down until you hear a click. This ensures that the chip is firmly in place and is making good contact. You must install the PMMU chip *exactly* as shown in Figure 4.5. Put the cover back on your Mac II.

FIGURE 4.5 Installing the PMMU chip



Markings on PMMU must align EXACTLY on the circular mark of the PMMU socket in the Mac II!

CAUTION: Improper installation of the PMMU chip can cause serious damage to the motherboard. Install exactly as shown in Figure 4.5.

Software Installation—Single User

This is the easy part, but it can be confusing. Unlike the hard disk that comes with your Mac II, the A/UX hard disk comes already initialized and loaded with A/UX. The following installation procedures can be done from either an *internal* or *external* hard disk. Your A/UX hard drive is an SCSI device and as such has a unique SCSI ID that tells the Mac II which drive to look for first. Your internal drive has an SCSI ID of 0 that is the default SCSI ID for A/UX. If you are using an external hard disk with A/UX, then you must change A/UX to recognize the external drive. The A/UX external drive comes preset with an SCSI ID of 5. Actually, this can be changed to any number from 1 to 6. If you want to attach other hard disks to your Mac II, then you may want to change ID numbers. For this procedure the external drive is set to 5. Whatever ID you select, you have to tell A/UX to look for the SCSI device with the specific ID you selected.

With an internal drive you do not have to do anything. As indicated, A/UX is preset to look for the drive with the SCSI ID of 0. The following procedure sets A/UX to boot from your *external* hard disk.

1. Look on the back of your external drive just below the SCSI connectors. You should see a small box with the number 5 in it. If it does not have a 5, then press the little button directly underneath the box until you have changed the number to a 5. Do not change the number to 0 or 7. The number 0 is for an internal drive and the number 7 is for the Mac II itself. Next connect the external drive to the SCSI port of the Mac II.
2. Turn on your external hard disk, then start up your Mac II. You will see the **Welcome to Macintosh** sign and the following A/UX message:

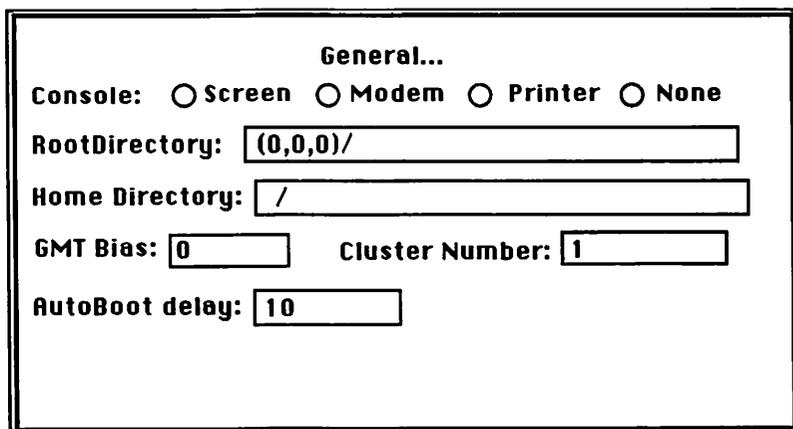
```
Disk c0d0s0 Error: Cannot select SCSI
device generic disk c0d0s0 Fatal Error:
Logical block 0 chroot failed
sash #
```

You will also see the familiar menu bar at the top of your screen. Select **General** from the Preferences menu. You will see the dialog screen shown in Figure 4.6. In the root directory box you will see three 0's ((0,0,0)/). Change the *first* 0 to 5 and click the OK button.

3. Choose **Restart** from the Execute menu, and the Mac will restart the A/UX system from your external hard disk.

The changes you made are to the Stand-Alone Shell that controls many of the basic system functions. If you ever switch your A/UX to an internal hard disk, you will have to change the Stand-Alone Shell back to 0 by following the above procedure.

FIGURE 4.6 A/UX general parameters screen



The image shows a dialog box titled "General...". It contains several settings:

- Console: Screen Modem Printer None
- RootDirectory:
- Home Directory:
- GMT Bias: Cluster Number:
- AutoBoot delay:

Starting the A/UX system is the same as starting the Mac II. You should hear the familiar tone and see the Welcome to Macintosh sign. The standard screen should be replaced with the A/UX automatic boot dialog box. Your screen should now look like the one shown in Figure 4.7.

You can wait until the system boots itself, click on the **Go** button, or press the Return key. When the A/UX has booted, you are presented with the screen shown in Figure 4.8.

CAUTION: Your mouse is not active in this Initial Console Emulation window. There is nothing wrong with your mouse, and it will be active in other A/UX programs.

FIGURE 4.7 A/UX Automatic boot screen

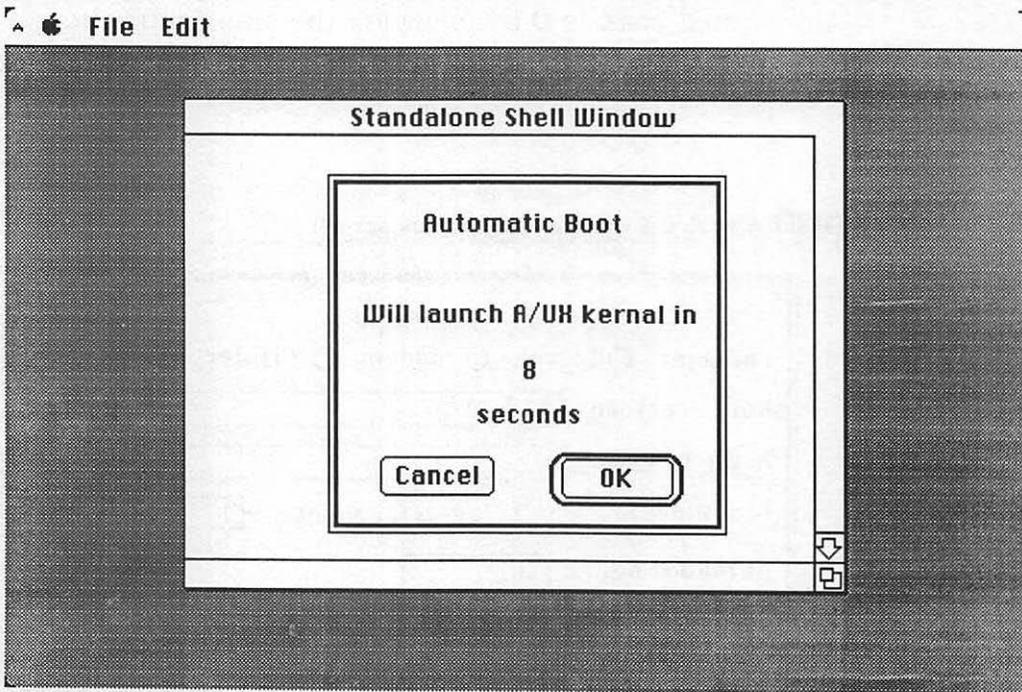
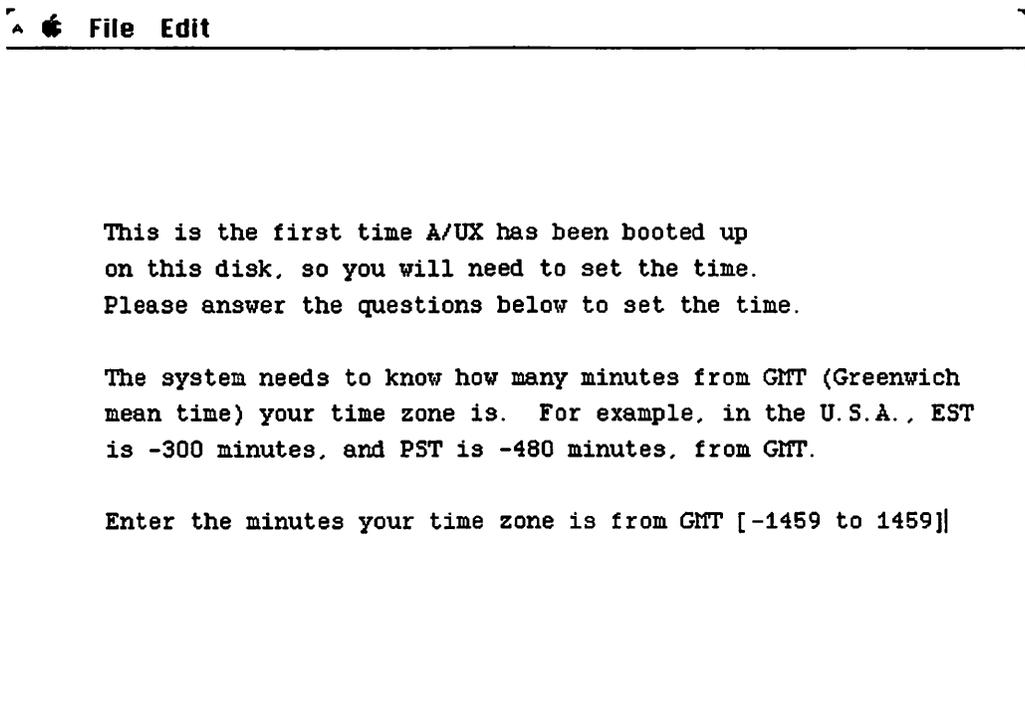


FIGURE 4.8 First-time screen

As you can see, you are asked to set the systems time in a manner that is very different from the normal methods. A/UX asks for how many minutes from Greenwich Mean Time (GMT) your specific time zone is. Have no fear, it is not as difficult as it looks. In the U.S., Eastern Standard Time (EST) is -300 minutes (yes that is a minus sign) from GMT. On the West Coast (where time doesn't really matter) Pacific Standard Time (PST) is -480 minutes from GMT. The Central Time Zone (CST) is -380 minutes from GMT, and Mountain Time is -420 minutes from GMT. If you are in doubt, Apple supplies a map showing the number of minutes from GMT worldwide. There really is a reason you have to set your time as minutes from GMT. A/UX uses this method to maintain time and date consistency with

other UNIX computers in different locations. This is part of the transportability feature found in A/UX and UNIX systems. A/UX uses minutes from GMT to time- and date-stamp files.

As an example, A/UX or UNIX files can be sent from Atlanta to Seattle. If a file was created in Atlanta at 1:00 P.M. and sent to Seattle, it would only be 10:00 A.M. in Seattle. Someone working on the file might think it had been created in the future. The Mac II running A/UX is a powerful computer, but not quite that powerful. A/UX automatically converts GMT to local time. When multiple users are working on files in different locations in different time zones, accurate time and date stamping becomes very valuable.

Once you have set the GMT (minutes from GMT), you simply follow the instructions on the screen for setting your local time and date. Remember, your mouse is still inactive. After you have set GMT and local time and date, A/UX confirms your entries with the following message:

```
Today is: Mon Apr 1 11:10:47 PST 1988
```

If you entered the wrong time and date, you can correct it with the `date(1)` command after you finish setting up your system.

Once you allow A/UX to take over control of your Mac II, you have entered an A/UX shell called the Stand-Alone Shell, better known in A/UX terms as `sash` (**s**tand-**a**lone **s**hell). You don't really need to know much about `sash` except that its purpose is to set up A/UX and to perform some basic housekeeping chores and file monitoring. One of the `sash` features is a file-system checking utility. In A/UX terms this is called `fsck`. After A/UX shows you time and date, you should see the following prompt:

```
Do you want to check the root file system?  
(y or n)
```

Even though this may be the first time you are setting up A/UX, you should respond with a `y` (yes) to this question. This automatically invokes the `fsck` utility. `fsck` checks for any file inconsistencies, and then repairs them if it can. On initial setup, `fsck` had better not find any file inconsistencies since you have

not created any files. After `fsck` checks the system for you, the Mac II reboots itself. Your screen will go black, and you will see the Welcome to Macintosh sign, the automatic boot dialog box, and then the message:

```
Do you want to check the root file system?  
(y or n)
```

If this is an initial setup, answer no. If you have used A/UX for a while, it may be a good idea to run `fsck` again just in case.

Next enter a host name. Make it unique, make it meaningful, maybe even make it fun. This host name identifies your Mac II on a network. You can change the host name at a later date if you wish. Unfortunately the host name can be no longer than eight characters and must consist of lowercase letters, digits, and dashes. Any name must begin with letter but can end with any character except a dash.

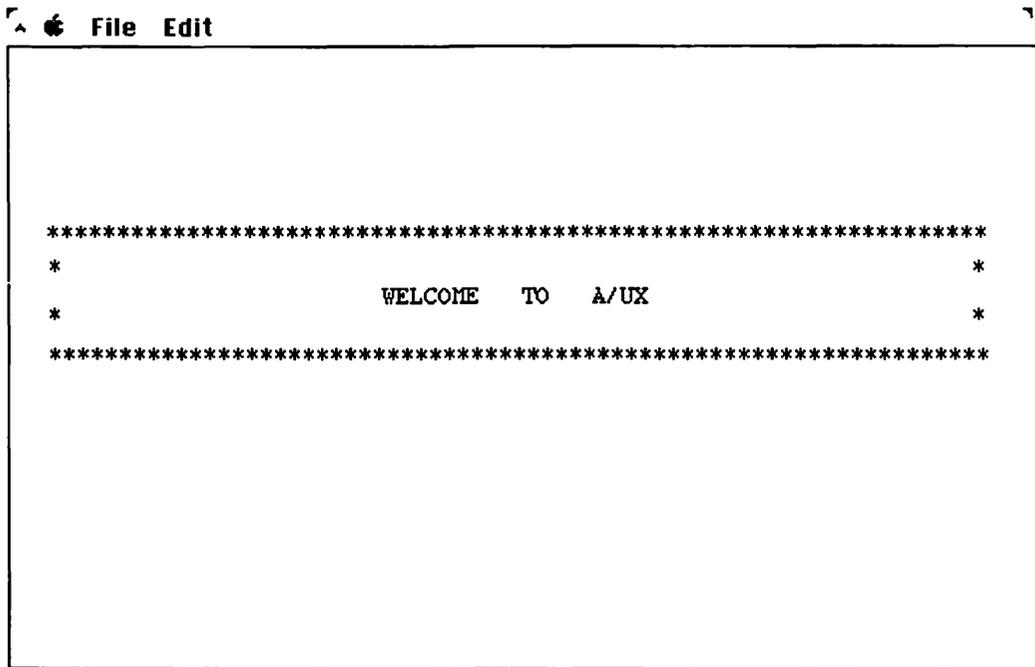
After naming the host, your preplanning becomes useful. You are now prompted to enter a domain name. A domain refers to a group of *locally* connected computers. Think of a domain as an individual local area network (LAN). The domain name you enter here identifies your Mac II to other domains (networks) to which you may be connected via Ethernet. These networks must also support the Network File Systems Yellow Pages facility. The Yellow Pages facility simplifies network administration by allowing computers to share a common database of users. A/UX assigns user IDs (UIDs) and group IDs (GIDs). The Yellow Pages facility uses the shared database to ensure that users maintain the same UIDs and GIDs throughout networks. Even if you are using A/UX in the single-user mode, it is a good idea to assign a domain name at this point. This will save you having to do this step later on.

Assign a domain name and then press Return. Once again the Mac II goes through a series of gyrations and cryptic on-screen messages and then reboots itself. Ignore these messages and wait until you see the `fsck` prompt. If you want, you can recheck your root file system. It is not necessary at this point and you can press n. Your screen should now look like the screen in Figure 4.9.

