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This book is dedicated to Steven Jobs and the other incredible members of the original Apple Macintosh\(^1\) team whose vision, perseverance, and skills made it possible to introduce a better computer for “The Rest of Us”; to John Scully whose vision carried the Macintosh forward and made it an everyday reality in Corporate America; and to numerous individuals at Apple and all the third-party vendors—both software and hardware—for continuously pushing the “outside of the envelope.” Their hard work, dedication, and commitment to the Apple Macintosh ideal constantly changes the shape and destiny of computing for the rest of us . . . always for the better!

This book is also dedicated to individual contributors and innovators at the storage device manufacturers: Quantum, Conner, Sony, Micropolis, Seagate, Maxtor, IBM, and all the rest. Kudos must also be given to all the hard-working individuals at numerous other third-party vendors responsible for designing, repackaging, and distributing today’s superior Macintosh software and hardware products.

Special thanks are due to Darwin Gross, author, musician, wayshower to many, and the most humble, creative genius anyone could ever have the good fortune to meet, for the continuing inspiration.

Warm thanks and appreciation to my wife, Bonnie Brant, for challenging the ideas, proofreading, and ensuring my written expression fell somewhat within the confines of the English language; and to my mother, Mary Brant, for first sparking my interest in books, writing, and life.

Thanks and appreciation also go out to Ron Powers, Sandra Johnson, Susan Bonthron, Kimberly Martin, Carol Nester, and many other hard-working folks inside and outside TAB/McGraw-Hill who have repeatedly shown me that publishing industry workloads are every bit as demanding as those in the electronics industry.

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\(^1\)This book presumes you are already familiar, at least in passing, with Apple Computer, Inc., and the Apple Macintosh computer. If you want additional information contact any authorized Apple Dealer or Apple Computer, Inc., 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010. Apple, the Apple logo, and Macintosh are registered trademarks of Apple Computer, Inc.
The book you now hold in your hands, *Macintosh Hard Disk Management*, builds on a successful heritage. It owes its life to Ron Powers, the Acquisitions Editor at TAB/McGraw-Hill responsible for the “build/upgrade your own computer” series. After acquiring his new Macintosh, Ron found few Macintosh-specific hard disk books to help him with his hardware and software questions: what hard disk to buy; how to buy it, set it up, make the best use of it, back it up; and what to do about future storage needs. Ron reasoned that answers to these Macintosh hard disk issues could benefit Macintosh owners just as many DOS PC-specific hard disk books have helped DOS PC owners.

Ron is right of course—you can save time, money and headaches with a little guidance in the Macintosh hard disk area. This book tells how to do it in three ways: buying the right hardware, using it correctly, and backing it up. It even includes a floppy diskette loaded with software programs to help you get started.

If you buy the right hard disk with the right software, organize it efficiently and take care to back it up regularly, you can save time, money and eliminate hard disk worry. You can rest more peacefully at night and free your mind to contemplate other issues—those that you really bought your Mac to help you solve.

**Don’t get attached**

Change is the key word in the 1990s. You know this. The media in all its forms bombards you with this fact daily. Whatever Macintosh and hard disk you have today, better ones will be available tomorrow. Smaller and more powerful Macintoshs will become available as faster and lighter hard disks are developed. At the other end of the spectrum, emerging optical technologies will enable every Macintosh owner to store a library of data next to his or her desk and access it quickly.

Enter this book. It offers you rational and money-saving hardware and software hard disk solutions to meet your needs today but keeps an eye on the future. Because nothing is permanent, technology-wise your posture must always be to “stay loose man” as they...
used to say in the streets. The Marine Corps credo, "improvise, adapt, overcome" applies equally well to the thinking process you should apply to your Macintosh and hard disk. Build a stable and trouble-free environment for your Macintosh today but do not hesitate to incorporate new innovations and products as they become available.

May the Force be with you

With more than six million Apple Macintoshes in the world, a substantial market in hard disks and other hardware and software has emerged—along with ever more efficient marketing and distribution channels—to continue to serve your interests in the future. You are only seeing the tip of the iceberg today. More hardware and software options will be available in the future and they will cost less as time goes on.

We are all individuals, and each person's concept of the Macintosh will always be different from the next person's. I continue to hold the vision that the highest purpose of the better computer for "The Rest of Us" will best be served by each person "custom-tailoring" a Macintosh to meet his or her own unique needs, and there will always be new, different, and better ways to do this.

You are about to embark on a voyage of expanding hard disk information and knowledge from which there is no turning back. Knowledge is power and all I have done here is to move the pivot point a little closer to you, the user.

Who I am

I am a full time Macintosh consultant who provides both software and hardware solutions for a wide range of business clients. In 1983, as Operations Manager for a publishing firm in Northern California, I became "hooked" by having one of the first $10,000 Apple Lisa systems on my desk. My initial Macintosh introduction followed a short time later, and several years in various sales and management capacities with Businessland, Nynex, Microage and a regional reseller in the Northwest honed my experience. Prior to that, a combined 10 years with DEC and Data General in the minicomputer industry with a BSEE from the University of Denver and credits toward MSEE and MBA degrees gave me my frame of reference.
I still remember my first Macintosh hard disk—a serial version made by the now defunct Sunol Systems. I thought I had died and gone to heaven after my purchase. It greatly multiplied my speed, storage space, and Macintosh efficiency. I could network several types of computers from this hard disk, and at one time shared it between my Mac, IBM DOS PC, and Epson QX10 CP/M computers. I was the envy of my friends who had internal Macintosh GCC and Rodime hard disks, who could brag of more speed but not of more flexibility.

Unbelievable by today's standards, my 45Mb hard drive cost about $4000. Equally unbelievable, its early vintage formatting software forced me to learn about all RLL/MFM coding schemes, spare tracks, sectors, formatting, initializing, and partitioning—all of which had to be done manually.

Today, you can hold Quantum's 80Mb 2 1/2-inch Go•Drive, shown in Fig. I-1, in the palm of your hand for less than $400. Formatting software for it requires only your ability to point and click your Macintosh mouse. We take much for granted today.
What’s first

As Darwin Gross says in his book called *Inner Trek*, you must first get the knowledge, then assimilate it, then reason about it, including the “How can I put it into practice in my life?” step. This is a process familiar to most of us.

An equally familiar scenario is the game played at automobile purchase time. No one would accuse most auto dealers of “outright dishonesty,” but neither would anyone disagree that there is quite a bit of “maneuvering” going on.

Most familiar is the truism, “Believe half of what you see, little of what you read, and none of what you hear from others.”

Aspects from all three of these philosophic pillars should be incorporated in your reading of this book:

- None of what is offered here is going to do you any good until you apply it to your own unique set of Macintosh circumstances.
- Not all Macintosh products and vendors are created equal. “Investigate before you invest” should always be the order of the day.
- Not everything said by well-meaning Macintosh gurus is sage advice. Check it out for yourself before you accept it as true. (Relax, I have no axe to grind here, you have already purchased the book!)

“If you don’t know where you are going, you will probably end up someplace else” is how Yogi Berra of the New York Yankees baseball team put it many years ago. So before you get started, a brief overview of this book is in order, including its organization and purpose, who should use it, how you should use it, its chapter contents, and some helpful starting hints.

Who should use this book

I presume if you are reading this book, you are either a Macintosh owner now or are familiar with the Macintosh. As a corollary, I presume you are familiar with basic Macintosh desktop fundamentals, and that you understand the vocabulary; in other words, you know and are familiar with icons, pull down menus, windows, elevators, size and grow boxes, cut-copy-paste, copying files by clicking and dragging, opening files by double clicking, and a host of other Macintosh-specific labor saving devices. If not, treat yourself to one of the introductory or comprehensive Macintosh books available.¹

If you are a DOS PC owner and have picked up this book out of curiosity, to build your knowledge base, or because of a future need, rest assured that I spend little time pontificating about the virtues of the Macintosh versus the DOS PC: this book offers you genuine and objective advice.

My own computer consulting business has introduced me both to gung ho DOS PC users and gung ho Macintosh users, each offering compelling reasons for their own view-

point. While I can pass on either solution to a client, sometimes both working together is the answer. The popularity of Windows 3, a subset of the Macintosh software environment for DOS PC owners, is living proof that all computer manufacturers are aggressively moving toward the Macintosh interface standard. Actually, Apple's recent introduction of new Macintosh models, coupled with price reductions on existing models, have made the Macintosh alternative more attractive than ever in both price and performance to today's first time users.

It's actually far easier to add a hard disk to your Macintosh, any model, than it is to do the equivalent in the DOS PC world. No DIP switch settings to worry about, fewer cables to connect, no complicated software to load, and no BAT files to create. Formatting your hard disk for the Macintosh is a breeze compared to a DOS PC. It is all done for you by today's setup software.

**Organization and purpose**

Despite the wealth of information available on Macintosh hard disks, few sources have ever gathered it together into one place. The book you now hold in your hand does just that. Use it as you would a road map. It gives you the foundations, and provides you with tools and guidelines you can use over and over again in the future.

For convenience, the book is organized into three areas:

- **Hardware**—Brief overviews of history and storage; how to buy and install your Macintosh hard drive hardware.
- **Operating your hard drive**—How to format and initialize your Macintosh hard drive; how to use your Apple system software; how to back up your Macintosh hard drive.
- **Optimizing your hard drive**—How to maintain, troubleshoot, and recover your Macintosh hard drive; how to use utility software; how to use the enclosed floppy diskette public domain software; closing words about the future, work habits, and ongoing information sources.

**Chapter overview**

Figure I-2 shows the chapter lineup and a contents summary in graphic form. Chapters one through four cover hardware, chapters five through eight operating the hard drive, and chapters nine through twelve optimizing your hard drive. To help you get started, the first chapter briefly covers some history and explains why nearly every Macintosh owner already has a hard drive. To help you on an ongoing basis, the last chapter covers additional information sources including the excellent weekly and monthly magazines, plus quarterly product guides that service the Macintosh community.

The complete chapter lineup and contents overview are:

- **Chapter 1** gives you a brief history and future perspective, then shows you why 95 percent of all Macintosh owners have hard drives today, and all will in the future.
- **Chapter 2** positions the alternative storage options for you, then discusses the basic workings and benefits of each—starting with how your Macintosh works.
Chapter 3 shows you how to determine your priorities, needs, and "whats" before going into the buying process, and leaves you with a buying checklist.

Chapter 4 covers SCSI fundamentals and the process of hooking up your internal or external hard drive to your Macintosh, and leaves you with location and setup tips.

Chapter 5 provides an overview of the formatting and initializing process, tells you why partitioning is particularly important, and covers SilverLining software.

Chapter 6 discusses how to use the TOI philosophy to get the most out of your Macintosh and hard drive; installing, organizing, and customizing Apple System 6 software; and the pros and cons of migration to System 7 for you.

Chapter 7 gives you an overview of Apple System 7 requirements; discusses some of System 7's new features; covers installing, organizing, and customizing System 7 on your Macintosh; and leaves you with a summary of its benefits.

Chapter 8 discusses the importance of backing up along with backup strategies, backup hardware, and Fastback II and Retrospect software.

Chapter 9 covers hard drive maintenance, troubleshooting, recovery techniques, and MacTools and Norton Utilities software.

Chapter 10 covers Now Utilities software and other commercial utility software products that can help you.

Chapter 11 briefly introduces public domain (noncommercial) software, including the software products residing on the floppy diskette that accompanies this book.

Chapter 12 presents a few closing thoughts about the future and your Macintosh work habits, and offers Macintosh sources to keep you updated on an ongoing basis.

How you should use this book

If you have a Macintosh computer and an older hard drive or none at all, you can read this book straight through in sequence to get the information you need, but the hardware and operating areas are probably of most interest to you. If you already have the hard drive you need, then the operating and optimizing areas will be most useful. If you are a power hard drive user, you can glance at the chapter headings or write your own book!

Please understand this book is not a technical manual with detailed discussion of every possible hardware and software hard drive topic. The instructions, photographs, and illustrations are designed to help you enjoy the fruits of your efforts in the shortest possible time: to be more productive with your Macintosh because you bought the right hard drive at the right price, and organized it, backed it up, and optimized it with utility software to best serve your needs.

With due respect to the numerous quality software and hardware vendors, it just isn't possible to discuss everyone's product, so only a few are mentioned. If I tried to include them all, the book would be out of date before it returned from the printers. Furthermore, because of the rapid pace of Macintosh technology and marketing changes, even the products, prices, and companies mentioned on these pages will change. This process of change is relentless, like the grass growing in your yard in the summertime. In fact, I guarantee it—sight unseen!

But you will be able to use the how-to-do-it information for a long time. Plus, you will
add to it over time as your own experience grows. Bottom line: use the sources and references mentioned in these chapters to research and investigate your own best solution. Consider the specific products discussed only as a point of departure.

A word to the wise
I earn my livelihood from assisting small business clients to get up and stay up on their Macintosh systems and networks. As such, I counsel my clients to avoid serial number 0001 of anything and to employ the KISS (keep it simple, etc.) principle as far as their Macintosh environment is concerned. This puts me at odds with those whose goal is to see System 7 on every Macintosh as soon as possible. It also puts me at odds with many Macintosh power users who enjoy the flexibility of having dozens (if not hundreds) of inits, cdevs, rdevs, DAs, etc. at their fingertips on their desktop. Finally, it puts me at odds with
the most innovative and knowledgeable Macintosh users who casually use ResEdit to customize their Macintosh's features, think nothing of adjusting a data or resource fork bit to tune a custom application program just right, or load up their Macintoshes with the latest in games as a break from their work chores.

As a result, while most of my clients will migrate to System 7 eventually, they will do so in a knowledgeable and orderly manner knowing in full the advantages and disadvantages of doing it. And they will each have their own unique migration plan.

As a further result, I get very few midnight client phone calls saying, "I've just installed the XYZ init and my Macintosh won't open the hard drive that has all my business files on it." My clients use their inits, etc., sparingly and wisely with full knowledge of the consequences.

The consultant's ultimate nightmare is to be brought in to solve a client problem and find out upon questioning that the Macintosh (or network!) has been "customized," or that "special" client-developed software was being run, or it seemed like a few games had been loaded, after which their Macintosh "mysteriously" crashed. I have found through experience that a clean (or at least a stable) Macintosh environment is the best guarantee of high uptime in my client's Macintosh systems and networks.

I've followed the same philosophy in this book that I follow when advising my clients.

**Terminology**

From now on, this book exclusively uses the term **hard drive** rather than hard disk. A floppy or hard disk mechanism is the physical device itself. A controller is the device used to make the disk interact with your computer. In the DOS PC world the two are usually separate (although the DOS PC world is increasingly adopting the Macintosh SCSI standard—more on this later). In the SCSI standard Macintosh world, regardless of the type of storage being discussed, the disk and controller devices are usually found integrated into one physically inseparable unit. The term drive (i.e., hard drive, floppy drive, optical drive, tape drive) is used in this book to label this disk-plus-controller unit.

**Hard is easy**

Hard drive hardware and software is difficult only because there are so many choices. That is the reason for this book: the difficult work has already been done. When you finish reading *Macintosh Hard Disk Management*, you will know what hard drive to buy; how to buy it, set it up, make the best use of it, and back it up; and what to do about future storage needs. This knowledge can save you time and money. Those with more experience might just want to jump directly into a chapter that interests you. Or read it from cover to cover with a bag of munchies at your side.
If you are going to travel to another country, you usually learn about its currency, customs, and language before leaving. You might even read up on its history. This chapter covers the same groundwork for hard drives. First, I start with a brief history lesson and a look at the future, because what is more important than just looking backward at historical trends is learning from them. Then you can see why you need a hard drive today and why so many Macintosh owners already have them.

History and future

For those who have been around the Macintosh since its beginning, the history of the Macintosh somewhat parallels the history of the hard drive. The Macintosh history is one of first crawling, then walking, then flying, then soaring as increasingly larger and faster hard drives became available.

A 40Mb hard drive you can hold in the palm of your hand today (Connor's CP2044 model, shown in Fig. 1-1) has roots stretching all the way back to its washing machine tub-sized great grandparent. It also owes its heritage to the basic motor, servo, electronic, integrated circuit, solid state physics, mechanical, and manufacturing engineering limbs on its ancestral family tree.

You and I take much for granted today. The same technology that landed us on the moon makes it possible years later to enjoy numerous electronic appliances—in miniature—that make us more productive and our work more enjoyable. But the realities of today's workplace (more competitive) and technology itself (more complicated) has insulated us from viewing the events that brought us to where we are today. And today, a far simpler reality overrides all—few of us have the time to think about it. When you operate your computer "appliance," your Apple Macintosh Classic with 2Mb of RAM and 40Mb hard drive, you don't stop to think about how it got to be so inexpensive, nor do you marvel at how its hard drive can now store so much data in so little space with the ability to retrieve it so rapidly.
Yet marvel you should. If numerous people had not made numerous contributions along the way, your Macintosh would resemble your desk, your hard disk would resemble your washing machine, and your 9-inch Mac monitor screen would require the cabinet space that today houses a 25-inch TV set.

**Hard drive history and future**

The history of the hard drive is the history of the computer as we know it. The earliest computers evolved out of the pressing needs of government agencies and large insurance firms and banks to keep track of things that even an army of clerks could not keep up with. The early computers were driven from punched cards. The introduction of "sequential" magnetic tape created a revolution in storage but not in the process; everything was still processed in batch mode just as required by the punched cards. Real-time, interactive computers evolved out of the needs of government (national defense) and large corporations (airline reservation systems), and owed their existence to the newly created "random-access" hard disk. The IBM 650 Ramac models of the late 1950s and 704 models of the early 1960s featured hard drives whose multiple two-foot-diameter platters very much resembled the offspring of a jukebox married to a washing machine. More than any other factor, the "Man on the Moon in a Decade" challenge created by the government-funded
space program of the 1960s laid the foundation and established the roots of computers as we know them today. You can neither mandate nor legislate innovation, but the technological climate created by pressing need and the availability of funds spawned a multitude of product innovations that we are still working from in the 1990s.