At this point A/UX is in the single-user mode (sometimes referred to as run-level). You will have the opportunity to change to multiuser mode later. Below this message is the message of the day banner. You will be able to change the message of the day later on. In fact, the message of the day is a great place to leave general information for network users. Notice that underneath the message of the day is the following prompt:

```
TERM = (mac2)
```

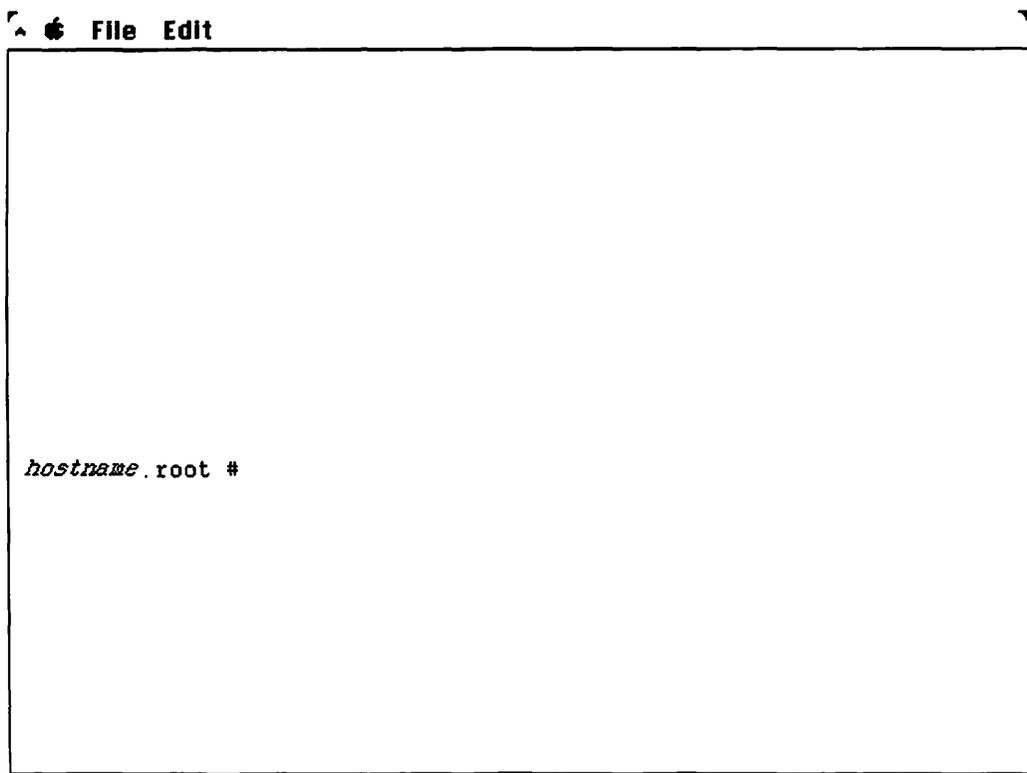
FIGURE 4.9 Message-of-the-Day screen



This prompt tells A/UX that you are of the `mac2` terminal type. A/UX can read and write data to and from literally hundreds of different terminals. The `mac2` terminal type is essentially a partial emulation of a DEC VT-100 terminal. Fortunately, this emulation takes advantage of the larger screen and higher resolution of the Mac II. You can change the terminal type if necessary. This is useful for communicating to other terminals on your network or on someone else's network. When you press Return, you find yourself at the screen shown in Figure 4.10.

The first name is the host name that you gave your system earlier. The name `root` is a user level. The root level gives you unlimited access to all A/UX files.

FIGURE 4.10 Root account screen



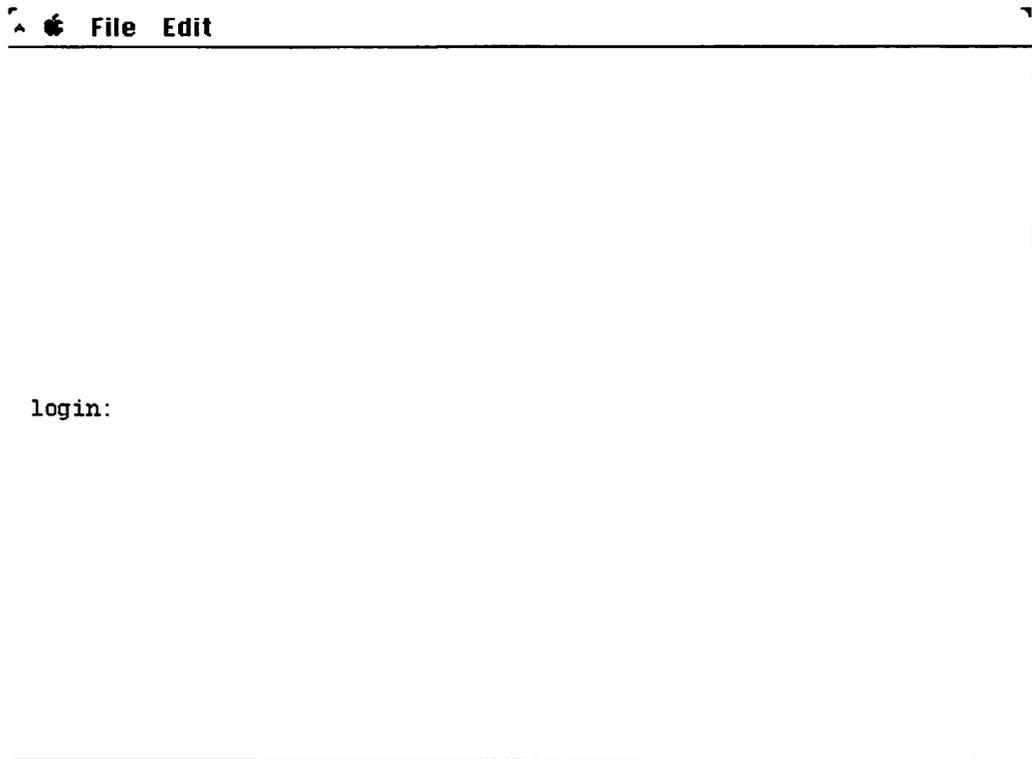
Software Installation—Multiuser

As long as your Mac II running A/UX is in the single-user mode, A/UX will accept input only from the system console, which is your Mac II. Anyone who has access to your Mac II while it is running A/UX in the single-user mode has what are called **superuser** privileges. A superuser (no relation to Clark Kent) has access to every file and command in the A/UX system. As you can tell, leaving your Mac II unattended in this single-user mode may not be a great idea. It is best to put A/UX into a multiuser mode (also called run-level 2). The multiuser mode is more secure because it requires users to authorize themselves before using the system.

At the `root #` prompt enter `init 2` and press Return. A/UX returns the following message: `INIT: New run level: 2` and then `fsck` asks you once again if you want your file systems checked. Respond with an `n` and you will see this message: `mv: cannot access /usr/lib/cron/log`. Since this is the first time you are setting up A/UX, simply ignore this message. A/UX does its thing and leaves you with the screen shown in Figure 4.11.

You have just set up A/UX in the multiuser mode. You can change back to single-user mode later. It is now assumed you are the systems administrator. As such you become the A/UX superuser. The superuser has access to any and all files at three different user levels. First, however, you need to assign yourself (superuser) a password at each of the three user levels. At the `login:` prompt type `root` and then press Return until you see the `root #` screen. At the `root #` screen type `passwd` and press Return. Follow the screen prompts and enter a password. Your password must be at least six characters long and contain any combinations of letters, numbers, or other characters. It is important to remember your password. Without it you are not allowed to log in. After entering your password, press Return and you are returned to the `root #`. The password you just entered has established you as a superuser at the **root** level. The root level is the standard System V Bourne Shell level. There are two additional user levels available in A/UX. They are

- * `rootksh`
- * `rootcsh`

FIGURE 4.11 Final login screen

Each of these root levels are associated with a particular UNIX shell. The level `root ksh` uses the AT&T Korn Shell and the `root csh` uses the BSD C Shell. You will learn more about these shells later in this chapter. For now you should set your password for each of these levels.

In assigning your password at the other levels, follow the same procedures as at the root level. At the `root #` prompt enter `passwd root ksh` and press Return. You should see this prompt:

New Password:

This allows you to set your password for the `root ksh` (**K**orn **S**hell) level. Enter your password (the same one you entered at

the root level). You are prompted to reenter your new password. Reenter your password, press Return, and you are back at the `root #` prompt. Follow this same procedure for setting your password for the `root csh` (**C Shell**) level.

That's it! How does it feel to be a superuser?

A/UX Components

Before you can begin to use the A/UX system, it is a good idea to familiarize yourself with some of the various *main* components of A/UX. For users already familiar with UNIX, these components will be familiar. This is not a complete listing of every feature that A/UX has to offer—it highlights major A/UX features:

- Administrator functions
- User functions
- The A/UX shells
- The A/UX text editor
- A/UX mail system

These features should provide an understanding of at least 90 percent of the A/UX system. Remember, at the system level, A/UX has the look and feel of the standard UNIX system. However, there are some Macintosh elements present. As you will see, pull-down menus are used to set parameters, and your desk accessories are always with you.

System Setup

Now that you have installed the A/UX hard disk and the A/UX software, it is time to set the system up for communication. Remember, A/UX words that are typed will be displayed in `this typeface`.

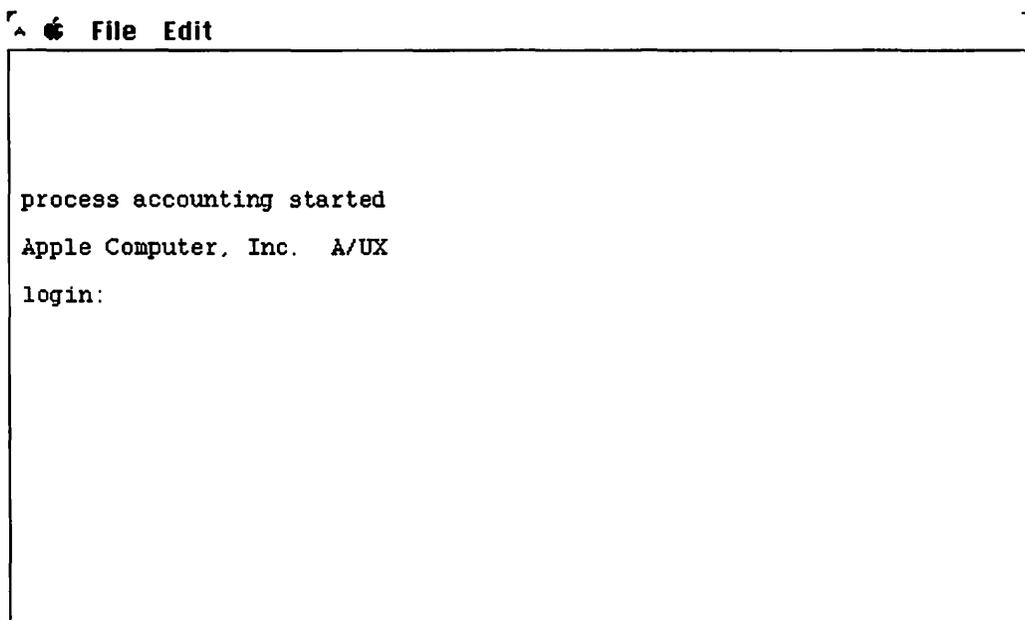
Administrator Functions

The administrator of a UNIX system has a very important role in determining how the system is organized and operated. A/UX,

like UNIX, is a multiuser system. This means more than one user can have access to a single file. In order to save confusion and frustration, it is important to understand the administrative structure of A/UX. A difficulty with UNIX is the complexity of the systems administration. Administration is different for a single computer system than for a network. These functions and procedures are for a multiuser A/UX system. Familiarity with them provides the basic foundation necessary to understand A/UX system administration. As a superuser, you have access to powerful utilities and system operations at the `root`, `rootksc`, and `rootcsh` levels.

Logging On A/UX requires every user and/or administrator to log on to the system. A/UX normally does an automatic boot. Following boot-up, your screen should look something like the one shown in Figure 4.12.

FIGURE 4.12 Boot-up screen



The system administrator should be familiar with the various root systems files. It is here that A/UX can recover files from crashes and complete general repairs. When you respond with a `y(es)` to the screen prompt, A/UX automatically invokes a handy file-system checking function. This is called `fsck`. If `fsck` finds any problems or inconsistencies with the file system, it will correct them or prompt you for the proper repairs. Any corrections to the file system automatically brings a reboot of A/UX. After rebooting, `fsck` again asks if you want to check the root file system. Apple recommends that you allow `fsck` to check the file system again. This is really only necessary if there has been a great deal of use. Otherwise you do not need to recheck the file system.

User Functions

Users are given specific access to the A/UX system by the system administrator. It is the system administrator who up every user's account and password. The account is actually your login name. As a user, your system administrator should have given you your login name (account name) and password. If you do not have these, then turn your Mac II off and quit the company. No, don't do that. Just ask your system administrator, or whoever set your A/UX system up, for the necessary login information.

Logging On and Off For the user, logging on to the A/UX system is quite simple. After you have turned on your Mac that is connected to the A/UX system, you will see the login prompt. It looks like this:

login:

You type your login name (account name) and press Return. Next you will see the following prompt:

Password:

Type your password and press Return. When you type your password, nothing appears to happen. This is because, to preserve your privacy, your password is not echoed back to your

computer. After typing your password and pressing Return, A/UX tells you that your terminal is a Mac II. In A/UX terms the system shows you

```
TERM = (mac2)
```

Press Return and you will see the soon-to-become-familiar A/UX command prompt,

```
$
```

You are now ready to enter the world of A/UX! Logging off from A/UX is even easier than logging on. At the \$ (the A/UX command prompt) type `exit`. You are now returned to the `login: message`. Either start another A/UX session or turn your computer off.

Checking Your Login Name Your login name is important because A/UX identifies its users by their login names. If you forget what your login name is, you can type

```
whoami
```

and A/UX displays your login name. You can also see who else is logged in on your system. To get a list of users, type

```
who
```

This returns a list that looks like this:

```
MistEd   ttyd0   Apr 1   07:30
Ricky    ttyd1   Apr 1   07:31
Lucy     ttyd2   Apr 1   07:32
Fred     ttyd3   Apr 1   08:10
Ethel    ttyd4   Apr 1   08:30
```

This first column is the other user login names, the second tells you their terminal number, the third and fourth tell you the date and times they logged in.

A/UX Command Structure

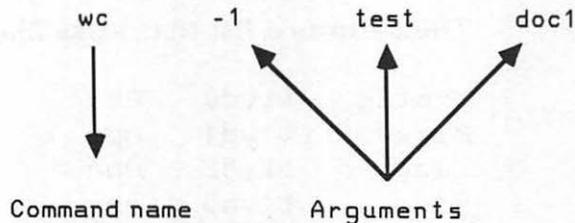
For the novice A/UX (or UNIX) user, A/UX commands look strange and different. This section is not meant to offer a complete course in A/UX commands. That would require a book in itself. Instead, this section is designed simply to familiarize you with the structure of A/UX commands. Becoming familiar with the structure (sometimes referred to as *syntax*) allows you to better understand and navigate your way around A/UX. Here is a simple A/UX command:

```
ls -l /sales/west/seattle
```

This command will create a long listing of all files in the sub-directory `seattle`, which is in the directory `west`, which in turn is in the `sales` directory. Figure 4.13 shows the various parts of an A/UX command.

CAUTION: You must enter A/UX commands exactly as they are intended. If the command requires lowercase letters, you cannot use any uppercase letters. A/UX is *very* literal! Improper use of case in commands can skew your results!

FIGURE 4.13 Parts of an A/UX command



The breakdown of this structure is:

- **Command name.** This tells the A/UX shell you are in *what* to do. In this case the `ls` means **list** files.
- **Flag options.** These options control *how* the A/UX command works. In this case the `-l` means long list, which includes the files' permissions, owners' sizes, and most recent modifications.
- **Arguments.** Arguments control *which* files the command will work on. In this example the files are in the `sales/west/seattle` directories.

This command structure allows you to set the parameters for virtually any A/UX command. With some commands you can specify more than one flag option. A complete listing and explanation of all A/UX commands may be found in the two-volume A/UX Command Reference. Common commands are listed and explained at the end of this chapter.

There are some other rules of the road for entering commands in A/UX.

- **Deleting characters.** You can delete characters by pressing the Delete key. This will delete the last character you typed. If you want to delete an entire line, you issue the *kill* command. This is a Command-u.
- **Commands longer than one line.** Once you press the Return key after entering a command, A/UX executes the command. However, it is often necessary to enter a command longer than one line. No matter which shell you are in, Stand-Alone, Korn, Bourne, or C, A/UX automatically wraps the line for you. Even if a file name is broken, once you press Return the command is interpreted and executed. If you want to control where your command line is broken, you simply type a backslash (\) immediately followed by a Return. The backslash (\) tells A/UX that this is not the end of the command but a way of getting to the next line. In all of the shells except the

Bourne, each new line is just a line. In the Bourne Shell, each new line has a prompt, > (greater-than symbol), at the beginning of each new line.

When you type an A/UX command within a shell, you are requesting A/UX to execute some program associated with your command. The shell interprets your command, runs the program, and assigns three standard files:

- 1) A standard *input* file from which the program takes the input data. By default this file is your keyboard characters.
- 2) A standard *output* file that receives the output of the program. By default this file is sent to your screen.
- 3) A standard *error* file that receives any error messages that may have occurred during processing. By default these error messages are sent to your Mac II screen.

All of these input/output (I/O) files are directed, by default, to your screen. They can be redirected by using A/UX I/O redirection commands. These commands make working with your A/UX files much easier; however, learning all of these commands is the true challenge. Here are some examples of redirecting input and output files.

- **Input file other than keyboard.** This is A/UX's way of sending information from a file instead of from the keyboard. As an example, instead of typing a message to someone, you can send the contents of a file that contains the message. This is done with the < symbol, which is followed by the name of the file with the message. Here is an example:

```
mail messages < memo1
```

This command line tells A/UX to use the file `memo1` as the input file for the command `mail` and send to the directory `messages`.

- **Output to another command.** Output files normally go to your screen or to an output device. You can also redirect A/UX output file to another command. This allows you to combine two or more commands, thus saving you time and command steps. Here is an example:

```
$ sort figures > salestm
```

```
$ inquiry < salestm
```

These two lines will generate a list of figures and store them in a file called `salestm`. A **pipeline** allows you to redirect the output of the first command line to the second command line. This command would look like this:

```
$ sort figures | inquiry
```

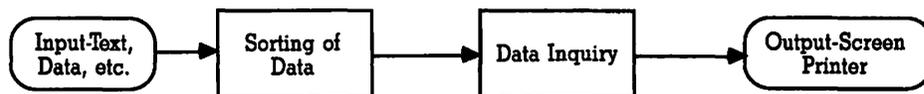
The vertical line (|) is a *pipe facility* that creates a *pipeline* flowing one output request into another output. Figure 4.14 shows a visual rendering of piping commands.

The foregoing are just two methods for redirecting input and output from the screen defaults. You can also blend input and output files to create a final output file. This is done with the `cat` (short for **concatenate**) command, one of the most widely used commands in A/UX. With this command you can blend two or more files into one. The following command lines illustrate the `cat` command:

```
cat letter memo resigna
```

```
cat myfile yourfile > ourfile
```

FIGURE 4.14 Piping commands



The first line prints out the files `letter`, `memo`, and `resigna` to the standard output (probably your screen or printer). The second line concatenates the files `myfile` and `yourfile` into a third file called `ourfile`. A handy feature if you want to blend information from one file to another. The `cat` command can also be used with flag options. For example, when the `cat` command is used with the `-v` flag option, nonprinting characters such as Control characters and other ASCII codes are printed. This would be like printing a Microsoft Word or WordPerfect document with all of the hidden codes printed out. The following line would print out all ASCII codes and control characters:

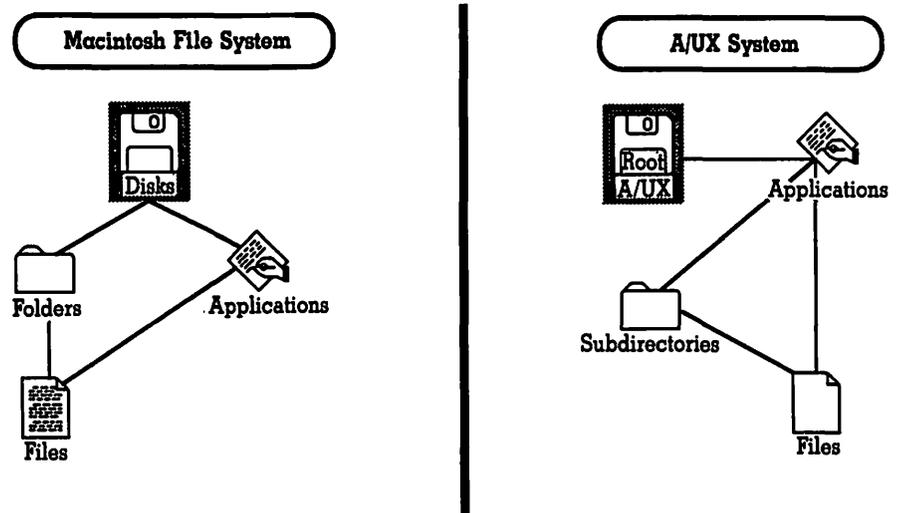
```
cat -v letter1
```

Control characters are printed with a caret. For example, a Control-X would print out like `^X`. A Delete character is printed as `^?`.

The command structure of A/UX (and UNIX) is one of the features that make any UNIX system complex, but it is also what gives A/UX its power. The Command Reference Manuals from Apple offer an excellent reference for all of the various commands available in the A/UX system.

File System

You have learned a bit about the A/UX command structure. Your commands won't do you much good if you do not understand the A/UX file structure. The A/UX file structure is the same as the UNIX file structure and not too dissimilar from the Macintosh hierarchical filing system. Unfortunately, the A/UX file system is far more complicated to navigate in and around—no friendly pull-down menus, icons, or folders. Probably a closer analogy would be to compare the A/UX file system structure with MS-DOS. As you read on, you will see the similarities. Figure 4.15 shows how the A/UX file system compares with the Macintosh HFS.

FIGURE 4.15 File systems compared

Directories

A/UX is a collection of files, each of which has a unique name. These files are then organized into *directories*. A/UX also treats directories as special system files and assigns names to each directory. These directories act like “file cabinets” that store user and system files. Directories are organized in a type of hierarchical file system called a *tree structure*. The tree structure of the A/UX file system is shaped like an inverted tree with the base, or root, at the top and the branches extending out from the root. Figure 4.16 shows the tree structure of the A/UX file system.

Any directory can contain subdirectories that in turn can contain more files. In the language of UNIX (and A/UX), a subdirectory is called “child” and the main directory holding the subdirectory is aptly named “parent.” In order to put to rest any comments that A/UX is “sexist,” you should know that any parent directory or child subdirectory is androgynous; that is, there is no sex attributed to the parent or child. The tree structure in Figure 4.17 shows the relationship of directories and subdirectories.

FIGURE 4.16 A/UX tree structure

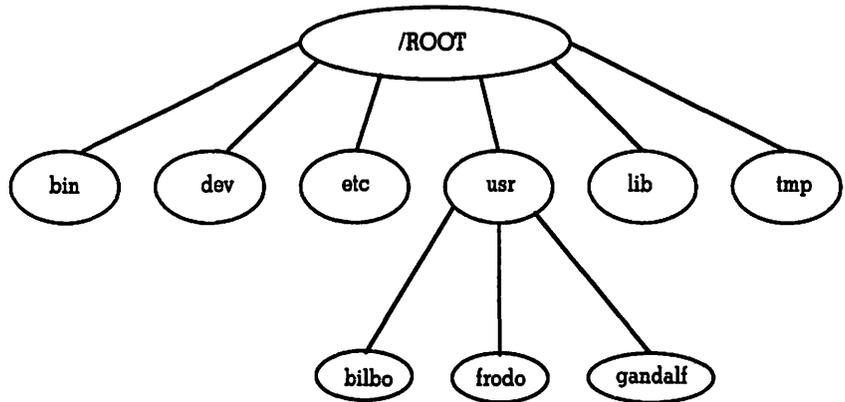
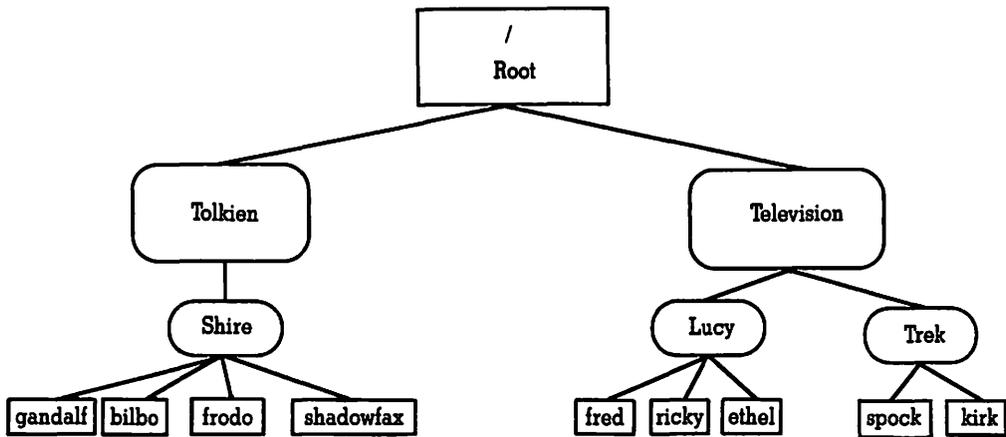


FIGURE 4.17 The family tree



Legend

 == Directories

 == Subdirectories

 == Files

As you can see, the directory `users` is a parent to three subdirectories (children). In turn a subdirectory may also have a child directory associated with it. As the figure shows, `users` is a parent to `bilbo` and `frodo` is a child to `bilbo`. In turn `shadowfax` and `rings` are files of `frodo`. Confusing? Many complex UNIX systems publish directory maps like the one shown. These UNIX directory maps guide users to appropriate subdirectories.

In order to tell A/UX where to go (after one hour with this system you may be longing to tell A/UX where to go), you must provide the system with *pathnames*. A pathname is a file that is preceded by its directory location. As an example, suppose you want to get to the file `rings`. Use the map in Figure 4.16 to visually trace the pathnames that take you to the file `rings`,

```
/users/bilbo/frodo/rings
```

The first `/` represents the `root` directory. Pathnames can be absolute or relative.

Relative Pathnames A relative pathname is relative to the directory and subdirectory you are currently in. For example, if you are currently in the directory `users` and the subdirectory `bilbo` and you want to get to the file `shadowfax`, then the command

```
frodo/shadowfax
```

is the relative pathname for

```
/users/bilbo/frodo/shadowfax
```

Relative pathnames never begin with a `/`.

Absolute Pathnames Absolute pathnames list all of the directories leading to your file.

```
/users/bilbo/frodo/shadowfax
```

However, if you are already in the subdirectory `frodo` then to get to the file `shadowfax` you would simply type,

```
shadowfax
```

Another way of viewing absolute pathnames is to think of them as a straight line to what you are looking for. Absolute pathnames always begin with a / (representing the `root` directory) unless you are in the directory that contains the file you want.

The filename is always the last name on the line. When you first log on to A/UX, you are in your `HOME` directory. Your home directory may be in some other subdirectory, but you can find out the absolute pathname of your home directory by typing `echo $HOME`.

Viewing the Current Directory No matter which directory or subdirectory you are in, you can find out where you are in the A/UX system. To find out where you are, type

```
pwd
```

This is short for **print working directory**. `pwd` prints out the absolute pathname of your working directory. Using the map in Figure 4.17, if you were in the subdirectory `frodo` and you typed `pwd`, A/UX would respond with

```
/users/bilbo/frodo
```

If you are a novice A/UX user, you will find yourself using the `pwd` command many times. The `pwd` is maybe the simplest A/UX command (a contradiction in terms no doubt). `pwd` has no options, takes no input (or prisoners), and produces a single line of output.

Changing Directories You may often find yourself buried deep within A/UX directories. To simplify accessing files, you may want to change to a directory that is closer to your working files. This requires you to change directories. You do this by typing `cd` (**change directory**) followed by your pathnames, for example,

```
cd / date/great/good/ok/bummers
```

This line would make `date` the current directory. The `bummers` files can now be more directly accessed with a simple absolute pathname. You can jump to any directory by using the

`cd` command. Once you have moved to another directory with the `cd` command, this new directory becomes your current directory. If you use the `cd` command without specifying a directory name, you are moved to your home directory.

File Security

A/UX is a multiuser system. This means it is possible that you are not the only one working within the file system. In fact, you might not be alone in a directory or a file. You may even be in the twilight zone of directories (this only occurs when file and directory permission allow it). In other words, you may be allowed in someone's directory but not in their files. If a file has both read and write permission for all users on the system, then anyone can have access to the file and can make permanent changes. A file with read-only permission means users can "look but not touch." The system administrator may set permissions for certain system directories and files and for certain users. Users on the other hand can set permissions for individual directories they own. Each file also has a group owner who owns a group of files. The same levels of security can be set for groups. There are three levels of security in A/UX:

1. **Read access.** Users can simply examine a file's content. The file can be displayed on your screen, printed, copied to another directory, etc.
2. **Read-write access.** The file can be read and written to. The file can be altered or even deleted.
3. **Execute access.** This level allows execution of a file as a program. Without this permission, users may not run executable programs.

The A/UX automatically establishes preset permissions linked to the specific directory you are in. You can, however, modify these permissions. The A/UX command to alter permissions is

`chmod`

The command `chmod` is short for **change mode**. When you use `chmod`, you add either add (+) or remove (-) for establishing read, write, and execute permissions. Figure 4.18 shows the command structure for `chmod`.

Here is a breakdown on each of the components of the `chmod` command.

1. **Access classes.** One or more of the three types of user groups. These are:
 - u The user and owner of the files and directories being changed.
 - g A group: members of the group of users to which you belong.
 - o All others: all the other users on the system.
2. **Operators.** The operator is either a + (grant) or - (deny). Operators must be one or the other; they cannot be both.
3. **Permissions.** As discussed, there are three types of permission:
 - r Read-only
 - w Read and write
 - x Execute

You can grant or deny (+ or -) more than one type of permission per file/directory. For example, you can grant w (**w**rite) permission to a file but deny x (**e**xecute).

4. **Filename list.** This is the list of files or directories whose permissions are about to be changed (and you don't have to go to Sweden to do it). Either relative or absolute pathnames can be used.

FIGURE 4.18 Structure of `chmod`



Believe it or not, A/UX offers another way to change permissions. The method just described uses *letters* to change permissions. A/UX calls these *symbols*, and this method for changing permissions the *symbolic method*. The other method to change permission is the *numeric method*. The numeric method uses three *octal* digits, which equals one octal number to assign the permissions. If you want to use this method over the symbolic method, check the A/UX Command Reference Guide from Apple, take two aspirin, and see a psychologist.

Making Directories

Before you can make a new directory, you must have write and execute permission in the parent directory. Now you need to move to the directory where you want to create the new directory. Once you are in the appropriate directory, you create a new directory by typing

```
mkdir thebest
```

The command `mkdir` stands for **make directory**. Once the directory has been named, you can create files to put in it or copy files to it.

Removing Directories

Removing directories is done with the `rmdir` (**remove directory**) command. Directories with subdirectories or files cannot be removed until they are emptied. If you attempt to remove a directory that has files or subdirectories, you will get the message

```
:rmdir: thebest : Directory not empty
```

You also do not have to be in the specific directory to remove it. Directories can be removed anywhere in the A/UX files system by supplying the absolute or relative pathnames.

Listing File Names

To see the contents of a directory or subdirectory in the MS-DOS, world you would simply `dir` at any command prompt. The result would be a listing of the contents of the specific directory you

might be in. In the A/UX world, life is not so simple. The command to list files in an A/UX directory is `ls` (list). There are several ways to view the files in a directory with the `ls` command.