One offspring of this challenge was the introduction of the highly-successful IBM 360 family in 1965. Its capabilities multiplied the demands for direct-access hard disk storage and laid the seeds for the IBM introduction of the Winchester disk drive announced in 1976. This sealed, contamination-free, Winchester disk drive technology is what has evolved, with much innovation along the way, into the Macintosh disk drive that makes us more productive today. Figure 1-2 shows an early 1980s vintage Quantum 8-inch Q2040 40Mb model (10Mb per platter). It is smaller than the washing-machine-sized models of a decade earlier, but a far cry from the 40Mb (and larger capacity) models you can hold in the palm of your hand today.

Figure 1-3 shows you hard drive evolution in graphical form. It shows the radical improvement of hard drive performance/price every decade. Performance (as measured by physical size, access time, or bits per inch storage density) dramatically improved and—as more computers got into the hands of more users—economies of scale further decreased the price, which created the need for more performance improvements in an endless self-perpetuating cycle.
Hard drive's increasing performance versus price over time.

The line in Fig. 1-3 is drawn straight only for the sake of simplicity. Actually, there were many breaks and discontinuities along the way, created by the introduction of new technologies. But the trend itself has continued for the last 30 years, and I feel very safe in predicting it will continue for the remainder of the decade. The $1,000,000 mainframe computers of the 1960s were the exclusive privilege of the few thousand companies that were able to afford them. Even after accounting for multiple hard drives at every site, you were not talking very many hard drives. The $100,000 minicomputers of the 1970s changed the picture: you were talking tens of thousands of computer sites and hundreds of thousands of disk drives. Enter the under $10,000 IBM and Macintosh personal computers of the 1980s. Suddenly you were up in the millions. Today, in the 1990s, you are looking at an installed base of over 60 million personal computers, and the prospect of upgrading every one of them with a larger hard drive. I believe I am too conservative in my estimates.

Memory history and future

The history of the personal computer is also the history of the silicon chip. Silicon, the pure form of sand, is one of the most plentiful elements on Earth. By controlling the impurities you add to pure silicon, you can control its electrical properties and make it either more or less conductive, hence the term semiconductor. Used in transistors, it replaced vacuum tubes in the computers of the late 1950s and early 1960s because it consumed less power, took less space, withstood shock and vibration better, and cost less to manufacture in volume.

At about that same time, a number of computer pioneers discovered it was possible to put multiple transistors on the same silicon base and gain even further power, space, and cost benefits. This was called the integrated circuit. Since its introduction, computers and the world as we know it have never been the same.
Whether you are talking about the CPU (central processing unit) chip at the heart of every personal computer, the RAM (random access memory) chip used in computer memory, or numerous other specialized chips, the principles involved are the same. You design the basic circuits, reproduce the designs, and interconnect them until you have the electrical design for the chip you want, then photographically reproduce this design and etch it in silicon. Today’s most advanced chips, such as the Motorola 68040 chip, pack 1.2 million transistors into a space no larger than your fingernail. The good news is that once you perfect the production process, it is no more difficult than baking a batch of cookies. The bad news is that in order to achieve ever higher packing densities, you are forced to work beyond the visible light region, using x-rays to etch the adjacent lines on the chip closer together; this means a big investment in bucks, time, and talent.

Taking a look at the history (and future) of commodity RAM chip capacity trends provides an interesting comparison. Figure 1-4 does just that. Notice that RAM chip capacity has quadrupled every three years since 1979. Right now, 1Mb RAM SIMMs (Single Inline Memory Modules made up from individual RAM chips) are the tool of choice for most Macintosh memory expansion projects because they are plentiful and inexpensive.

Figure 1-5 shows you a typical 30-pin 1Mb SIMM unit in the foreground with two 256K SIMM varieties in back (four times the capacity in the same physical space). We are nearly at the crossover point today where 4Mb RAM chips will displace 1Mb RAM chips because of their greater packing density and price advantage. By 1994, 4Mb RAM chips will be displaced, in turn, by 16Mb RAM chips. If you extrapolate this curve forward three generations to the year 2000, everyone will be using 64Mb RAM chips. This is a virtual certainty.

Not only will you handily be able to run System 7 on your laptop Macintosh, but a whole generation of voice input and other new products will be made possible by the new technology, not to mention the price/performance improvement in your hard drive, whose controller also uses this same technology.
Personal computer hard drive history and future

Like the mainframe computers of the 1950s, the first personal computers of the 1970s were extremely limited because they had no hard drives. It was up to a few individual pioneers, trained in mainframe hard disk development, to apply the lessons they learned to a whole new set of specifications—the emerging generation of personal computers.

Figure 1-6 summarizes the history (and future) of personal computer hard drive capacity trends. In this case, I used as reference points the ability to obtain the product in the marketplace at a commodity price of roughly $500. Though the line is straight only for convenience, notice that personal computer hard disk storage has doubled every three years.

Today, you can buy an 80Mb hard drive for your Macintosh for less than $500. By 1994, a 150Mb hard drive for your Macintosh will cost the same. If you extrapolate this curve forward two more generations to the year 2000, $500 hard drives of 600Mb capacity will be the norm. I am even more certain of this statement because it is only based on carrying forward the current technologies, not on any new breakthrough technologies.

The other good news is that physical size is decreasing while, at the same time, hard drives are delivering increased capacity, increased reliability, and faster access times. Whatever your background, you must appreciate that this is an incredible feat of engineering. Figure 1-7 delivers the point visually. It shows, from left to right, the Quantum 51/4-
inch Q250 40Mb model (that went into the 1987-vintage Mac II), the Quantum 3½-inch PRO105 105Mb model (its earlier 40Mb and 80Mb cousins went into the 1989-vintage Mac SE 30 and Mac IICx), the Quantum 3½-inch LPSS2 52Mb model (that goes into the 1990-vintage Mac LC, IIsi or Classic) and the Quantum 2½-inch GO80 80Mb model (that goes into 1991-vintage laptops).

Understand where I am heading with this. You will be able to enjoy a 600Mb hard drive on your Mac at $500, but the leading edge of the technology will be at six gigabytes (6Gb) of storage and the price will be commensurate. It gives me goosebumps to think about it.

Perhaps the brightest star is optical

As long as I am speculating on the future, I think you would be well-advised to check out the newest generation of 3½-inch rewriteable or magneto-optical (MO) drives. Today, you can get a 128Mb drive in a 3½-inch cartridge (the same size as a standard 3½-inch floppy diskette but twice as thick) with a 50 ms access time (identical in performance to the hard drives of only a few years ago) for around $2000 or so. Plus, you get a removable media you can put in your shirt pocket with a lifetime measured in decades, which will never present you with a head crash, which is impervious to magnetic fields, and whose optical technology is inherently able to support higher packing densities than magnetic media. No, you haven't just heard a word from your sponsor. I am just daydreaming about how fast and convenient it will be to back up my 6Gb hard drive onto my 6Gb 3½-inch optical cartridge and lock it up in my desk drawer at night before going home.

Unique needs

Early personal computers got along with very modest means for data storage. Paper tape, floppy disks, tape cassette, and small hard disks were all adequate for the task, although in

The job was relatively easy to do by today's standards. You were mostly manipulating text in word processing, spreadsheet, and database applications.

**Macintosh has unique hard drive need**

Enter the Macintosh. It is a graphics-intensive computer. While there were other graphics computers and interfaces before it, the Mac really set the standard for all the graphical user interfaces (GUI) to follow—and for today’s emphasis on the graphical “windowing” environment standard for nearly every computer. However, if one picture is worth a thousand words, a corollary is that it is also a thousand times harder on the computer doing it. The bottom line is that all of what makes the Macintosh easy to learn and easy to use calls for lots of computing horsepower and storage capability under the hood. If you want to do it in color, you can raise that by an order of magnitude. If you want color, full motion video, and sound you are talking several orders of magnitude.

At its introduction in 1984 when the contemporary computers of its day were chugging along nicely on 8- or 16-bit processors, the Macintosh required the 32-bit capabilities of the Motorola 68000 chip. The 5Mb or 10Mb of storage offered by the early hard disks, usually adequate to the tasks of the early DOS PCs, groaned under the requirements of the Mac, especially when choked by the initial ability to communicate only through the Mac’s serial port. Few other contemporary computers showed the voracious appetite for storage characteristic of the Macintosh.
Today the shoe is on the other foot. The same basic hard drive on any mid-range Macintosh model running System 7 easily outperforms its counterpart on a mid-range DOS PC running the windows environment on top of its DOS software. A machine designed from the ground up to run graphics simply performs better than a character-oriented machine with a graphics interface piled on top of it. It has to. So the Macintosh, in any of its models, really needs a hard drive to take full advantage of its abilities (obviously this goes double for DOS PC windows environment users, which is good news for hard drive manufacturers). Most Macintosh owners already know this.

**Your Mac hard drive need is unique**

You might have no hard drive on your Mac 128 today and no interest in getting one ever. You might have several 1.2Gb hard drives on your Mac IIfx and an urgent need to add more capacity. Most likely, you are somewhere in between. Figure 1-8 tells the story at a glance. The area under the curve shows the distribution, on a percentage basis, of five different classifications of hard disks among all Macintosh owners. The fact is that over 95 percent of all Macintosh owners own some type of hard drive today. The audience for this book is the 92 percent of all Macintosh owners in the middle three classifications on the chart.

Macintosh owners without hard drives today either represent very casual users or those with highly specialized applications not requiring hard drives, such as industrial controllers and data gathering devices. (Neither kind of owner is likely to want a hard drive even after reading this book!) On May 15, 1991, Apple increased the burden on this user group by announcing System 7, which requires a hard drive (preferably 40Mb or more) to run. If you are a member of this group (or presently own an older 20Mb hard
drive), I believe you can see the handwriting on the wall. Macintosh owners with 600Mb and larger disk drives represent "power users" who have long ago learned most of their hard drive lessons from a gentleman named Murphy and who could probably write their own version of this book. They will scan this book cover to cover, and then emit a single sound after putting it down: "Yup!"

On the other hand, Macintosh owners with serial hard drives might believe they have died and gone to heaven after trading up to one of the newer SCSI hard drive offerings. Any of the majority of Macintosh owners can benefit from upgrading to a newer technology, larger capacity hard drive. Even if your budget does not permit you to upgrade your hard drive until next year, you can still benefit from this book's software and organizing tips applied to the hard drive you own now.

Why you need a hard drive

Why do you need a hard drive? Because it improves your productivity. Anyone in business today has encountered "the need to improve employee productivity," either via reading or seminars or directly from your boss. Productivity is defined simply as the amount of work you are able to accomplish or useful results you are able to produce in a given amount of time. Apple said it most succinctly in a recent magazine ad for its System 7: "Do more. Work less." Whether you're an individual in business for yourself or part of a work group in a larger organization, you and your organization are constantly called upon to deliver more. That's why you or your organization bought a Macintosh to begin with. The Macintosh graphic user interface helps you to be more productive because it's easier to learn and easier to use.

Using a hard drive rather than working from a floppy drive greatly increases your productivity. In fact, other than your Macintosh itself, your hard drive and its performance is the main reason why your Macintosh helps to make you more productive.

Figure 1-9 shows why. Today, you can buy an Apple 1.4Mb internal FDHD floppy drive at a street price of about $250, the same price it would cost you to buy the newest Quantum 52Mb internal hard drive through a mail order reseller. The floppy rotates at 300 rpm. The hard drive rotates at 3600 rpm. Bottom line, you get more than 10 times the retrieval speed and more than 35 times the storage capacity for the same cost outlay.

In addition, when you power up your Macintosh all your applications and data are on your Macintosh desktop waiting for you to go to work. You have no need to shuffle floppy diskettes in and out of your Macintosh until you get the application you want together with the data it requires on your screen at the same time. Your hard drive enables you to be more productive because all your important applications and data are available to you online, and you can get to them almost instantly with the click of a mouse.

Finally, if you want to take advantage of the benefits of Apple's new System 7—and there are many—you need a hard drive. Period.

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1Headline from Apple ad appearing in Business Week, August 12, 1991.
Same cost outlay buys you a 52Mb hard drive or a 1.4Mb floppy drive.

What else can I say? That is why you need a hard drive today. Actually I am preaching to the choir here. You are probably one of the 95 percent of all Macintosh owners who already has a hard drive. My objective in this book is to help you upgrade to a newer, larger one or make more effective use of the one you already have.
Parkinson's law applied to computer data storage would be: "data expands to fill the space available for it." You already know this. Like the closets in your apartment or house, your graphically-based Macintosh has a voracious appetite for storage to begin with, and using the newest high-performance graphics, multimedia, database, and spreadsheet software applications just exacerbates the problem. Fortunately, you have a wide spectrum of solutions to help you.

While this book focuses on hard drives, you should be aware of the other storage alternatives available to you as a Macintosh owner. In this chapter, I'll first overview and position the Macintosh storage devices for you, starting with the memory chips inside your Macintosh, then examine floppy, hard, removable, optical, and tape drives in turn. For each category along the way, I'll briefly cover how they work, discuss some products, and make a few recommendations.

The spectrum of Macintosh storage alternatives

Since the primary function of your Macintosh (and all computers) is to store and retrieve data, the most significant step you can take to improve your Macintosh's performance is to improve the storage capacity and retrieval speed of the storage devices attached to it. Fortunately, as you read in chapter 1, technological change has already assisted you by greatly reducing the cost per unit of storage capacity of all of these devices over time, and this trend will continue into the future. Unfortunately, the fastest storage technologies have the smallest capacity and the slowest storage technologies have the largest capacity.

Speed versus capacity

Figure 2-1 tells the story. The fastest of the Macintosh storage devices are semiconductor technology: the CPU and its supporting random access memory (RAM) and read-only memory (ROM) chips. Relative to other storage alternatives, the random access memory chips used by your Macintosh CPU have the fastest access/retrieval time but the smallest storage capacity and the highest cost per bit of capacity.
In the mid-range of the Macintosh access times are the disk technology devices, whose stored contents are online and available to your Macintosh at all times. (All disk drives are direct access and not random access because access time varies with the location of the data on the drive.) Although disk technology access time is measured in milliseconds, it is far slower than semiconductor access time (measured in nanoseconds), but its storage capacity is much larger, its cost per bit is much lower, and it comes in numerous capacity, speed and cost combinations.

The slowest of the Macintosh storage devices are tape technology. These are sequential access storage devices whose stored contents are typically kept offline and loaded into your Macintosh only at special times by restore or retrieval software. Although tape storage capacity is virtually unlimited and its cost per bit relatively low, the media must be mounted, and all its records must be searched in serial, sequential fashion until the desired record is located.

Storage alternatives compared

Table 2-1 compares the storage alternatives in terms of the main storage measuring parameters: size (capacity), speed (average access time), drive cost (price of the device and its cost per megabyte) and media cost (price of the media and its cost per megabyte). I've taken artistic license with some of the figures to arrive at round numbers. For example, although both are listed at 20 ms, hard drives are faster and removable are slower than
Table 2-1  Macintosh storage speed versus cost comparison

<table>
<thead>
<tr>
<th>Storage medium</th>
<th>Size/type</th>
<th>Speed</th>
<th>Unit or drive cost</th>
<th>Media cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>SIMM</td>
<td>100 ns</td>
<td>$50/1Mb = $50/Mb</td>
<td></td>
</tr>
<tr>
<td>Hard drive</td>
<td>3 1/2 inch</td>
<td>20 ms</td>
<td>$500/100Mb = $5/Mb</td>
<td></td>
</tr>
<tr>
<td>Removable drive</td>
<td>5 1/4 inch</td>
<td>20 ms</td>
<td>$1000/100Mb = $10/Mb</td>
<td>$100/100Mb = $1/Mb</td>
</tr>
<tr>
<td>Optical drive</td>
<td>3 1/2 inch</td>
<td>50 ms</td>
<td>$2000/100Mb = $20/Mb</td>
<td>$100/100Mb = $1/Mb</td>
</tr>
<tr>
<td>Floppy drive</td>
<td>3 1/2 inch</td>
<td>200 ms</td>
<td>$200/1Mb = $200/Mb</td>
<td>$1/1Mb = $1/Mb</td>
</tr>
<tr>
<td>Tape drive</td>
<td>Cassette</td>
<td>20 sec¹</td>
<td>$1000/100Mb = $10/Mb</td>
<td>$20/100Mb = $0.2/Mb</td>
</tr>
</tbody>
</table>

¹This is an optimistic figure—anywhere from 30 seconds to 10 minutes or more is possible.

this figure; although both are listed at 100Mb, removable media is 90Mb and optical media is 128Mb. You get the idea. While there is a product to fit your every need, it is up to you to choose wisely.

Hard drives have the edge in speed (< 20 ms) and cost ($5/Mb) and you can expect this trend to continue until the end of the decade. Read/write optical media in the 3 1/2-inch format listed ($1/Mb) is the same cost as removable and floppy drive media today. You can expect the former to displace both of the latter (for short-term storage) to some extent by the end of the decade as storage densities go up and access times decrease. You can also expect optical drives to displace hard drives for specific working storage applications (security, nonmagnetic, removable) in this time frame.

I expect tape drives to continue to be available forever because of their lowest media cost ($0.20/Mb) but not in all of the present formats. Optical drives will make inroads in long-term storage too, as the convenience in getting to your data quickly and the longevity of optical versus tape media outweigh pure media cost considerations.

Floppy drives stick out somewhat in the table with their slow speed (200 ms), high drive costs ($200/Mb) and media costs ($1/Mb) only equal to that of the much larger capacity removable and optical formats. It all points the way to the imminent new introductions on the horizon: 2.8Mb floppy diskettes and 20.8Mb floptical media.