`ls` Returns a simple list of files within a directory except those files that begin with a dot (`.`). Typing `ls /sales` returns these files from the directory `sales`:

```
west
east
midwest
southwest
southeast
lettersw
lettersmw
```

`ls -a` Lists all the files in a directory including those files that begin with a dot. Typing `ls -a /sales` returns the following list:

```
.
..
.offices
west
east
midwest
southwest
southeast
lettersw
lettersmw
```

The `.` and `..` signify the current directory and the parent directory. This is actually very similar to viewing DOS directories and subdirectories.

`ls -l` Offers the most complete listing of files. Typing `ls -l /sales` returns this:

1	2	3	4	5	6	7
total 3						
drwxrwxr-x	2	user	bilbo	53	May 3 09:00	frodo
-rw-rw---	1	user	bilbo	231	May 3 09:40	shadowfax
-rw-rw---	1	user	bilbo	345	May 9 10:00	rings

While this listing looks quite cryptic, it contains all of the elements of the A/UX file structure previously discussed. The column numbers at the top of this listing is *not* part of the way A/UX lists your files with the `ls -l` command. Those numbers were added to simplify the explanation. Here is what each column contains:

Column 1. File type and permissions. The first character tells you what type the file is.

`d` = *director*

`-` = *regular A/UX file*

Right after the file type is the files permissions. The first three letters (after the `d` or `-`) signify permissions for the first file, `user`. In this example, `user` has read, write, and execute permissions. The next three letters show permission for the file `bilbo`. The last three letters indicate permissions for the file `frodo`. As you can tell, some of the files do not allow read, write, or execute access. This prohibition is signified by three dashes (`---`).

Column 2. Link counts, to be discussed later.

Column 3. This is the login name of the files' owners.

Column 4. The group name. Every file can be placed in a group directory (which is also considered a file by A/UX). The group to which this particular file is connected is `bilbo`.

Column 5. This is the size of the file. The size is listed in bytes.

Column 6. This date is the modification/creation date and time. All A/UX files are time- and date-stamped. Any modification by any users results in a new date and time being stamped on the file. A/UX's time- and date-stamping facility is a reason why it is important to properly set your date when setting up A/UX for the first time. Without setting your minutes from GMT, A/UX files created in the Eastern Time Zone and sent to the West Coast would be time-stamped three hours later. If a user did not know the files came from the

East Coast, it would appear as if the files had been created three hours into the future. We all know the Mac II is fast, but not that fast!

Column 7. The final column is the actual file name.

Viewing a File

Once you manage to find your file in A/UX, you probably would like to take a look at it. To view a file's contents, you use the Page command. In A/UX this is `pg`. The `pg` command allows you to view your file one page at a time. After you view the first page, A/UX waits for an additional command. Additional commands offer you a number of different ways to view your file. When you first enter the `pg` command, you will see a screenful (23 lines) of your file followed by a colon (:). At the colon you can enter any one of the following commands:

<code>h</code>	Help—displays a list of available <code>pg</code> commands.
<code>Return</code>	Goes to the next page of text.
<code>d</code> or <code>Control-d</code>	Shows additional half page of text.
<code>.</code> or <code>Control-l</code>	Redisplays current page of text.
<code>l</code>	Shows next line of text.
<code>n</code>	Goes to the next file specified in the command line.
<code>p</code>	Shows the previous file specified on the command line.
<code>f</code>	Skips the next page of text and displays the following page.
<code>q</code> or <code>Q</code>	Quits the <code>pg</code> command.
<code>\$</code>	Shows the last page of text in the selected file.
<code>w</code> or <code>x</code>	Sets the window size and shows the next page of file.
<code>/pattern/</code>	Searches <i>forward</i> looking for specified characters (patterns).
<code>= savefile</code>	Saves your file in a specified directory (savefile).
<code>?pattern?</code> or <code>^pattern^</code>	Searches backward for specified characters (patterns).
<code>!command</code>	Executes a command.

As you can see, there are quite a number of ways for viewing files. To execute any of these `pg` commands, just type the command after the colon followed with a Return. The `pg` command can also be preceded by a number, as follows:

- +1 Shows the next page.
- 1 Shows the previous page.
- 1 Shows the first page of the file.

When you reach the end of of your file, A/UX shows the end of file prompt:

(EOF):

At the (EOF) prompt you may either quit and return to the shell by typing `q` or `Q` or you may issue one of the `pg` commands.

Printing Files

Now that you know how to view and page through a file, it might be nice to print it. This is done with the `lp` command. If you have an ImageWriter or a LaserWriter attached to the network, you can send a file to either one by specifying which printer you want to use. To print the file `shadowfax`, you would enter the command

```
lp shadowfax
```

A/UX returns the message

```
request id is 310 (1 file)
```

The number is the printer number that A/UX uses to identify the printing job. A/UX provides you with a print spooler. If there are others printing at the same time you are, you will be put into a print queue. Your file is then printed when A/UX gets to your file. If you know there will be several users using the printer, you may want to see the list of the print queue to get an idea of how many other print jobs are ahead of you. To see the queue list, type

```
lpstat -0
```

Your queue list looks something like this:

```
lp-234    rings    10345    Apr 1 09:30
lp-137    sales    9834     Apr 1 09:35
lp-113    frodo    11256    Apr 1 09:37
```

If it looks as if your print job will take too long to print, you can cancel. To cancel your print job, type

```
cancel 310
```

You get the A/UX message

```
request 310 canceled
```

The number is of course the print job number given to you when you issued the `lp` command.

Renaming Files

Renaming and moving files are done with the same A/UX command. The `mv` command not only allows you to rename a file but also move that file into another directory. For example,

```
mv frodo freda
```

This line would rename the file `frodo` to `freda`.

CAUTION: Renaming files will cause A/UX to overwrite any files in your directory with the same name. To avoid this, use the `-i` flag option.

When you add the `-i` flag option, A/UX provides an overwrite prompt. This prompt is

```
mv -i frodo freda
```

The `-i` flag option forces A/UX to respond with

```
remove freda
```

before it overwrites the file. If you respond with a `y`, then the already existing `freda` file will be overwritten. An `n` response cancels the operation.

These examples allow you to rename a file. If you use the `mv` in conjunction with directory pathnames, then you can move files to a different directory, for example,

```
mv frodo /users/bilbo/gandolf
```

This command moves the file `frodo` to the directory called `gandolf`.

Removing File Names

To remove a file, use the `rm` (**r**emove) command. If you use the `rm` command by itself, your file is permanently removed. If you want A/UX to prompt you before the file is removed, use the `-i` flag option. The line

```
rm -i frodo
```

tells the system to prompt you with

```
rm: remove frodo?
```

Respond with `y` to remove the file or `n` to cancel the operation.

CAUTION: Like the `mv` command, the `rm` command must be handled with care. It is always safest to use the `rm` command with the `-i` flag option.

Copying Files

As most of us computer maniacs know, it is always a good idea to copy your files for backup purposes. Sometimes, however, it is nice to make a copy of a file and give it a different name. In

A/UX this is done with the `cp` (**copy**) command. The following example illustrates the copy command:

```
cp -i shadowfax.oats horse.food
```

This line creates the file `horse.food` that is identical to the file `shadowfax.oats`. If you already have a file with the name you are copying to, then the `-i` flag is used. Like the `rename` and `remove` files command, the `-i` option causes A/UX to return the `overwrite` prompt. There are a couple of rules to know when copying files in A/UX:

1. You cannot copy a file to itself in the same directory. If you do, you will get the prompt

```
cp: Cannot copy file to itself
```

2. You may have files with identical names in *different* directories. To accomplish this, you must use complete pathnames, as an example,

```
cp shadowfax.oats /users/bilbo/gandolf
```

This example copies the file `shadowfax.oats` to the directory `gandolf`. The original `shadowfax.oats` file in the `bilbo` directory has been left untouched.

A/UX Text Editing

You need to know right up front that text editing in A/UX will not be like using MacWrite or MS Word. Unlike these word processors where you have a nice, easy, command structure to follow, fully integrated editing and formatting functions, mouse support, and a WYSIWYG (**What You See Is What You Get**) screen, A/UX requires you to follow some strict rules of the road. For example, once you open a file into an A/UX text editor, you have to enter commands to tell A/UX where you want to go and what you want to do. If you want to enter, or insert new text, then you have to change modes. In other words, you cannot enter and edit text in the same mode. If it sounds like a hassle, it is. However,

once you get used to it, A/UX text editors can be quite powerful and fast. You enter the commands and A/UX executes them and changes your file. Essentially, there are two parts to processing text in A/UX, *text editing* and *text processing*.

Text editing is concerned with the entry and edification of your text documents. Text processing deals with the formatting of your text. You do not format text with text-editing tools. This section is concerned with text editing in A/UX. Text editing contains specific tools that allow you to enter text with the keyboard, store your text (file), and then recall the text and modify it. You use one of two “types” of editors in A/UX to edit text, *interactive* or *stream*.

There are differences between the two editors. The interactive editors allow you to enter text and specific text-editing commands *while* you are viewing the text. The stream editor, a quicker but somewhat more imprecise method of editing text, allows you a single run-through of your text. During this run-through, you can tell A/UX how you want the text edited; however, you won't see the editing right away, you are just entering the text-editing commands. The stream editing commands are kept in a temporary file for execution later. The stream editor is much faster than the interactive but, as you will see, less reliable and less creative. The interactive editor has three primary editors and the stream editor is a solo act. Selecting the type of text editor you want to use depends on your needs, file size, and the amount of time you want to spend editing your text.

Interactive Editors

There are three interactive editors, each of which allows you to perform different functions. The easiest to use is the `vi` editor. Somewhere out in UNIX land there is someone who knows what `vi` is short for. Many rumors abound, but few seem founded in fact. One candidate was **v**isual **i**nput. Another was **v**icarious **i**nformation. More than likely, `vi` stands for something uncreative like **v**isual editor (if the truth be known). In the world of computers it is hard to separate rumor from fact. Suffice it to say, `vi` is a text editor, period! However, I am sure someone out there knows the answer to the true meaning of `vi`! Other editors include the `ed` editor (somewhat redundant), the `ex` editor, and the `sed` (**s**tream **e**ditor). You will spend most of your time

in `vi`. However, if you enjoy having your fingernails pulled out and six-hour judo workouts, then the `sed` text editor may just be your cup of tea. Basically, the `sed` editor is viewed as an *advanced* text editor while `vi`, `ex` and `ed` are reserved for us sissies. To be fair, `ex` is really just another mode of `vi` and performs functions very similar to those of the `ed` editor.

`vi` is of course a screen editor that displays the contents of a file one screenful at a time. In `vi`, when you type a command to add or change text, the screen is immediately updated to reflect the changes. `ex` is a line editor. You edit your text one line at a time with `ex`. When you are in `ex`, you have to specify the line numbers you wish to work with. Also, your editing changes are not seen as quickly as in the `vi` mode. Many users, however, prefer the speed of the `ex` mode. Most of the basic text editing commands are the same for `vi` and `ex`.

Before you can begin using the `vi` editor, you must enter the editor and identify the file you want to edit. This is done by entering the following command at the A/UX command prompt:

```
vi filename
```

The term *filename* is whatever file you want to edit. You can edit an existing file or create a brand-new file with the `vi` editor. `vi` uses the entire screen to edit the file you want. This is unlike the `ed` editor that edits one line at a time.

Once you have opened (or created) a new file, you cannot just jump in and start typing. The `vi` editor has two modes of operation, *command* and *insert*.

Command Mode When you first enter the `vi` editor, you are in the *command* mode. This means that `vi` assumes everything you type is an A/UX command. As you type something in, `vi` tries to execute it as a command. Not very convenient for writing that letter to the boss. To change from the command mode of `vi` to the insert mode, you type

```
i
```

Insert Mode Typing `i` places you in the *insert* mode of the `vi` editor. Now you can start typing. While you are in the insert mode, everything you type is placed in a temporary "text buffer."

You see your file on the screen, but A/UX does not create a “real” file until you return to the command mode and issue an A/UX save command. In essence, the `vi` editor creates two copies of your file. The first copy is kept in the text buffer until saved. Once it is saved, you have a “real” A/UX file. If you go back to work on your file, the `vi` editor uses the copy of the file in the text buffer. The “real” file is left unchanged until you use the save command again. The `vi` save command is

```
:w
```

As long as you periodically save the file you are working on, you never have to worry about losing your master file. To leave the `vi` insert mode and go back to the `vi` command mode, press the Escape key.

Moving Around in `vi` Once you have called up or created a file, the `vi` editor offers various ways to move around in your text. First, there are some keys that perform some special functions for you in `vi`. The Return key terminates all commands on the `ex` command line. In the normal command mode you do not have to press Return. The Escape key ends the `vi` insertion mode and takes you back to the `vi` command mode. `CONTROL-c` provides an interrupt that stops `vi` from executing a command that is already started. `CONTROL-c` works in a similar fashion to `COMMAND-period` (`.`) in Macintosh applications.

A/UX supports the arrow and Delete keys on the Macintosh keyboards in the `vi` command mode only! The arrow keys move the cursor in the direction of the arrows while the Delete key deletes one character to the left. These keys, when used in the `vi` command mode, are preceded by a number. The number indicates how many spaces you want to move. These are the *simple* commands. What follows is a listing of the more useful and widely used *motion* commands. Motion commands are essentially what their name implies, a way to move the cursor in the file without affecting the contents of the file. Generally one-letter commands, they dictate the direction of cursor movement in your file. Most often these motion commands are preceded by a number that tells the `vi` editor how many spaces to move in a specific direction.

As an example, you opened the file rings by following the correct path,

```
users/bilbo/frodo/rings
```

Once you have opened the file with `vi`, you need to change the third word on line 7. You first need to move to the seventh line. The following three `vi` commands do this:

```
7+
```

```
7j
```

```
7↓
```

Any one of these commands moves your cursor to the beginning of the seventh line of your file. Remember, when you first enter the `vi` editor, you are in the `vi` command mode. This is the mode where you enter these movement commands. The insert mode is where you actually change the text. Now that you are at the beginning of the seventh line, you need to move to the third word where you want to begin your changes. The `vi` movement command you want to enter is

```
3w
```

This moves the cursor to the third word on line 7. Simple, hey?

Of course, as you have probably noticed, there are no line numbers on your screen. To find what line you are on in your file, type `G` (note, this is a *capital* G). This command moves you to the end of your file. Now type a `CONTROL-g` (lowercase `g`). This command prints the name of the file and the line number you are on. To jump back to your cursor position in your file, type the back quote twice. *Voilà!* You are back at your cursor point. You can also display your line numbers with the following command:

```
:set nu
```

You will now see line numbers along the left column. To turn line numbers off, type the command

```
:set nonu
```

The numbers disappear.

ex Now that you are getting the feel of moving around in the *vi* editor, you should know that there is a command that jumps you a specified string. It works very much like the Find command in word processors. To find a particular string, you have to enter the **ex** command line. As you recall, **ex** is a line editor. This means **ex** allows you to work on one at a time instead of an entire screenful of text. To look for a specific word or series of characters, type the backslash (****) key. This moves you to the **ex** command line. At the **** prompt, type in the word or characters you are looking for. For example, if you wanted to find the word *Great* in your file, you would type

```
/Great
```

This will take you to the first occurrence of the word *great*. There are a large number of wildcard characters and string expressions that can be used to search for very specific occurrences of words or characters. For a complete listing (a small book in itself) see the appropriate A/UX reference guide.

Changing Text The *vi* editor lets you change text. You replace text by deleting text and inserting new text, both of which happen at the same time. There is even an Undo command. If you are in the insert mode, then the new text you type either pushes the existing text to the right or changes the text according to the commands you type. As you can see, you use the insert mode to add and change text and the command mode to move around or delete your text. Like moving around in the *vi* editor, the commands to change text use numbers associated with the commands to determine how much text you want to change. For example, the command

```
2r
```

lets you replace two characters. Most of the change commands require you to press the Escape key after entering the command.

Macros A/UX allows you to create macros within the *vi* editor. The A/UX terminology for macros is **map**. Once in *vi*, you change to the **ex** line editing mode by typing a colon (**:**). The **map** (macro) lasts only as long as your current editing session.

If you want to keep your `map` on a permanent basis, you have to insert it in your `login` file. Single keystrokes and function keys can be set up as `maps`. The format for creating a `map` in the `ex` line editing mode is

```
:map string definition <RETURN>
```

String is a single keystroke or function key. **Definition** is the `vi` command you want as a `map`.

NOTE: A string cannot be longer than ten characters and a definition cannot be longer than 100 characters.

There is one very important command to use in creating a `map`,

`CONTROL-v`

`CONTROL-v` allows you to use “nonprinting” commands in your `map`. These commands might be such things as carriage returns (CR), blank spaces, escapes, tabs, etc. A/UX `maps` can be quite complex or very simple in design.

NOTE: When creating a `map` with `CONTROL-v` commands, any commands following the `CONTROL-v` are included in the `map`. To end the `CONTROL-v` sequence, insert another `CONTROL-v`.

`maps` can also be “linked” together. You simply create a `map` that ends by calling another `map`, which ends by calling another `map` and so on. Here is an example of a simple A/UX `map`. This `map` makes one character, `q`, quit `vi` and write (save) the file.

```
:map q :wqCONTROL-v<CR><CR>
```

The normal A/UX command for this function would be

```
:wq<CR>
```

You can also incorporate function keys into your map. The strings 0 through 9 correspond to the appropriate function keys.

ed The **ed** editor is similar to **ex** but contains more powerful commands. Like **ex**, **ed** is a line editor; that is, it allows you to edit your text one line at a time. Unlike **ex**, **ed** is a command-oriented editor. **ed** accepts commands given to it just as you do when you are in an A/UX shell. **ed** accepts the user command and then performs (or executes) the operation. Sounds simple but it isn't. The **ed** editor requires the user to be extremely familiar with the editing commands. The command structure for editing a file with **ed** might look something like this:

```
$ed          starts the ed editor
r hobbits   ed reads the file results into the buffer
290         ed provides the file length
7,8,9p      ed prints lines 7, 8, & 9 to your screen
```

```
bilbo  baggins  shire  rings  112  040188
bilbo  baggins  shire  rings  213  041288
frodo  baggins  shire  rings  515  051288
```

```
7,8s/bilbo/gandolf/      —ed substitutes text
```

```
gandolf  baggins  shire  rings  112  040188
gandolf  baggins  shire  rings  213  041288
frodo    baggins  shire  rings  515  051288
```

```
w        writes the new text to the file
290      file length is not changed
q        quits ed
$
```

In case you are wondering, this example is a simple search-and-replace command, or at least one method for searching and

replacing. In `ed`, you can make some complex pattern searches either forward or backward in your file. These can include:

- Wildcard matching of one or more character
- Matching of text only at beginning or ending of lines
- Exact matching of characters on the screen.

Here are some common `ed` commands that are used the most often. You can assign numbers (n) with them to tell `ed` how many times you want the command repeated.

- (n)a Adds new lines.
- (n)i Inserts new lines.
 - r Reads the contents of a file.
- (n)d Deletes lines.
- (n)m Moves lines.
- (n)t Copies lines.
 - j Joins two lines to make one line.
 - s Substitutes one piece of text for another.
- (n)c Changes (replaces) lines.
 - p Prints lines to your Mac II screen.
 - n Prints lines to your Mac II screen with line numbers.
 - l Prints lines with nonprinting characters (ESCAPE, CONTROLS, <CR>, etc.).
 - h Help screen.
 - u Undo—like the Mac, only the last command given.
 - w Writes the file to your directory.
 - q Quits the `ed` session.

There are of course *many* more commands associated with `ed`. Complete commands are listed and illustrated in your A/UX manuals.

As powerful as the `ed` editor is, there is one major drawback. The `ed` utility is only capable of working with files that fit into the main memory-editing buffer. This is generally 40 percent to 65 percent of your RAM space, depending upon your system. Large files will have to be broken into smaller segments or edited with the stream editor.

Stream Editor

The A/UX mnemonic for the **stream editor** is **sed**, another of A/UX's text editors. Like **vi**, **ex**, and **ed**, text can be entered and changed (not formatted, however). Even though these editors all edit text, there is a difference between **vi**, **ex**, and **ed** and the **sed** editor. The **sed** commands are quite complex, too complex to be presented in this chapter in their entirety.

As you have found out, when you edit an A/UX text file, the original is left untouched until you issue a write (save) command. The editing is done on a copy of the file that A/UX creates and places in a special buffer. None of your edifications have been done on the actual file, just the file in the buffer. Then, once you have made your changes in your text using **vi**, **ex**, and **ed**, you can take a final look at your edited file (it is still in the text buffer) and then write the permanent file to your directory. With **sed**, your file is still held in a text buffer but **sed** maintains just the editing changes in a file. Neither your buffer file nor the original file is changed until you give **sed** the command to write the changes to your files. Once you get used to it, **sed** is a much faster text editor than either **vi**, **ex**, or **ed**. You can also edit much larger files with **sed**.

When you edit with **sed**, you essentially create an editing "script." This script tells **sed** what file you want to edit, what line(s) you need to edit, and what you want to edit. An example **sed** script might look something like this:

```
sed -e 's/\.dc\./dec./' -e 's/\.3b\./u3b./'
```

This example replaces specific occurrences of certain letters in a file (whichever file you specified).

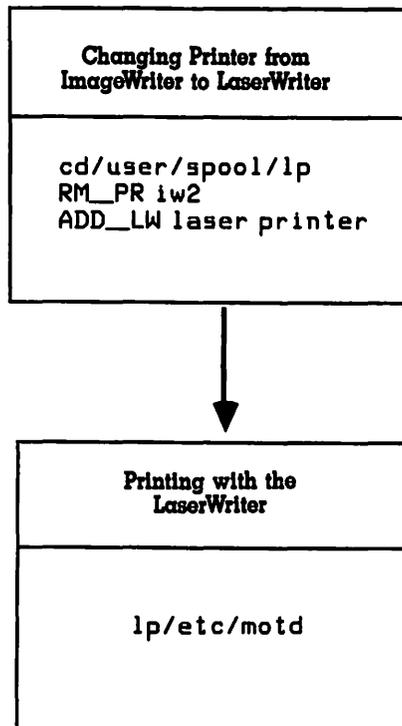
A/UX Text Formatting

As you have seen, there are several editors that allow you to edit your files. In A/UX, however, editing text does not mean your text will be formatted correctly. You have to view text editing and text formatting as two separate A/UX functions. Each of the functions has its own set of unique A/UX tools. As you have read, text editing uses the tools associated with **vi**, **ex**, **ed**, and **sed**.

Text processing also has its own unique set of formatting utilities. The diagram in Figure 4.19 illustrates the A/UX process that produces a printed copy of your file.

Text-processing tools allow you to perform a number of useful formatting functions on your files. For example, you can imbed special codes to print your file to a laser typesetter or LaserWriter. The same file can be formatted to print on your ImageWriter. You can format tables, charts, equations, and even create formatting macros. In addition, A/UX offers you the capability to produce line drawings and graphs. What follows are the highlights of these text-formatting tools. Please refer to your reference manuals for more details.

FIGURE 4.19 A/UX process for producing a printed document



troff/nroff

Two programs offer the standard formatting commands. `troff` is designed to format your file for output to a typesetter or LaserWriter. `nroff` formats files for other printers such as ImageWriters and letter-quality printers. Both `troff` and `nroff` are compatible with each other. This means that a file formatted with `troff` can be used in `nroff` to be sent to an ImageWriter for draft purposes. Sounds a bit like Sesame Street, doesn't it? Suffice it to say, `troff` and `nroff` are generally used in the same breath. A file formatted in `troff` will still print out in `nroff`, only your output is adjusted to the output device you are using. With `nroff`, this output device will generally be your Mac II screen or ImageWriter. `troff` is used to format your files for output to one of Apple's LaserWriters.

There is a way to envision working with both `troff` and `nroff`. Think of using MS Word with *all* of the hidden codes turned on. Not only are the codes turned on, but you can alter them to produce a document any way you want. Of course the Macintosh way of text processing would be long gone. Instead, boldfacing a single word would require you to enter the appropriate codes. `troff` and `nroff` are just like this concept. However, A/UX is not totally unaware of "ease of use." A/UX offers users a very *large* set of text-processing macros that are used in conjunction with `troff` and `nroff`.

mm

The `mm` mnemonic stands for **m**emorandum **m**acros. Actually, these macros have nothing to do with writing or sending memorandums. Rather they are a collection of general-purpose text-formatting macros used in conjunction with `nroff` and `troff`. As a user you can write your own macros or use the many macros provided by A/UX. A/UX macros are split into two different categories, `mm` and `ms`. Approximately 156 different `mm` macros cover such formatting capabilities as the following:

- Page headers and footers
- Changing fonts, styles and sizes
- Creating tables of contents

There are approximately 84 `ms` macros that offer simplified formatting commands different from the `mm` macros. These are commands for the following:

- Left and right margins
- Centering
- Printing date and time
- Setting indents and tabs
- Setting one- or two-column printing

There are of course many more formatting features controlled by these A/UX macros. Here is an example of a very simple macro that indents a line and adds the number 2.

```
.IP (2)
A typical line to be indented.
```

The `.IP (2)` macro produces a line that looks like this:

```
(2) A typical line to be indented.
```

tbl (Tables)

The `tbl` program works with `troff` and `nroff` and allows you to select specific files and have them formatted in tabular fashion. You can even add vertical and horizontal lines and boxes in your table. The `tbl` command is generally used with other commands. These other commands are what add the lines and boxes or center your data in the table. Here is an example of a `tbl` being used to create a simple table contained within a box:

```
.TS
expand box center tab(:) ;
cs
1|1
Love Pairings
—
John:Martha
Adam:Eve
Yin:Yang
Fred:Ethel
Oscar:Felix
```

The resulting output would look like this:

Menu	
John	Martha
Adam	Eve
Yin	Yang
Fred	Ethel
Oscar	Felix

eqn (Equations)

The `eqn` is a mathematical equation formatting program and works with `troff` and `nroff`. `eqn` may be one of the easiest programs to use when formatting. `eqn` automatically understands how most mathematical equations should be formatted and even understands Greek letters and special math symbols. The following example illustrates the `eqn` operation.

```
.DS I
.EQ
x = k (z over 3) / z over 3
.EN
.DE
```

This would produce the following output:

$$x = y \left(\frac{z}{3} \right) + \frac{z}{3}$$

pic (Pictures)

The `pic` program allows you to draw simple graphics within `troff`. `pic` works in similar fashion to `tbl` and `eqn`. That is, `pic` begins with the commands `.PS` and ends with `.PE`. `pic` starts with the command line

```
pic name of file | troff -mm
```

When you are formatting with `t r o f f`, you can specify the location in your document where you want a picture to be. Pictures can be circles, squares, ellipses, lines, arrows, or arcs and may contain text. An example might be:

```
ellipse '\s18\f2Yo Dude!\f1\s0
```

This line would produce an output like this:



Mac users are accustomed to creating graphics by simply drawing them. With applications designed to run under A/UX, you will have this option. When working in the basic A/UX system environment, the `pic` program is used.

grap (Graphs)

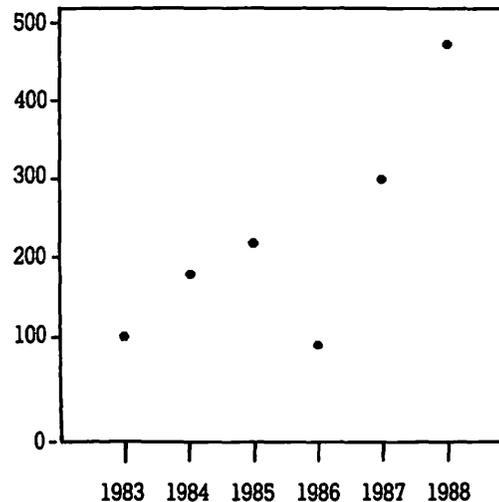
The `grap` program will draw simple to complex graphs and charts. `grap` works in conjunction with `pic` in the `t r o f f` formatting mode. Like `pic`, you define your chart with `.G1`, the start command, and `.G2`, the end command. The general format for `grap` is:

```
.G1  
Chart specifications and data  
.G2
```

The following example illustrates `grap`.

```
.G1  
1983    100  
1984    189  
1985    210  
1986     75  
1987    300  
1988    450  
.G2
```

This data produces a graph that looks like the one shown in Figure 4.20.

FIGURE 4.20 Graph produced by grap format

This is nothing fancy, but additional commands allow you to add text, lines, and other embellishments.

A/UX Shells

The A/UX system has three shells for users—the Bourne Shell, the Korn Shell, and the C Shell. Shells are A/UX utilities or system states that accept user commands, interpret those commands, and then send the commands to the system for execution. You always know you are in a shell because of the \$ (dollar sign) prompt. Whenever this shell prompt is present, A/UX is awaiting your input. All shell prompts can be redefined, and users can access files in their user directories.

The three shells are similar yet slightly different from each other. Each of them allows you access to the standard functions and commands that you will use the majority of time. The primary differences you will see in the shells show up when you want to program within them.

- **Bourne Shell.** This is the standard shell that you begin the A/UX system with. The Bourne Shell is also the fastest and most efficient shell to program. Programs written in the Bourne Shell will run two to five times faster than programs written in the C Shell.
- **Korn Shell.** The Korn Shell primarily provides provides job controls. This means you can switch back and forth between different jobs. In other words, multitasking. Within the Korn Shell, one job can be processing while you begin an entirely different job.
- **C Shell.** The C Shell can write programs that are not compatible with either the Korn or Bourne Shell. Basically, the C Shell lacks many of the programming capabilities of the Bourne and Korn, most specifically, file descriptor assignment and most error handling. However, users experienced with programming in C will find the C Shell much like the C language.

A/UX Communication System

The A/UX communication system contains some of the more popular components of A/UX. The program `mail` allows you to send and receive electronic mail. `B-Net` is the LAN program that connects your A/UX system into a network. `UUCP` is used to communicate with other UNIX systems either over telephone lines or serial connections. `cu` is the equivalent to your telecommunication applications such as `MicroPhone™` or `RedRyder™`.

You access `mail` at the shell level (the `$` prompt). The A/UX mail system is easy to use. At the `$` prompt simply type `mail` and the name of the person you are sending to. The mail command structure looks like this:

```
$ mail ferd
```

This begins the process of creating a letter that will be sent to `ferd`. When you have finished typing your letter, press Return and type a `CONTROL-d` to send your letter. You can even send mail to yourself. Great idea for those lonely nights! When `ferd` logs in the next time, he will receive a message from A/UX that says:

```
You have mail.
```

If you log on and see this message, simply type `mail`. A/UX will list your messages. You then type the number of the message you want to read. After reading your letter, typing `CONTROL-d` automatically quits `mail` and saves your message in your mailbox that is in your personal directory. You can even send mail to other users over B-Net. The only difference is the address you use to send your message. You must add the following command to identify the remote host you are sending to:

```
mail ferd@boss
```

`ferd` is the name of the person receiving your message and `boss` is the name of the remote A/UX host.

The same process is used for sending mail over UUCP. The exception is that you reverse the name of the person receiving mail and the name of the remote host. Sending a message over UUCP looks like this:

```
mail boss!ferd
```

It is safe to assume that you might want to send mail to more than one user. This is done just like sending mail to one user except that you list all of the users that are to receive the message you are sending. The command structure looks like this:

```
mail ferd mertzes playmate stud lucy ricky
```

To send the same messages over B-Net and UUCP, simply add the name of remote host after each name. For B-Net this would look like this:

```
mail ferd@boss mertzes@boss playmate@steno  
stud@steno lucy@TV ricky@TV
```

With UUCP, the command structure looks like this:

```
mail boss!ferd boss!mertzes steno!playmate  
steno!stud TV!lucy TV!ricky
```

After you have finished reading your messages, you can save them or delete them. To delete them type

d (n)

This command deletes message number (n).