Inside your Macintosh

Since this book is about Macintosh hard drives, the most logical place to begin is with your Macintosh. So I'll begin by taking a brief detour to look inside at how your Macintosh works. Even if you never use the information, think of how much better a conversationalist you'll be at cocktail parties. Power Macintosh users can skip ahead.

How your Macintosh works

Figure 2-2 shows a block diagram of your Macintosh along with its hard and floppy drive peripherals. The shaded area represents what's inside your Macintosh. The hard and floppy drives can be either inside or outside your Macintosh.

When you first turn on your Macintosh, it goes through a diagnostic routine to check if its memory and other circuits are okay; copies its initial instructions from ROM to
RAM; establishes communications with all attached devices (hard drive, floppy drive, keyboard, mouse); looks for the system software (first on the floppy drive, then on the hard drive) and loads it; and finally presents you with the “Welcome to Macintosh” screen and your Macintosh desktop just as you left it when you last turned off the power. When you click on the icon representing the software application or file you want to open, your Macintosh fetches a copy of it from your hard or floppy drive and loads it into RAM, after which the application instructs your Macintosh how to proceed.

Your Macintosh is easy to learn and easy to use because it does all the difficult work invisibly—mostly by harnessing the operation of its different storage devices to work in unison. Let’s take a closer look.

The central processing unit (CPU)

Although encased in a larger protective housing as shown in Fig. 2-3, a CPU chip no larger than your thumbnail is the “brain” of your Macintosh. (The microcomputer CPU chip that makes your Macintosh go belongs to the Motorola 68000 family that today has four members: 68000, 68020, 68030, and 68040.) Your Macintosh CPU manipulates information by storing, retrieving and performing calculations on the data in accordance with its programming instructions stored in ROM, instructions loaded in RAM from external storage, or instructions provided by you (or other input/output sources) in real
time from the keyboard or mouse. The CPU keeps you appraised of its actions via the monitor screen (or provides hard-copy output to a printer).

The slowest of Macintosh CPU chips run at 8 MHz (eight million cycles per second) but this is more than sufficient to perform millions of operations between keyboard input from even the fastest power typist. When you hit a key on the keyboard and a character "magically" appears (or you click the mouse and a picture with millions of elements in it is redrawn) on your Macintosh monitor screen, this is possible only because of the blazing speed at which your Macintosh's CPU chip operates, supported in its mission by its ROM and RAM chips.

Read-only memory (ROM)

ROM is permanent memory. ROM chips use thousands and thousands of tiny fuse-like links to store a permanent pattern of 1s (represented by connected links) and 0s (represented by open links). This pattern gives any computer its unique personality by telling it how to execute certain instructions. The programming instructions stored in ROM are permanent data, called firmware, as distinguished from the temporary software data that gets loaded into RAM from storage devices. The Motorola 68xxx processor chip at the heart of the Macintosh is also used in the Atari, Amiga, NeXT, and numerous other computers. The major difference between them (physical architecture aside) is the instructions stored in their ROM chips. When Apple first introduced the Mac 128, the 64K of instructions optimized and crammed into its two ROM chips shown in Fig. 2-4 is what really made it a Macintosh.
Random access memory (RAM)

RAM is nonpermanent memory. This is the memory your Macintosh uses to run all your programs. Today's semiconductor computer memory, like the processor chips, is very fast—RAM chips typically have an access time of 100 ns (nanoseconds) or better— but "volatile" because when you turn the power off you erase memory. So RAM memory only temporarily stores your data. No power, no data.

Single inline memory module (SIMM)

On the earliest Mac 128 and Mac 512 logic boards, Apple soldered RAM chips directly onto the board as shown in Fig. 2-5. Repairing or upgrading them was very difficult. SIMMs, first introduced on the Mac Plus in 1986, revolutionized memory use and made it possible to add additional memory easily to the Macintosh Plus logic board and to any Macintosh developed since then.

A SIMM typically consists of two to eight individual RAM chips attached to a small printed circuit card like those shown in Fig. 2-6 (Some IIci and IIfx SIMMs use nine chips—the extra one is for parity—a quick way of checking your memory's health). A 1Mb RAM SIMM typically costs about $50 today.

Hard and floppy drives

Hard or floppy drives perfectly complement the ROM and RAM inside your Macintosh, and assist it in its computing mission because of their permanent storage capabilities. The information stored on your hard or floppy drive can be changed by writing new information over it; accessed directly (although not as quickly as with RAM chips); and stored at a much lower cost per unit of storage than RAM chips.

Macintosh recommendation

As far as your Macintosh is concerned, a faster, more powerful CPU and more memory are always better. Logic board and accelerator board upgrades are not available to everyone because of their cost. But, at $50 per Mb for a 1Mb RAM SIMM, more memory is within everyone's budget. Plus you have an enormous amount of flexibility in hardware
2-5 Soldered on 256K RAM chips on Mac 512 logic board.

2-6 Different 256K SIMM types.
and software memory products to help you today. Add 4Mb to your earliest Macintosh models using upgrade boards, use up all your 256K SIMMs in converter boards, add 8Mb to your Mac II or IIci, and push your 32-bit clean Mac IIci and IIfx models to 32Mb and beyond with 4Mb SIMMs. My earlier book covers these topics in detail. For the moment, I’ll paraphrase the Nike ad and say, “Just Do It!”

The floppy that doesn’t flop

For short-term storage today, 3 1/2-inch floppy drives do the best job of getting data into and out of your Macintosh. Their performance has steadily improved over time. Today, Macintosh 3 1/2-inch floppy drives come in three storage capacities: 400K or single sided, 800K or double-sided, and 1.4Mb or high-density. While the 1.4Mb floppy is currently recommended, Macintosh owners will also have 2.8Mb and 20.8Mb 3 1/2-inch floppy drive options in the near future.

How floppy drives work

Everyone is familiar with the operation of a phonograph record player: a vinyl plastic record, rotated by a constant speed motor, is played back via a needle mounted on a tone arm that follows its spiral grooved track.

A floppy disk drive can be thought of as the phonograph’s distant, high-technology, cousin. But, unlike a phonograph record’s spiral, a diskette’s information is recorded on it in concentric areas called tracks. The recording of concentric track circles onto the diskette’s initially blank media surfaces is done by the read/write heads under the direction of the formatting software. Also, you would have to imagine a tone arm and needle cartridge with almost no weight at its needle end that could go to any spot on either side of the record instantly to read (play) or write (record) digital information (versus analog information for record player) at a very high transfer rate.

When you first open a box of new floppy diskettes, its media has been tested at the factory, but it is completely blank—just like a new audio cassette tape. Formatting a diskette is like putting sorting bins on the blank wall of a post office: formatting creates specific “pockets” in concentric track and sector locations around your floppy diskette, from which you can read and into which you can write data. Figure 2-7 shows the organization of tracks and sectors on the floppy diskette’s surface.

Each sector or block, as it is also called, holds 512 bytes of data in it. The older 400K single-sided and 800K double-sided diskettes had 8 sectors on the innermost tracks and 12 sectors on the outermost. The 400K diskettes record data on one side, hold 80 tracks or 400 sectors, and have a total capacity of 409,600 bytes. The 800K diskettes record data on both sides, hold 160 tracks or 800 sectors, and have a total capacity of 819,200 bytes. The 400K and 800K diskettes utilize GCR (Group Code Recording) where the floppy drive spins the diskette faster (590 versus 394 rpm) when accessing the 12 sectors per track on the outermost tracks than it does when accessing the 8 sectors per track on the innermost tracks.

1My Build Your Own Macintosh and Save a Bundle (Windcrest 1992) and Upgrade Your Macintosh and Save a Bundle (Windcrest 1991) covers this.

20 Macintosh storage overview
The newer 1.4Mb Macintosh FDHD diskettes that utilize MFM (Modified Frequency Modulation) recording spin at a constant 300 rpm with 18 sectors on every track, and are totally compatible with DOS PC diskettes which utilize the same format and technique. This is why you can read or write DOS PC diskettes in any Macintosh that supports the newer FDHD floppy drive—a tremendous advantage. The 1.4Mb FDHD double-sided diskettes also hold 80 tracks on each side with 18 sectors per track or 2880 sectors, giving a total capacity of 1,474,560 bytes.

The media is the message
In a floppy diskette, the medium is the flexible disk made of thin plastic with an even thinner magnetic coating on both sides. Older 8-inch and 5-inch floppy diskettes were enclosed in coated paper, which made the entire assembly flexible and thus gave rise to the floppy name. In the 3½-inch floppy format, the flexible magnetic media diskette is enclosed in a semi-rigid plastic housing—thus giving rise to the play on words of this section heading. Apple legitimized the 3½-inch floppy format by introducing it on the Mac 128 in 1984. Other vendors soon began using it in their products and it has become the de facto standard today.