A/UX Wrap-up

Well, there you have an overview of the new A/UX system. Remember, this chapter has presented just the highlights of A/UX. Actually, A/UX is much like any other UNIX system. Its exceptional values are in the A/UX-based applications created by A/UX developers. A listing of these developers and their products may be found in Appendix A. These developers have produced Macintosh-like applications that fully exploit the power and features described in this chapter.

To be sure, there are some features of A/UX that developers have not been able to use. While multiuser applications have either been developed or are under development, multitasking applications have not yet arrived. This is due mostly to Apple's Macintosh operating system. Even with MultiFinder, the current Mac operating system is not designed to provide multitasking capabilities. Apple has announced plans to redesign the Mac operating system to support multitasking applications running in the A/UX environment. Compatibility with existing Macintosh applications remains to be seen.

Common A/UX Commands

cat Short for *concatentate*. The **cat** command concatenates (group together) files and then displays them either on your screen or on a printed copy (if your screen is redirected).

cat <file name(s)>

cd Short for **change directories**. This command works the same as the change directory command in MS-DOS. **cd** leaves the directory you are in and places you in the directory designated.

cd <directory>

chmod Short for **change mode**. **chmod** allows you to change the file access permissions. Permissions are a combination of read(r), write(w), and execute(e).

chmod <permission> <file>

cp Short for **copy** file(s). This command is used to create copies of specified files into specified directories.

cp <file1> <file2>

echo **echo** is not short for anything. **echo** is used to echo your arguments, associated with specific commands back to your screen. The **echo** command is useful for checking what arguments a command is using when you are using complex argument strings.

echo [-n]arguments

ed Short for **editor**. Invoking this command places you into the standard A/UX text editor.

ed [-] <file>

file The **file** command determines the file type. The different types of A/UX files are object, source, text, and application.

file <file>

kill The **kill** command halts (aborts) any A/UX process that is currently running.

kill <process>

lp Short for **line printer**. The **lp** command spools a file to a selected line printer (or laser printer).

lp [option] <file>

lpstat **lpstat** is short for **line printer status**. The **lpstat** command echoes back the status of the printing device that is currently printing your document.

lpstat <file>

ls Short for **list files**. This command will list the contents of a directory. The most common options used with the **ls** command are:

- d** List only the names for directory files, not the contents.
- l** List directories in the long form. This includes permissions, number of links, owners, size.
- r** List in reverse order.
- s** List by size (in terms of blocks).
- t** List in chronological order.
- u** List by time of last *access* (not modification).

ls [options] <file>

mail The **mail** command sends mail to others or allows you to read your mail. The most common options used with the **mail** command are:

- d** Delete this message, go to the next one.
- m** <user> Mail this message to <user>
- p** Repeat the display of this message.
- q** Quit reading mail, leave unread mail in the mailbox.
- s** <file> Save this message in <file>.
- w** <file> Save this message without header.
- x** Without changing the mailbox file.
- Repeat display of previous message.
- ? Display a summary of valid responses.

mail <user>

mail <options>

mkdir Short for **make directory**. This command makes a new directory provided the user had write permission in the parent directory.

mkdir <directory>

mount This command mounts a file system for use. The **mount** command attaches the mounted file to the A/UX root directory system. Directories can be mounted with the -r option (see **rm** below). This option makes the mounted directory read-only.

/etc/mount <directory> [option]

mv Short for **move**. The **move** command actually renames files.

mv <file1> <file2>

mv <file> . . . <directory>

passwd Short for **password**. The **password** command changes or installs a password.

passwd

pwd Short for **print working directory**. The **pwd** command will display the full pathname of the working directory.

pwd

rm Short for **remove files**. The **rm** command deletes named files from the current working directory, provided the user has read/write status with the parent directory. The options most commonly used with the **rm** command are:

-i Ask for y (yes) response before removing the file(s).

-r Ask for a y (yes) response for every entry if removing a directory file.

-f Forces the removal without any questions asked.

rm [options] <file>

rmdir Short for **remove directory**. This command removes directories from the A/UX system. Directories cannot be removed unless they are emptied (see **rm**).

rmdir <directory>

root# This the Bourne Shell root directory command prompt.

rootcsh This changes your root level to the C Shell root level.

rootksh This the root level for the Korn Shell.

sed Short for **stream editor**. This command will place you into the stream text editor.

sed

unmount The unmount command is used to unmount a root directory for the A/UX system.

/etc/unmount <directory>

vi Short for **visual editor**. **vi** is the most common screen editor used in A/UX.

vi < >

who **who** shows who is on the A/UX system. Without any options, **who** will show the terminal pathnames, user identification names, etc., of everyone who is currently on the system. When used with the *ami* option, **who** displays information about just the user.

who <ami>

Text Editor Commands

eqn Short for **equation**. This formats mathematical figures to equation-like notation.

eqn [-d <x> <y>] <file>

grap Short for **graphics**. This command allows you to draw a graph with specific inputs.

grap [-d <x> <y>] <file>

ms **ms** is the A/UX macro library. These are a group of macro commands that make formatting technical documents much easier. Some of the more common macros are:

.FS to .FE	Footnotes start and end.
.KS to .KE	Keeps blocks of text together.
.LP	Left flush (unindent) paragraphs.
.NH	Numbered headings.
.PP	Indented paragraphs.
.SH	Simple (unnumbered) headings.
.TL	Titling.

-ms [*option*]

nroff Short for **new runoff**. **nroff** is used to format text files. The formatting commands associated with **nroff** are such things as set margins, left and right justification, indent paragraphs, number and title pages, etc. The **-ms** (macro) options are used within **nroff**. Some of the other main options associated with **nroff** are:

-m <name>	Use a specified macro library.
-n <n>	Number the first page <n>.
-o <n1, n2, n3, n4, etc.>	Print only pages specified <n1, n2, n3, n4, etc.>.
-s <n>	Stop every <n> pages to allow for paper changing.
-T <name>	Use terminal of type <name>.

nroff [*options*] <file>.

tbl Short for **table**. This is a table formatter that is used in either **nroff** or **troff**.

tbl <file>

troff Short for **typesetter runoff**. Text files can be reformatted in **troff** to be sent to an electric typesetter. **troff** functions are similar to **nroff** except that there is a wider range of options because output is going to a typesetter and not to a "line printer."

troff [*options*] <file>

write **write** allows whatever is typed on the keyboard to be sent to a specific user.

write <user> <terminal>

Troubleshooting

The Mac is no different from any other computer system. There comes a time when it breaks down. The Mac II is of modular design, something like a human being. Each part, or module, has a specific function, and all work together for the successful operation of the whole system. Parts are separate yet interdependent. However, if any one of them fails, the system is not totally destroyed. The defective module can be isolated and repaired or replaced in much the same way as doctors diagnose and possibly repair or replace a failing part in a human being.

DIAGNOSIS AND TREATMENT

To a limited degree, users can “play doctor” with their Mac II. Luckily, the Mac II is not nearly so complex and intricate as the human body. However, owners can use the same basic diagnostic techniques as doctors or psychologists to determine what might be wrong with their machines. Simple do’s and don’ts and troubleshooting steps should allow most users to isolate a problem. Often the problem is as easy to fix as replacing a cable. This saves downtime and money.

The average basic service charge by a qualified Apple service technician is roughly \$45 per hour. Remember, this is the basic service fee. That means it may cost you a minimum of \$45

just to leave the computer with the repair service. It could take a technician several hours to just figure out what is wrong and anywhere from a half-hour to several weeks to fix the thing! All the while, the machine is not being used for productive purposes and you are losing money. When you follow the procedures outlined in this chapter, you can often isolate the problem and at least save the technician several hours of diagnostic work.

Repairing a module is usually accomplished by replacing it. Generally if a module goes bad, it's bad! Usually there is nothing a service technician can do short of replacing it. Unless the problem is the simple replacement of a cable or add-on board (the items Apple says users can replace themselves), then your qualified Apple technician must make the repairs.

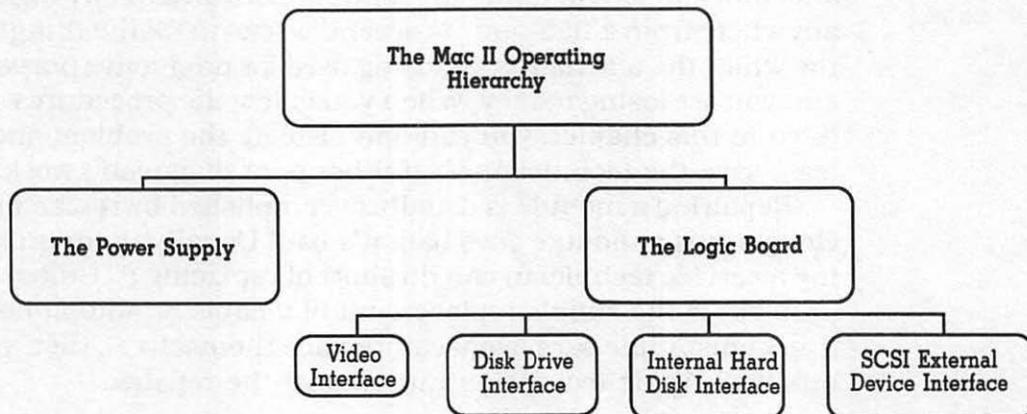
Grounding

As a word of caution, before we can begin discussing replacing cables or add-on boards, you must understand the importance of grounding yourself. Grounding protects you and your Mac II from static electricity charges. These small bolts of electrical current can wipe out a chip and cost you plenty in replacement costs. A simple procedure for grounding yourself should be followed *each and every time* you work on your Mac. One of the easiest methods for accomplishing this is to place your Mac II on a pad of antistatic material. This can be a thin piece of foam rubber or some other antistatic, rubber-based material. You should always ground yourself before replacing an add-on board or cable.

Operational Hierarchy

Before you begin examining the inner reaches of the Mac II, it might be helpful to see an overview of the hierarchy of the Mac II's psyche, displayed in Figure 5.1. As you can see, the basic Mac II is not very complex. Apple purposely designed the Mac II to be easy to get into and easy to service (sounds like a Toyota).

FIGURE 5.1 The Mac's hierarchy



Visualizing the Mac II's operational hierarchy allows you to see the manner in which the Mac II thinks. Let's take another look at the basic hardware structure to refamiliarize you with the parts and areas that you can check when troubleshooting. Figure 5.2 reveals the works.

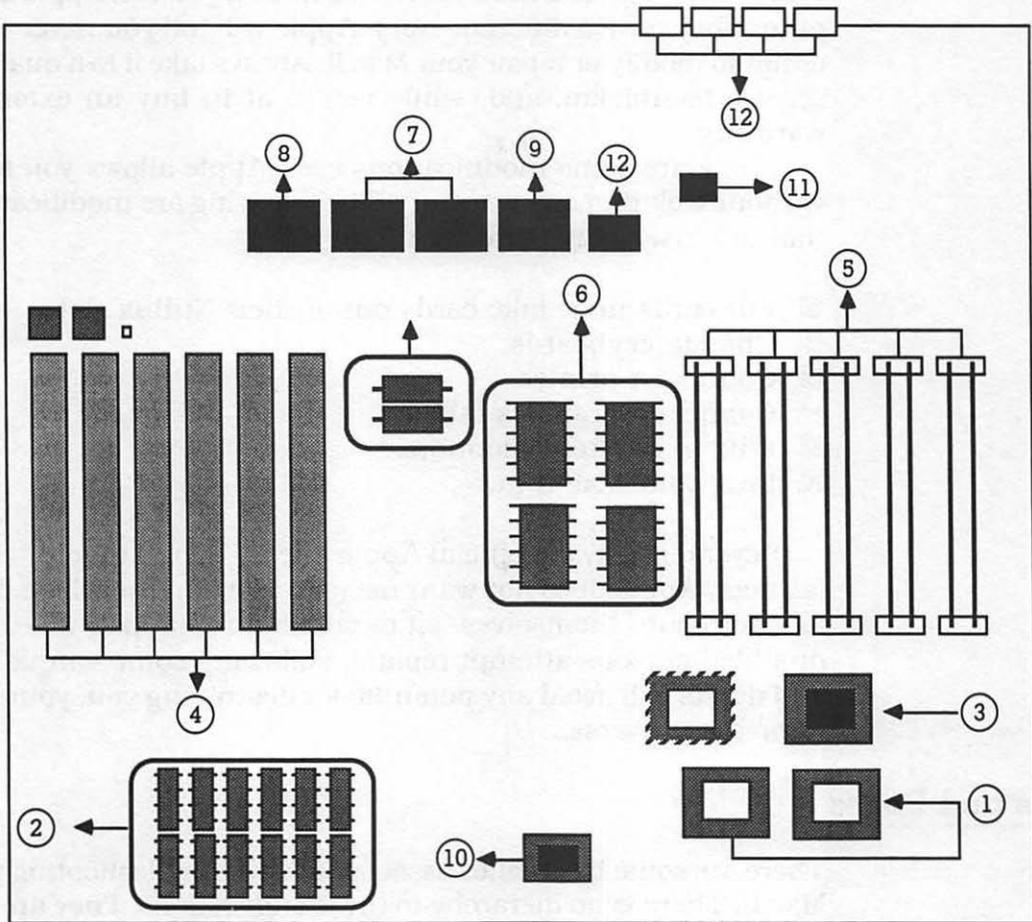
The Apple Warranty

Learning to troubleshoot your Mac II cannot begin before discussing one *very* important issue—**your warranty!** Apple guarantees the product for a period of 90 days. If any of your Mac II's components bite the dust (fail) during this 90-day period, Apple will gleefully replace the defective part(s). After 90 days, you pay the bill!

CAUTION: Tampering or repair of a Macintosh by an **unauthorized** Apple service technician will void your warranty! During the first 90 days, if a problem occurs, take your Mac II to your dealer for repair.

You can however, purchase a one- to three-year extended warranty. The amount of extension depends upon the price you want to pay. Average cost for an extended warranty is between \$250 and \$600.

FIGURE 5.2 The hardware



As you well know, there is no free lunch. Does it pay to purchase an extended warranty? Good question. There is a rule of thumb in the computer repair business: If you purchased an extended warranty for your automobile, then you had better get one for your Mac II. That is not to say that problems don't pop up after 90 days. As with cars, something generally goes wrong 95 days *after* your purchase. Most often major problems should occur within the 90-day grace period covered by Apple's warranty. An extended warranty can be expensive. With proper care,

cautious troubleshooting, and accurate record-keeping, repair bills can be kept to a minimum. Of course if you ask Apple Computer, they have a different story. Apple will tell you never to attempt to modify or repair your Mac II. Always take it to a qualified service technician, and, while you're at it, buy an extended warranty.

There are some modifications even Apple allows you to do without violating any warranty. The following are modifications that any user may perform:

- Put cards in or take cards out of their NuBus slots.
- Change keyboards.
- Connect a printer.
- Connect a graphics tablet.
- Plug in different monitors.
- Plug your Mac II in.

Beyond these, the official Apple line is, "Don't touch!" In all fairness, Apple does not want users to blow up their Mac IIs or to electrocute themselves, all of which *can* happen when unqualified persons attempt repairs. Following some simple do's and don'ts will avoid any potential for destroying you, your Mac II, or the universe.

Do's and Don'ts

There are some basic rules associated with troubleshooting your Mac II. There is no hierarchy to these suggestions. They are just that, suggestions.

Do's

1. There is an old saying in the education field, If all else fails, read the directions! Read them!
2. Write everything down. What is the problem, what caused it, can you make it happen again?
3. Check the obvious—cable connections, power cords, etc.

4. Consult the troubleshooting chart that follows. What appears as a serious problem may have a simple solution.
5. Make sure you have the right parts to do the job. The standard 8-bit Apple video card cannot be used for a high-resolution RGB monitor that requires a 24-bit video card.
6. Know what you are doing. If you don't know, or are unsure of what to do or how to do it, check with an authorized Apple service technician.

Don'ts

1. Do not attempt to replace or repair *anything* unless you know all of the proper steps!
2. Do not shortcut safety measures. These are designed for your protection.
3. Do not use "spare parts." Make sure the Apple service technician uses Apple replacement parts or the equivalent. Shortcutting on parts may cost you later.
4. Do not attempt complex repairs yourself.

Taking these ideas into consideration *before* you begin troubleshooting is the only way to go. There is nothing more embarrassing than being a shade-tree mechanic whose car has to be towed in because of "home repairs." One of the do's is to write things down. A Customer Configuration Chart is an excellent method for tracking what your Mac II's system consists of, the problems, what caused the problems, were the problems reproducible, and what, if any, was the fix. A sample Customer Configuration Chart might look like the one in Figure 5.3.

If you cannot diagnose or isolate the problem yourself, this chart can save a service technician diagnostic time. Remember, when you take your Macintosh to be repaired by an authorized Apple service technician, the longer it takes the technician to diagnose the problem, the more money it costs you. After you have filled out your Customer Configuration Chart, you can check it against the Troubleshooting Symptom Chart.

1. The SIMMS in RAM 1 should be exchanged and the self-test run again.
2. The SIMMS in RAM 2 should be exchanged and the self-test run again.
3. If these exchanges do not work, a service technician will exchange the logic board with the **original** SIMMS reinstalled and run the self-test again.
4. If your system still does not work, the service technician will repeat step 2 with the new logic board and run the self-test again.

Monitor Failure

The self-test also checks the status of the monitor interface. Four chords from **low to high** indicate a failure of the monitor system. To correct the problem, do the following:

1. Replace the video monitor card, then retest.
2. If test monitor fails, then have your monitor checked.

Mac II Symptom Chart

This chart is designed to assist you with troubleshooting problems with your Mac II. It is not meant to be a comprehensive repair manual. Some solutions are numbered 1 or 2 to indicate (1) which items need to be repaired or replaced by a qualified Apple service technician and (2) which items you can replace yourself. Another aspect regarding replacing defective parts is the exchange procedure. Apple works on "module level exchange." This means that when any module in the Mac II is replaced, Apple gets the old one back. Therefore, if your power supply goes bad, you buy a new one and Apple gets the old one back.

Apple's official service policy is that no repairs can be done by anyone other than a level 1 qualified Apple service technician. Other than replacing add-on boards, peripherals, and cables, be sure to take your Mac II to your dealer.

4. Consult the troubleshooting chart that follows. What appears as a serious problem may have a simple solution.
5. Make sure you have the right parts to do the job. The standard 8-bit Apple video card cannot be used for a high-resolution RGB monitor that requires a 24-bit video card.
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FIGURE 5.3 Customer configuration chart

Mac II Customer Configuration Chart				
Customer				
Serial Number				
Internal Disk Drives 1 2				
Internal Hard Disk				
Memory Management Unit				
SIMMs				
Bank B	# Installed	Bank A	# Installed	
256K		256K		
1M		1M		

PROBLEM/SOLUTION

A troubleshooting symptom chart has always been one of the best methods for troubleshooting problems with any computer system. Essentially, the chart is an overview. It should show specific symptoms and their correlation to possible causes and solutions. This troubleshooting symptom chart is not designed to be the final word for pinpointing the difficulty in your Mac II. If all of the suggested solutions fail to bring about a fix for your problem, write this fact down. Knowing this type of information saves valuable time for the authorized Apple service technician.

Startup Mac II Music

When the Mac II is first powered on, users are treated to “Mac II music.” Upon power-up, the Mac II ROM executes a self-test. During normal startup a medium-pitched chord is emitted, and the traditional disk icon with a question mark appears on the screen. With a hard disk attached, the familiar Welcome to Macintosh greeting comes on your screen followed by your desktop.

CAUTION: If the Mac II emits chords that you cannot interpret, write this fact down and proceed to troubleshoot according to the Troubleshooting Symptom Chart.

If any part of the self-test fails, there will be **three** sequences of different chords and a blank gray screen: startup chord, error chord, and test monitor chord.

- **Startup chord.** This is the standard chord sounded by the Mac II upon startup. It is a medium-pitched chord that signifies all systems are fine.
- **Error chords.** There are three error chords that indicate a problem. These chords indicate trouble in two areas, initial hardware and RAM. The RAM failure chords come in two varieties. Since there are two banks of RAM (RAM 1 and RAM 2), the self-test checks both banks and emits different error chords when a failure occurs in each bank.
- **Test monitor chord.** These are four chords from low to high that indicate failure of the monitor system.

Initial Hardware Failure

An initial hardware failure is indicated by a **short, harsh** chord. This indicates a problem with the logic board or with SIMMS (System In-line Memory Modules). To correct the problem:

1. Exchange the SIMMS and put them back on your **original** logic board. Again, this must be done by an *authorized Apple service technician*.
2. Exchange the logic board. This will require you to take your Mac II into an authorized Apple service technician.

RAM 1 and RAM 2 Failure

A failure in the RAM 1 bank is signified by a **long, medium-pitched** chord. A RAM 2 bank failure is indicated by a **medium-pitched, then high** chord. Corrections should only be done by a qualified service technician.

1. The SIMMS in RAM 1 should be exchanged and the self-test run again.
2. The SIMMS in RAM 2 should be exchanged and the self-test run again.
3. If these exchanges do not work, a service technician will exchange the logic board with the **original** SIMMS reinstalled and run the self-test again.
4. If your system still does not work, the service technician will repeat step 2 with the new logic board and run the self-test again.

Monitor Failure

The self-test also checks the status of the monitor interface. Four chords from **low to high** indicate a failure of the monitor system. To correct the problem, do the following:

1. Replace the video monitor card, then retest.
2. If test monitor fails, then have your monitor checked.

Mac II Symptom Chart

This chart is designed to assist you with troubleshooting problems with your Mac II. It is not meant to be a comprehensive repair manual. Some solutions are numbered 1 or 2 to indicate (1) which items need to be repaired or replaced by a qualified Apple service technician and (2) which items you can replace yourself. Another aspect regarding replacing defective parts is the exchange procedure. Apple works on "module level exchange." This means that when any module in the Mac II is replaced, Apple gets the old one back. Therefore, if your power supply goes bad, you buy a new one and Apple gets the old one back.

Apple's official service policy is that no repairs can be done by anyone other than a level 1 qualified Apple service technician. Other than replacing add-on boards, peripherals, and cables, be sure to take your Mac II to your dealer.

VIDEO TROUBLE

Trouble

- Screen is dark, disk drive(s) do not work, but the internal fan is running, the LED for the internal hard drive (if you have one) is lit, and there is no audio.

KEY
<ol style="list-style-type: none"> 1. This part should only be replaced by a qualified Apple service technician. Trying to replace it yourself may cause more damage to your system. 2. These parts can be replaced by the user. However, you should proceed with caution and know what you are doing. Some experience in electronics would be helpful.

Solutions

1. Replace video cable.²
2. Move video interface card to a different slot.²
3. Replace the video interface card.²
4. Have a qualified service technician replace the SIMMS.¹
5. Have a qualified service technician replace the logic board.¹
6. Have a qualified service technician replace the power supply.¹
7. Change monitors.²

Trouble

- The screen is dark but there is audio, the drive(s) work, the fan works and the hard drive light is lit.

Solutions

1. Adjust the brightness on the monitor.²
2. Change monitors.²

3. Replace video cable.²
4. Put the video interface card in a different slot.²
5. Replace the video interface card.¹
6. Have a qualified service technician replace SIMMS.¹
7. Have a qualified service technician replace the logic board.¹
8. Have a qualified service technician replace the power supply.¹

Trouble

- The monitor is on and lit, there is audio, but there is nothing on your screen.

Solutions

1. Change monitors.²
2. Replace the video cable.²
3. Put the video interface card in a different slot.²
4. Replace the video interface card.²
5. Have a qualified service technician replace the logic board **only**.¹

Trouble

- The monitor screen is completely dark, there is no audio, the fan is not running, and the hard disk's LED is not lit.

Solutions

1. Make sure the wall socket the monitor is plugged into has power.²
2. Have a qualified service technician check the internal lithium batteries.¹
3. Have a qualified service technician replace the power supply.¹
4. Have a qualified service technician replace the logic board **only**.¹

DISK DRIVE TROUBLE

Trouble

- Your disk ejects from the internal drive and your screen shows a disk icon with a blinking "X".

Solutions

1. Make sure that the disk has system files on it. If not, use a disk with a good system file.²
2. Have a qualified service technician replace the internal disk drive cable.¹
3. Have a qualified service technician replace the internal disk drive.¹
4. Have a qualified service technician replace the logic board only.¹

Trouble

- Your Mac II will not eject your disk.

Solutions

1. Power off the Mac II and hold your mouse button down while powering the Mac II back on.²
2. Have a qualified service technician replace the disk drive.¹

Trouble

- You have video and audio on your monitor, but your internal floppy disk drive does not work.

Solutions

1. Check your disk and replace it if it is bad.²
2. Disconnect all **external** SCSI devices (hard disks, printers, etc.).²

3. Replace the internal disk drive cable.¹
4. Have a qualified service technician replace the internal disk drive.¹
5. Have a qualified service technician replace the logic board only.¹
6. Have a qualified service technician replace the power supply.¹

Trouble

- Your internal hard disk does not work.

Solutions

1. Replace the SCSI cable connector.²
2. Replace SCSI power connector.²
3. Have a qualified service technician replace your hard disk.¹
4. Have a qualified service technician replace the logic board only.¹

Trouble

- Your internal floppy drive runs continuously.

Solutions

1. Check the disk by powering off and holding the mouse button down as you power back on. This ejects the disk. Replace the disk with a known disk that is good.²
2. Have a qualified service technician replace the internal disk drive cable.¹
3. Have a qualified service technician replace the internal disk drive.¹
4. Have a qualified service technician replace the logic board only.¹

Trouble

- Your internal floppy tries to eject your disk but doesn't.

Solutions

1. Power down, then reseal the top cover of the Mac II so that the drive slots line up correctly with the cover.²
2. Have a qualified service technician replace the internal floppy drive.¹

PERIPHERAL TROUBLE

Trouble

- After boot-up you get no response to any key on the keyboard.

Solutions

1. Check the keyboard connection at the back of the Mac II.²
2. Replace the keyboard cable.²
3. Replace the keyboard.²
4. Have a qualified service technician replace the logic board only.¹

Trouble

- Your pointer does not move when you move your mouse.

Solutions

1. Check the mouse connection.²
2. If the mouse was connected to the keyboard port, connect it to the mouseport.²

3. If your mouse does not work in any port, then try your mouse on a good Mac.²
4. If your mouse does not work on a good Mac, then replace your mouse.²
5. If your mouse works on a good Mac, have a qualified service technician replace the logic board.¹

Trouble

- Your pointer moves, but clicking your mouse has no effect.

Solutions

1. Replace your mouse.²
2. Have a qualified service technician replace the logic board only.¹

Trouble

- Your ImageWriter won't work.

Solutions

1. Check the ImageWriter's connection to your Mac II and to the ImageWriter.²
2. Make sure you have the most current versions of the Finder, System, and ImageWriter files. If you are not sure of the most current, contact your local Apple dealer.²
3. Pull down the Apple menu and select Chooser. Make sure you select the ImageWriter icon. You must use Chooser 3.2 or newer.²
4. Replace the printer interface cable.²
5. Have a qualified service technician replace the logic board only.¹

Trouble

- You cannot print to a LaserWriter.

Solutions

1. Check the AppleTalk connections to the LaserWriter and to your Mac II.²
2. Replace the AppleTalk connections for your LaserWriter and Mac II.²
3. Make sure you have the most current versions of the Finder, System, and ImageWriter files. If you are not sure of the most current, contact your local Apple dealer.²
4. Pull down the Apple menu and select Chooser. Make sure you select the LaserWriter icon and click the AppleTalk Active button. You must use Chooser 3.2 or newer.²
5. Have a qualified service technician replace the logic board only.¹

MISCELLANEOUS TROUBLE

Trouble

- Your entire system shuts down on an intermittent basis.

Solutions

1. Make sure the power cord is securely plugged in.²
2. Make sure the air vents on the sides and top of your Mac II are free from obstructions. The Mac II has thermal protection circuitry, which will shut your system down to protect from overheating. After clearing the vents, wait for 30 or 40 minutes before powering on again.²
3. Replace the power cable.²

4. Have a qualified service technician check the internal lithium batteries.¹
5. Have a qualified service technician replace the power supply.¹
6. Have a qualified service technician replace the logic board only.¹

Trouble

- Your entire system crashes on an intermittent basis.

Solutions

1. Make sure you have the most current versions of the Finder, System, and ImageWriter files. If you are not sure of the most current, contact your local Apple dealer.²
2. Make sure you are using compatible software.²
3. Have a qualified service technician replace the logic board only.¹
4. Have a qualified service technician replace SIMMS.¹
5. Have a qualified service technician replace the power supply.¹

Trouble

- You hear a chirping, clicking, or thumping sound when you use your Mac II.

Solutions

1. Have a qualified service technician replace the power supply.¹
2. Have a qualified service technician replace the logic board only.¹

Trouble

- You get no sound from your Mac II speaker.

Solutions

1. Pull down your Apple menu and select Control Panel. Check to see if the volume control setting is set to 1 or higher.²
2. Have a qualified service technician replace the speaker.¹
3. Have a qualified service technician replace the logic board only.¹

Remember, this symptom chart allows you to troubleshoot to the component level. If you have trouble with the your Mac II and cannot "cure" it using the symptom chart, take it to a service technician.

These charts should not be construed as the end-all troubleshooting guide. There just may be problems that only an experienced microcomputer electronics expert can fix. When in doubt, take it in.

Appendix A

A/UX Products

Courses

Products: Courses: A/UX Operating System, Macintosh User Interface for UNIX Programmers, Designing a Macintosh Application

Company: Bear River Associates

Address: P.O. Box 1021
Berkeley, CA 94701
(415) 644-9400

Office Automation

(Each is several stand-alone products: word processor, spreadsheet, calendar, mail, etc.)

Product: Uniplex II Plus

Company: Uniplex

Address: 150 W. Carpenter Freeway
Irving TX 75039
1(800) 356-8063

Product: WingZ-Spreadsheet
Company: Informix Software, Inc.
Address: 16011 College Blvd.
Lenexa, KS 66219
(913) 492-3800

Product: R Office +/E-Mail Office Productivity
Company: R-Systems
Address: 10310 Markison Road
Dallas, TX 75238
1(800) 527-7610

Networking/Connectivity

Product: SoftPC (software emulation of MS-DOS)
Company: Insignia Solutions
Address: 1255 Post St. Suite 625
San Francisco, CA 94109
(415) 771-7001

Product: GatorBox (AppleTalk to EtherNet gateway)
Company: Cayman Systems
Address: One Kendall Square, Bldg. 600
Cambridge, MA 02139
(617) 494-1999

Product: u(micro)Share (hardware and software giving Macintoshes access to UNIX mail, file sharing, virtual disks, etc.)