Figure 2-8 shows the inside and outside of a 3½-inch floppy diskette. Only an extra hole punched in the plastic protective housing and located opposite the write protect hole externally distinguishes 800K floppy diskettes from their 1.4Mb counterparts. (Inside, their media have different magnetic capabilities, so you can’t just punch an extra hole and substitute one for the other.) In Fig. 2-8, the top row shows the disassembled diskette, and the bottom shows it as viewed from the front and rear. The thin plastic flexible disk media is shown in its housing at the top left. The top right shows the liner that protects the media from its semi-rigid plastic housing. At the far right is the metal shutter that covers the media (except when it is inserted into the floppy drive); above it is the spring clip that holds the shutter closed. In between the upper and lower left side views is the plastic write-protect tab. When it is in its “closed” position you can write on the diskette. When it is locked at its other position and you can see through the rectangular hole in the diskette, the diskette is write protected—you cannot write information on it.

A head for reading and writing
On a floppy drive, read/write heads on opposite sides of the media press it between them, and the tiny electromagnets at the tip of the heads either read or write data. In Fig. 2-9, the pen points to the lower read/write head on an Apple 800K floppy drive. The figure also
2-8 Disassembled 800K floppy diskette showing component parts.

2-9 Macintosh 800K floppy drive—pen points to lower read-write head.
shows how a floppy diskette’s shutter is opened before the read/write heads are lowered/raised to come into contact with the media. This contact is the reason both the heads and the media eventually wear out with use.

You probably learned about electromagnets in school: a few turns of wire wrapped around an iron or steel nail magnetized it when an electric current was applied to the wire. When you turned off the current, you no longer had a magnet. The orientation of the poles was determined by the polarity of the current applied—reverse the polarity and you switch the poles. You proved it by locating a compass nearby—change polarity and the compass needle turns around. You also found out that you could permanently magnetize the nail (or any iron/steel object you brought close enough to it) if you made the current strong enough.

If you bent your electromagnet into a “U” shape and made it super small (about the size of a match head), you would have a floppy drive read/write head. Passing a current through its wires magnetizes the magnetic oxide coating on the media underneath it with the same polarity as its poles. Reversing the current flow magnetizes the magnetic media in the opposite direction. This is how the head “writes” on a diskette (or hard drive), and is shown in Fig. 2-10.

If you pass a magnetized media underneath the poles, you generate a current in the wires (technically, a voltage is induced proportional to rate of change of flux in the head). Sensing this current and its direction is the process that occurs when the head “reads” from the diskette (or hard drive), as shown in Fig. 2-11. Your Macintosh floppy diskette

The floppy that doesn’t flop 23
(or hard drive) works just as if it had a lot of tiny permanent magnets located in the tracks on its surface. They remember their polarity whether power is applied or not.

Figure 2-12 shows you a greatly expanded picture of how the bits of data are recorded on a disk. Each bit is actually like a small permanent magnet on the surface of the disk. The arrows indicate the north/south polarity, or in this case, the arrows pointing to the left indicate 1s and those pointing to the right indicate 0s. The binary 8-bit pattern shown—01000010—represents the capital letter B in ASCII code.
Go directly to . . .

All floppy drives set aside several tracks as directory tracks. The rough analogy is that they function like the table of contents in a book. You can look up the location of the topic you are interested in, then go directly to it. Your Macintosh diskette's directory contains information flags or pointers that point to (identify the location of) data on the diskette. When you throw an icon into the trash on your Macintosh and empty it (same as typing erase or delete along with the filename and extension on a DOS PC), all you are doing is deleting its entry from the directory. The data is still there—until you write over it. Although the analogy is the same, in reality the Macintosh diskette directory is quite complicated. It takes care of an enormous amount of housekeeping invisibly, or "transparently" to the user. Space is reserved for the system startup information or boot blocks, the volume information (the volume being the diskette in this case), volume bit map, catalog file, and extents file (which keeps track of large fragmented files). I'll save these for the hard drive section.

Macintosh 400K floppy—rest in peace

Today the 400K floppy drive is a dinosaur—but, unfortunately, not yet extinct. It is inexpensive (you can probably pick one up for $25 to $50) and makes an excellent companion to your Mac 128 system, but is the slowest of all floppy drives, offers the least storage capacity, and is a solution only if you are contemplating a hobbyist or low-utilization word processing use. You could have difficulty finding parts to fix it if it breaks. If you are using one today, I implore you in the strongest terms to upgrade to an 800K floppy drive.

Macintosh 800K floppy—the winner by distribution

Today the 800K floppy drive and 800K floppy diskette media is the Apple Macintosh standard—but only by virtue of its widespread distribution and its inexpensive media cost. It's very practical—an 800K floppy diskette can hold 100 to 200 typewritten pages, fits in your shirt pocket, and costs under 50 cents! Plus, chances are almost certain that whether you give the diskette to your neighbor down the street or to a business on the other side of the world, they can easily read it. No matter what the marketing advantages of future and better media, the 800K floppy and media will be with us for a long time to come just by sheer weight of numbers: installed base and low-cost. If it makes good sense in your case and the numbers make sense, you cannot hurt yourself by using it.

Macintosh 1.4Mb FDHD floppy—the new champion

Here's where the action is. Because Apple now offers its 1.4Mb FDHD floppy drive on every new Macintosh sold from the Classic on up, it is only a matter of time before the 1.4Mb floppy drive overtakes its 800K "cousin" in terms of market share. Its overwhelming benefit in this age of open systems—compatibility with DOS PC media and (with the help of Apple File Exchange utility software) the ability to read and write DOS PC 3½-inch drives formatted at 720K and 1.4Mb—is simply too great an advantage to overcome.

Add its ability to read and write 400K, 800K, and 1.4Mb diskettes and you have to start asking yourself why bother with anything else? The coup de grace is applied by the

The floppy that doesn't flop 25
high density 1.4Mb floppy diskettes in the media area. They are now at the crossover point—a 1.4Mb floppy diskette costs just under $1.00—twice the cost of an 800K floppy diskette. But the rate of price decline on 800K diskette media has slowed and that of 1.4Mb diskette media is accelerating. Plus you are not limited to buying a floppy drive from Apple; you can now choose from at least five other 1.4Mb drive vendors: Applied Engineering, Dayna, Kennect, PLI, and Quadmation.

2.8Mb or 20.8Mb—the future Macintosh floppy drive standard

For a while, it was difficult to pick up any computer or electronics magazine and not notice Toshiba’s advertising spread touting its new 2.8Mb 3½-inch Extra High Density floppy diskette and its new Barium Ferrite perpendicular recording technology advantage. Drive and media costs should only be incrementally greater than today’s 1.4Mb products once production volumes increase. Toshiba’s new 2.8Mb models are backward compatible with 1.4Mb offerings—they have 720K and 1.4Mb DOS PC diskette read/write capability—and Toshiba has licensed its 2.8Mb technology to numerous drive and media manufacturers. The new IBM and NeXTstation models already incorporate it. Can Apple be far behind?

Meanwhile, imagine taking a high density 3½-inch floppy diskette, stamping an indelible servo track optical pattern into its media surface, and being able to store 20.8Mb on it. Insite Peripherals’ Floptical and Brier Technology’s Flextra products (same idea, different approach) do exactly that, are also backward compatible with 1.4Mb diskettes, and have licensed a number of vendors. PLI’s Insite-technology mechanism and Quadram’s Flextra-mechanism Macintosh drives both sell for street prices in the $600 ballpark, and media costs about $30 each.

Floppy drive recommendation

Just as less expensive 256K DRAM chips drove out 64K ones (remember back then?) and 800K floppies replaced 400K ones, 1.4Mb floppies are today displacing 800K models and they, in turn, will be replaced. My recommendation is to pick a floppy that meets your needs today—1.4Mb would be my choice—but don’t get too comfortable with it. The 2.8Mb floppy drives are first to volume production, and IBM’s endorsement by putting them in their newest PS/2 models is a tremendous step towards standardization. On the other hand, the 20.8Mb floptical drives are available in the Macintosh replacement market today. Ultimately, market forces will decide . . .

Hard drives are not so hard

Hard drives have changed drastically since their first introduction in the 1950s—this technology trend continues. Next to memory and CPU chips, they are the number one reason responsible for the increase in the number of personal computers installed today. The newest offerings have more capacity and greater performance at a lower cost at both ends of the size spectrum. Today, 2 gigabyte 5½-inch, 600Mb 3½-inch and 80Mb 2½-inch hard drives are a fact of life for Macintosh owners. In the near future, Macintosh portable owners will also have 1.8-inch hard drive options.
But hard drives come in fixed and removable flavors and with magnetic, optical, and combination media. Which type should you use? You want speed and capacity in the device for storing and using your Macintosh's data on a day-to-day basis. Although there are exceptions, your working storage needs are today best met by fixed, magnetic media hard drives. They fit the speed and capacity criteria perfectly and offer the additional benefit of low price.

How hard drives work

Hard drives work the same as floppy drives in principle only. They offer greater capacity—and faster storage and retrieval time—by using: a sealed environment; multiple highly polished perfectly flat, rigid platters rather than a flexible plastic one; and a much smaller read/write head at the end of an arm that has been optimized for minimum mass, and which is controlled by servo-driven voice coil mechanisms rather than slower floppy-style stepper motors. The floppy controller is replaced by the embedded, industry-standard, SCSI interface controller. This controller allows hard drives to transfer data at high rates, yet retain the flexibility to communicate with multiple devices concurrently connected to the Macintosh via the SCSI bus.