Company: Information Presentation Technology

Address: 23801 Calabasas Rd. Suite 2011
P.O. Box 8609
Calabasas, CA 91302
(818) 347-7791

Product: MacNIX (multiuser Finder for A/UX)

Company: EuroSoft

Address: list Spa.
Piazza Mazzini, 6 1-56100
Pisa, Italy
39-504-4023
39-504-4023 (Fax)

 **Hardware**

Product: Big Picture and Big Picture IQ (monitors)

Company: E-machines

Address: 9305 SW Gemini Dr.
Beaverton, OR 97005
(503) 646-6699

Product: NS8/16 (memory expansion board)

Company: National Semiconductor

Address: Building 16
2900 Semiconductor Dr.
Santa Clara, CA 95051
In California: 1(800) 345-4006
In the U.S.: 1(800) 538-8510
Outside the U.S.: (408) 562-8719

Products: Commcard, Spectrum 1000/8 and 1000/24 boards
DataFrame XP series of large drives
SuperView II monitor

Company: SuperMac Technology

Address: 295 North Bernardo Ave.
Mountain View, CA 94043
(415) 932-6308

Products: Irwin Macintosh Tape Drives (20, 40, 64, or 80
megabyte; allows file transfer directly among Mac
OS, A/UX and MS-DOS)

Company: Irwin Magnetic Systems, Inc.

Address: 2101 Commonwealth Blvd.
Ann Arbor, MI 48105
(313) 996-3300

 **Statistics**

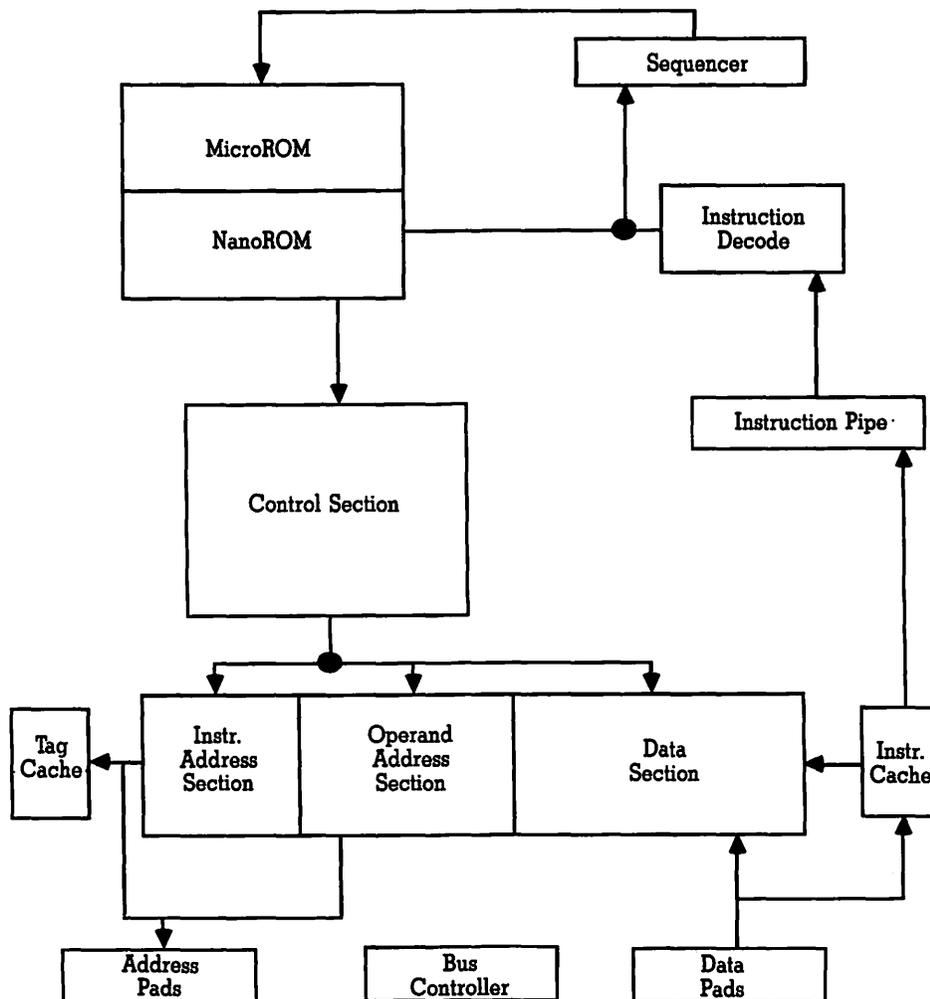
Product: StatView II

Company: Abacus Concepts

Address: P.O. Box 3086
Berkeley, CA 94703
(415) 540-1949

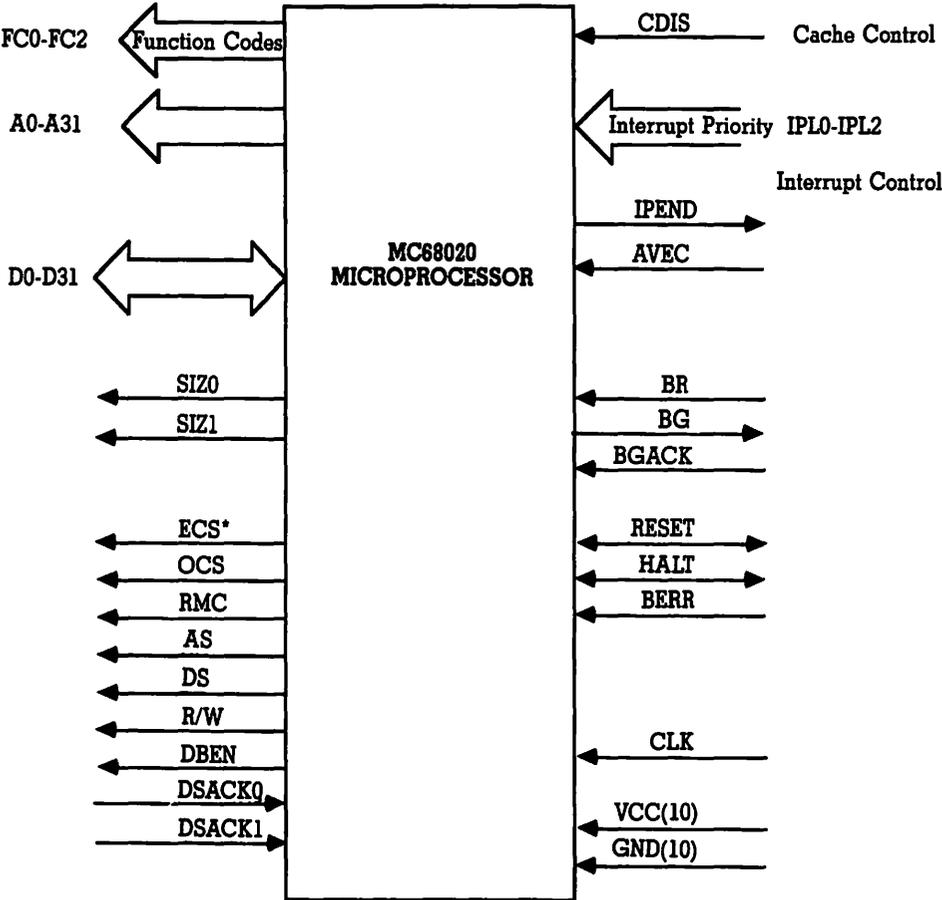
Appendix B

FIGURE B.1 MC68020 functional block diagram



Appendix C

FIGURE C.1 Functional signal group



Signal Descriptions

Function Code Signals (FC-FC2)

Address bus (A0-A31)
Data bus (D0-D31)
Transfer size (SIZ0-SIZ1)

Asynchronous Bus Control Signals

External Cycle Start (ECS)
Operand Cycle Start (OCS)
Read-Modify-write Cycle (RMC)
Address Strobe (AS)
Data Strobe (DS)
Read/Write (R/W)
Data Buffer ENable (DBEN)
Data transfer and Size ACKnowledge (DSACK0, DSACK1)
Cache DISable

Interrupt Control Signals

Interrupt Priority Level (IPL0-IPL2)

Bus Arbitration Signals

Bus Request (BR)
Bus Grant (BG)
Bus Grant ACKnowledge (BGACK)

Bus Exception Control Signals

Reset (RESET)

Halt (HALT)

Bus **ERR**or (BERR)

CLo**C**K (CLK)

Power Supply (VOC)

Grou**ND** (GND)

Index

A

- AT&T UNIX, 103
- A/UX and OSI, 105–107
- A/UX basic commands
 - cat, 131
 - cd, 136–137
 - chmod, 137–139
 - access classes, 138
 - operators, 138
 - permissions, 138
 - cp, 145–146
 - fsck, 119–120
 - lp, 143–144
 - ls, 128–129, 139–142
 - mkdir, 139
 - mv, 144–145
 - password, 123–124
 - pg, 142–143
 - piping, 131–132
 - pwd, 136
 - rm, 145
 - rmdir, 139
 - root#, 121–123
 - TERM, 120
 - who, 127
- A/UX basic configuration, 108
- A/UX basic tools, 105
- A/UX communications, 162–164
 - B-Net, 163
 - deleting, 164
 - mail, 162–164
 - UUCP, 163
- A/UX file system, 132–146
 - copying, 145–146
 - directories, 132–137
 - changing, 136
 - making, 136
 - path names, 135–136
 - absolute, 135
 - relative, 135
 - removing, 139
 - viewing, 136
 - listing, 139–142
 - structure of, 141
 - printing, 143–144
 - to printer, 155–156
 - to screen, 143
 - removing files, 145
 - mv command, 145

- renaming, 144–145
 - flag options, 144
- security, 137–139
 - access levels, 137–139
 - change mode, 137–138
 - classes, 138
 - operators, 138
 - permissions, execute, 138
 - permissions, read, 138
 - permissions, write, 138
- viewing, 142–143
 - command for, 142
- A/UX hardware, 110–114
 - additional RAM, 113
 - hard disks, 114
 - external, 114
 - internal, 114
 - PMMU, 113
- A/UX installation, 109–124
 - command structure, 128–132
 - moving around in, 110
 - cat, 132
 - parts of, 128
 - arguments, 129
 - flag options, 129
 - inputs, 130
 - name, 129
 - outputs, 131
 - piping commands, 131
- A/UX keyboard equivalents, 110
- A/UX major features, 104
- A/UX shells, *See also* shell names
- A/UX software, 114–124
 - automatic boot screen, 116
 - fsck, 118–119
 - checking root directory, 118–119
 - general parameters, 115
 - multiuser mode, 122
 - root level, 120
 - setting level, 122
 - setting new password, 123–124
 - superuser, 122–124
 - setting, shell, 122
 - setting time, 117–118
 - single user, 114–121
 - Stand-Alone Shell, 118–119
 - terminal type, setting, 120
- A/UX system setup
 - administration functions, 124
 - logging on as, 125
 - user functions, 126
 - logging on/off, 126
 - login name, 127
 - setting password, 126
- A/UX text editing, 146–155
 - editors, 147
 - ed & ex, 147
 - stream editor, 147
 - vi, 147–155
 - and ed, common commands, 153
 - and ed, starting, 153
 - and ex, 151
 - and stream editor, 155
 - arrow keys, support of, 149
 - changing text, 151
 - command mode, 148
 - Control-c (use of), 149
 - difference between, 148
 - getting into, 151
 - using, 151
 - insert mode, 148–149
 - macros in, 151–153
 - movement commands, 150–151
 - saving, 149

- A/UX text formatting, 155–157
 equations(eqn), creating, 159
 graphs(grap), creating, 160
 mm (Memorandum Macros), 156
 ms, 156–157
 nroff, 156
 pictures(pic), creating, 159–160
 tables(tbl), creating, 158
 troff, 156
- B**
- Bourne shell, 161–162
- C**
- CD-ROM, 54–55
 Apple CD-ROM, 55
C-shell, 161–162
Customer Configuration Chart, 186
- D** *UDSIC*
- Desktop publishing. *See* Mac II market
 Software
- E**
- Expansion cards, 27–47
 extended memory, 28, 51–54
 AST-RM4, 54
 Dove, 52–53
 Micron Technologies, 53
 NS8/16, 52
 miscellaneous, 28, 46–51
 MacProto, 46
 NuVista, 48–49
 Pegasus, 48
 QuickCapture, 47
 TV Producer, 49–50
 Mac286, 50–51
 monitors, 28, 34–37
 comparison chart, 35–36
 network connection, 28, 37–45
 AST-ICP, 45–46
 EtherPort II, 40
 EtherTalk, 38–39
 FastNet II, 44–45
 Four+One, 44
 LANSTAR, 42–43
 MacIRMA, 40–42
 power requirements, 29–30
 video cards, 27–28
 Apple, 31–32
 24-Bit Cards, 32–34
 SuperMac Technologies, 32–34
 RasterOps, 32–34
- H**
- Hierarchy of Mac II, 172
- K**
- Keyboards, new, 8–9
Korn shell, 161–162
- L**
- Logic board, 16
- M**
- Mac II market
 CAD/CAM, 10
 communications, 10
 desktop publishing, 10
 developers, 12–13
 hardware, 12
 software, 13
 education, 11
 engineering, 10
 graphics, 11

N

- NuBus, 17
 - advantages of, 24–25
 - coprocessors, 24
 - expansion slots, 18
 - maximum RAM, 24
 - power requirements, 29–30
 - schematic, 23
 - slot arbitration, 25–26
 - video capabilities, 24

O

OSI. *See* A/UX and OSI

P

- PMMU, 17
 - installing, 113
 - use in A/UX, 17, 108, 113

S

- SCSI interface, 20
- SIMMS, 18–19
 - troubleshooting, 177–178
- Software
 - communications, 80–83
 - InBox, 82
 - TOPS, 80–83
 - 3+, 82–83
 - compatibility
 - 68020 vs. 68000, 56–57
 - speed, 58–59
 - desktop publishing, 95–99
 - Interleaf, 98–99
 - PageMaker 3.0, 95–96
 - Quark XPress, 97
 - Ready, Set, Go, 96–97
 - graphics, 83–95
 - Adobe Illustrator, 94–95

- CAD/CAM, 89–92
 - MacDraw, 90–91
 - MGMStation, 91
 - Pegasys II, 92
 - VersaCAD, 89–90
- Colorizer, 88
- Color Sep, 88–89
- FullPaint, 87
- MacPaint 2.0, 84–85
- Modern Artist, 83–84
- PhotoMac, 86
- PixelPaint, 85
- SuperPaint, 86–87
- VideoWorks II, 93–94

- MultiFinder, 69–72
- Spreadsheets, 99–100
 - Excel, 99–100
 - Wingz, 100
- Testing, benchmark, vs. IBM PS/2
 - 80386, 60–67
- Word Processing, 74–80
 - FullWrite, 77–78
 - MacWrite 5.0, 79–80
 - MS Word, 74
 - NISUS, 76
 - WordPerfect, 74–75
 - WriteNow, 78–79

68020

- block diagram, 193
- differences from 68000, 56–57
- functional signal group, 104
 - signal descriptions, 195–196

Structure

- A/UX, 106
- Macintosh II, 5–15, 172–173
 - hierarchy, 172

T**Troubleshooting**

- customer configuration chart, 186

- disk drive trouble, 181–182

- grounding, 171

- miscellaneous trouble, 185

 - no sound from speakers, 186

 - system shutdown, 185

- peripheral trouble, 183–185

 - Imagewriter, 184

 - keyboard, 183

 - LaserWriter, 185

 - mouse, 183–184

- startup chords, 177

 - initial hardware failure, 177

 - chords, 177

 - what to do, 177

 - monitor failure, 178

 - chords, 178

 - what to do, 178

 - RAM 1 & 2 failure, 177–178

 - chords, 177–178

 - what to do, 177–178

 - symptom chart, 175, 178–187

 - user repairs, 174

 - video board, 179

 - chords, 179

 - what to do, 178–180

 - what users can do themselves, 174–175

V

- Versatile Interface Adapters, 19–20

- Video Interface Card, 21–22

 - power requirements, 29–30

W

- Warranty, Apple, 172–173

 - extended, 172–173

 - voiding, 172

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Mark Veljkov is a curriculum design specialist for computer-aided instruction at Western Washington University. He is senior editor for *Computing Today* and communications editor for the *The CAD/CAM Journal for the Macintosh Professional*. Dr. Veljkov is the author of *MacLANs: Local Area Networking with the Macintosh*, published by Scott, Foresman and Company.

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