While the names, designs, sizes and shapes of parts differ, each hard drive vendor utilizes the same basic approach. Figure 2-13 shows you a cutaway view of a large capacity Micropolis 1500 series hard drive—the elements identified are common to all hard
drives. Let's look more closely at how the increased complexity of hard drives extends the floppy drive lexicon.

**Media is still the message**

In a hard drive the medium is a rigid disk made from aluminum, a metallic alloy, or glass coated on both sides with a thin magnetic oxide layer. The rigidity of the disks (also called platters) when compared to flexible, floppy media gave rise to the name *hard drive*. Older platters came in 5 1/4-inch, 8-inch and even 14-inch sizes, but 3 1/2-inch is the most popular size for the mid-range Macintosh market. Figure 2-14 contrasts the 3 1/2-inch media: two polished metal hard drive platters with one flexible plastic diskette.

![Polished metal hard drive platters versus floppy diskette media.](image)

Hard drives typically have multiple platters. Identically located tracks on adjacent platters in a stack are often called *cylinders*, since their arrangement directly above (or below) one another describes a cylinder in space. The terms *cylinder* and *track* are frequently used interchangeably when discussing hard drives. Figure 2-15 shows the 3 1/2-inch Conner CP3500 540Mb hard drive with its multiple platters clearly visible.

Like a floppy diskette, hard drive tracks are further subdivided into *sectors*. Sectors are also called *blocks*, and refer to specific locations on a given track where data is written. Unlike a floppy diskette, a Macintosh hard drive might be formatted with 512, 1024, 2048 (or some other number of) bytes of data per sector or block. Because the interface reads or writes one sector at a time, regardless of the amount of data actually being read from or written into the sector, putting a lot of small files in the upper address space of a large hard drive can rapidly waste space.

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Formatted hard drive capacities (the amount of data in bytes that can be stored on the hard drive's platter surfaces) depend on the computer, disk controller and formatting software used. As you read in the floppy drive section, capacity is smaller after formatting—sections set aside for directory and housekeeping usage are not available for data. While this is fairly straightforward in floppy diskettes, it varies widely in hard drives because of track/sector arrangement, recording schemes, read/write techniques, and interface hardware/software utilized by the different manufacturers. The point here is that one manufacturer might advertise their hard drive's capacity before formatting, another might quote capacity after formatting. For example, the Maxtor LXT100 has a capacity of 88Mb (not 100Mb) after formatting, while the Quantum LPS105 actually has a capacity of 105Mb after formatting.

Low-level formatting is actually the correct term to use when talking about formatting hard drives (or floppy diskettes or removable media, etc.) for the first time. This process imparts tracks and sector information to the initially blank surface. High-level formatting, used interchangeably with the term initializing, creates the directory that informs you of what is located where on the drive.

Because of this distinction, it is usually safest for you to buy your hard drive and formatting software at the same time from the same vendor—unless you have formatting software that can be used with any drive as discussed in chapter 4. By doing this you minimize the risk of incompatibility that can occur when you buy a Brand X low-level formatted hard drive and use Brand Y high-level formatting software on it—because the Brand Y software inadvertently overwrote the space the Brand X software had reserved for its directory information.

Newer drives employ zone-recording techniques in which more data is placed on each track as the head moves away from the center of the drive. The object is to have the same recording density on all areas of the platter, rather than just recording the same amount of data on each track. This way you take full advantage of the higher densities newer drive media are able to support over their entire platter surface—not just near the center of the drive. In a way, this is a throwback to how data is recorded on the older Macintosh 400K and 800K floppy diskettes. But, unlike earlier Macintosh floppy drives whose rotation speed varied with location on the diskette, newer hard drives continue to rotate at constant speed—what changes is the speed of writing to and reading from the drive.
Don't platter yourself

I didn't mean to be funny with the heading. To make Fig. 2-8, I took apart an otherwise perfectly good floppy diskette—an irreversible humpty-dumpty style process—but my investment was in the $0.50 to $1.00 range and I wouldn't want to reuse it anyway. On the other hand, notice the duplicate “Warranty void if seal broken” warnings on the older Quantum 5 1/4-inch Q250 hard drive in Fig. 2-16. Opening the cover of any hard drive on the planet voids the manufacturer's warranty because it virtually guarantees the imminent if not immediate destruction of your hard drive, setting you back several hundred dollars, and more important, causing you the loss of megabytes of data.

You will find few warnings from me in this book. This is one of them. Don't open your hard drive unless you are into destroying things for the fun of it. Hard drives are assembled in Class-100 type “Clean Rooms” (whose occupants are clothed in surgical style caps and gowns) just like NASA uses for its space program equipment because a tiny speck of dust—or even just breathing on the platter—can cause loss of data, and a fingerprint or human hair can cause the loss of your hard drive.

An advanced head for reading and writing

The read/write heads in a hard drive work on the same principle as those in a floppy drive a far as reading and writing data are concerned. But all similarities end there because of the much higher track densities, media rotation speeds, and closer head design tolerances within the hard drive. Unlike a floppy, current technology 3 1/2-inch hard drive heads fly
above the media surface at a distance of eight microinches—that's eight millionths of an inch. A carbon overcoat lubricates the disk surfaces to prevent wear due to head contact with the disk surfaces during head takeoff and landing. Because hard drive heads float on a cushion of air and never touch the platter’s incredibly flat surface in operation, air circulating within the drive must be kept free of particles. A head drive assembly (HDA) is sealed at the factory in a Class-100 purified air environment and a constant stream of air flows through the HDA casing, typically via a 0.3 micron filter bonded to its side.

The headstack assembly of modern hard drives consists of multiple read/write heads (typically two per platter), head arms, spacers, and positioner assembly, located so as to counterbalance one another and place the center of the headstack mass at the headstack mounting hub. Figure 2-17 shows the head stack assembly from a Quantum 31/2-inch Pro-Drive.

While earlier hard drives got along quite well using stepper motors (you advance on your eventual target in discrete intervals or steps—until you get there), today’s advanced hard drives have to accomplish the job much faster. So they rely on voice-coil actuators (similar to what you might find inside your stereo speakers), driven by servo technology, which position the head stack assembly extremely rapidly and accurately with the aid of servo and positioning information written on the platters in reserved locations not available to data storage use. A servo (short for servomechanism) is a feedback control system in which the controlled variable—a position or velocity—output is continuously fed back to the input reference until the output position or speed is exactly where you want it to be. Hard drives also use extra bits embedded in the data locations on the platters to read and write the data more efficiently. Earlier hard drives used Modified Frequency Modulation (MFM) encoding to place data on the hard drive. Synchronization bytes on a separate timing track provided location information to the read/write head. Virtually all of today’s
Macintosh hard drives use 2,7 RLL encoding because it produces a 50 percent increase in drive capacity and a 50 percent increase in transfer rate between the controller and the drive compared to MFM. Run Length Limited (RLL) encoding initially evolved in the mainframe world out of a need to increase the amount of data that can be stored in a track. Because a sophisticated disk controller doesn’t measure 1s and 0s—only the transitions to the 1s from the 0 state—the 2,7 RLL method encodes the data so that at least two to seven 0s occur in sequence before the next occurrence of a 1 transition. By placing the 1s transitions further apart—guaranteed—2,7 RLL data bits can be made smaller, more data can be placed on a track, and the electronics can still read it.

Directory assistance

A hard drive’s directory functions exactly like the one described in the floppy drive section except that it is larger, more complicated, and ultimately more important. Some formatting software actually allocates it to multiple locations on the drive.

The formatting/initializing steps build exact track and sector locations into your hard drive where you can later find data, and identifies certain tracks as directory tracks so that data can be moved quickly on and off the drive. These contain information flags or pointers that point to or identify the location of data on the drive. As you learned earlier, when you delete data on a PC DOS machine or throw an icon into the trash on a Macintosh, the data remains on the drive until you overwrite it. All you are doing is deleting its entry from the directory.

Here are the key parts and their functions in a Macintosh hard drive’s directory:

- **Boot Blocks**—The area on a formatted drive (the first two logical blocks of a drive or drive partition, or the first block of a file system) that contains the system’s startup (or bootup) instructions and information.
- **Volume Directory**—A nonrelocatable block that contains information about what kind of hard drive is being used, its name and size, how many files and folders are on the drive, and the locations of the directory and allocation table. Sometimes called the Volume Information Block.
- **Volume Bitmap**—A “map” that keeps track of which sectors are free and which sectors are in use (used to map the file allocation information) but which contains no file information.
- **Catalog File**—A file that stores all the information about the file or folder: name, size, date created, what folder the file is in, and what blocks on the drive the file occupies. Also called Catalog B-Tree for an HFS drive.
- **Extent File**—A file that stores extra information used to find files that have become extremely large and fragmented; also called Extents B-Tree for an HFS drive.

Small computer system interface (SCSI)

Although invented much earlier, the SCSI was popularized by its introduction on the Macintosh Plus in 1986, has since become an industry standard, and is evolving to the much broader and faster SCSI-2 standard. In the Macintosh world, it refers to Apple’s adaptation of a high-speed bus that transfers data at 1.5Mb per second, and allows you to daisy chain up to seven devices (disk drives, CD-ROM drives, tape drives, scanners, printers,
etc.) each generating its own input and output traffic on the bus. It will be covered in more detail in chapter 4.

Macintosh SCSI hard drives contain an *embedded controller*. This means that an intelligent controller board is part of the disk drive package rather than separate from it, as with the hard drive controller cards popular in the DOS PC world for so many years.

**Interleave**

Interleave determines whether the next logical sector read or written by the controller is identical with the physical sector located on the drive. Depending on the speed of the computer attached to the hard disk, it might not be fast enough to read all the data from one sector transferred by the disk interface or to write it in one rotation of the disk. To avoid the problem, drives initially being formatted to work with slower Macintoshes have their sectors interleaved. Refer to Fig. 2-18.

![Interleave Diagrams](image)

*2-18 Different Interleave patterns when formatting drive media.*
A Macintosh with a fast CPU such as a 68020-based Macintosh II, a 68030-based Macintosh SE 30 and up, uses a 1:1 interleave as shown on top. The hard drive controller just reads the sectors in sequence.

A slower 68000-based Macintosh SE requires a 2:1 interleave as shown in the middle. The next logical sector read or written actually skips one sector over from the last physical sector located on the disk.

A slower 68000-based Macintosh Plus requires a 3:1 interleave as shown on the bottom. That means the next logical sector that the controller reads from or writes on is actually two sectors over from the last physical sector located on the disk.

As you can see, the interleave problem affected older generation Macintoshes and hard drives. Newer hard drives are usually formatted at 1:1, and speed adjustments are accomplished through read/write buffers or adjusted via formatting software.

**Fragmentation**

On a newly formatted hard drive, files are written to continuous and connected (i.e., contiguous) sectors and tracks. As you use the drive—erasing files, writing new ones, etc.—all the contiguous space eventually gets used up and new files are then written in pieces or "fragments" all over it. This is called fragmentation, and greatly reduces drive performance. Figure 2-19 illustrates it graphically. Here a single file is written in four physical locations on the hard drive because they were the only free or unwritten locations available. While this is not particularly a problem on floppy diskettes, it can be very severe on a larger drive with hundreds or thousands of files on it. The cure is to do periodic maintenance on your hard drive and “clean it up” occasionally! This is covered in chapter 9.

![Fragmentation pattern when writing file to media with already occupied sectors.](image)

**Fragmenting**

**Hard drive recommendation**

As mentioned in chapter 1, there is no end in sight—over the next ten years, hard drive capabilities will improve by an order of magnitude in every department. Their increased storage capacity, smaller size, reduced access time, and much lower cost will bring their benefits within reach of every Macintosh user, and every Macintosh user will own a hard drive matching his or her exact needs. This section just gave you an overview of how hard drives work—although it might have been more than you ever wanted to know! Since this book is about Macintosh hard drives, chapter 3 is entirely devoted to the subject of how you buy the right one and related topics.
Removable drives go many ways

For your long-term storage you want a device to back up your data for safety and/or preserve your data for archiving. Floppy drives take care of you if you are using a small application on a single Macintosh, and/or don’t have a large amount of data. Other Macintosh owners should look at more powerful solutions. Beyond floppy drives, I recommend you consider a removable cartridge disk or read/write optical disk for backup use. I would recommend tape as a lower-cost alternative. Let’s get into the details.

You need my hard drive—here take the whole thing

A number of manufacturers make hard drive enclosures that allow you to remove your hard drive intact and transfer it to another Macintosh. Figure 2-20 shows a bracket, frame, and carrying case made by Wetex. The 3½-inch hard drive functions just like any other external hard drive in use. When you need to move the drive, you can unlock it and slide it out in its carrying frame. Put the drive/frame into the carrying case that comes with it, then either put it into secure storage or easily transport it to another location for storage or use.

2-20 Wetex removable hard drive kit—3½-inch drive inside bracket at right.
For example, say you have a Macintosh SE 30 you’re using regularly for your work. Your “removable” hard drive sits in a “zero-footprint” type case under your Macintosh. At the end of the day, you just power-down, slide your “removable” drive frame into its carrying case and either take it home with you or place it into a security vault. Or use it only as a backup device for the main hard drive inside your Macintosh. A quality hard drive utilized just a few minutes a day as a backup device should last almost indefinitely. Several 31/2-inch hard drives kept circulating this way make a very reliable and/or secure backup system.

Believe it or not, the removable hard drive is nothing new. Tandon pioneered it with its removable Digital Data Pak for DOS PC machines in 1987. On the Macintosh side, ETC’s Data Port has raised it to a new art form with their multiple removable hard drive offerings. You need the drive mechanism as well as the media to get at your information. With this alternative, both are always available together in the same spot. The down side, of course, is that it costs much more to use the entire mechanism as a storage device rather than just using the media itself. Ultimately, this is probably why it has not become more popular, although it has definitely found support in niche markets such as high security environments.

45Mb in your coat pocket

Building on the removable idea, if removing the whole disk is great, then removing just the media and leaving the heavy and more delicate electro-mechanical components behind should be even better. Has someone already thought of this idea too? You bet. This broader and more common category of removable hard drives is available today in three distinct and noncompatible flavors with offerings from SyQuest, Iomega, and newcomer Ricoh.

While the 51/4-inch removable cartridge media is only 1/2 inch thick (about the height of five stacked floppy diskettes), it holds 45Mb of data—the equivalent of the data stored on over 30 floppy diskettes of 1.4Mb capacity. Plus you can get at it 10 times as fast—at 20 to 25 millisecond disk access rates rather than at floppy disk speeds. These two capabilities, both of which fit under the benefit called “convenience,” and its widespread use for backup, archiving, secure storage, and transporting of large files is what has accounted for the great popularity of 45Mb removable cartridge media. Let’s look more closely at the three flavors it comes in.

SyQuest’s design is simplicity itself. Just repackage the rigid hard drive media in a practical, transportable package and leave the drive electronics behind. Unfortunately, SyQuest did too good a job. Despite numerous warnings on the media and in the drive’s instruction manual, the simple, highly functional cartridge can be inserted backwards (or even upside down—arggh!) into the drive or removed from it while the media is still spinning by unthinking users—any of which can be damaging to the mechanism. But looking at the cartridge itself, shown in Fig. 2-21, it’s hard to believe users can be confused. The pen points to the orientation arrow at the right rear. My finger points to the write-protect mechanism and the ribbed area on only the front part (the part that goes toward you when loading!) of the cartridge. But even with this potential liability, SyQuest is the de facto leader in the Macintosh 45Mb removable cartridge media market, with an installed base of over 500,000 drives.
This tremendous installed base—almost one out of every ten Macintosh users—directly maps to convenience and security. Chances are good that the typesetter across the country you want to ship your large graphics file to also has access to a SyQuest drive. Or if your system goes down, you know of another SyQuest owner nearby who can help you out in a pinch. Plus the SyQuest price—under $500 for the drive and under $70 for the media—is an overwhelming advantage over the alternative removable cartridges. There are also numerous sources for both the drives and the cartridges. Alliance Peripheral Systems is a quality vendor that offers quality products at attractive prices; Fig. 2-22 shows their packaged SyQuest solution. It comes with one cartridge—just plug it in and you are ready to go.

Ricoh makes SyQuest’s design user-proof by redesigning the cartridge so that it can no longer be inserted backwards, and at the same time seals it better, providing its rigid media with an environment more closely resembling a real hard drive. But the Ricoh drive is new, its installed base is very small, both the drive and media are relatively expensive compared to SyQuest, and there are far fewer sources for product.

Iomega’s design employs flexible media inside its rigid cartridge—it resembles a large floppy. The Bernoulli principle (i.e., the air flow that pulls the flexible media toward the heads in operation is nonexistent in shutdown) results in a drive media whose surfaces are virtually immune to head crashes. But the thin plastic flexible media also has its downside: it wears out with use due to the continual flexing, and it’s more susceptible to heat.
Storing a SyQuest or Ricoh removable cartridge in your car trunk on a hot summer's day is no big deal; doing the same with an Iomega cartridge probably destroys it.

Removable drive recommendation
I do recommend you consider this technology as your next step-up solution when you begin to outgrow your floppy drives. My experience has shown that personal preference, more than anything else, dictates a user's choice of drive technology and cartridge. So my counsel would be to study the offerings, ask lots of questions, and take your best shot.

My experience has also shown that the low-priced SyQuest drives in the hands of experienced users are often exceptional values. If you don’t accidentally put your thumbprint on the media, insert the cartridge backwards, or remove the cartridge from a still spinning drive, they tend to work quite well. I have seen one accidentally erased, but I have never seen one lose data.

Optical drives light the way
It is said that everything shrinks with age. In electronics, they say "downsizing" the next generation brings increasing economies of scale. In Macintosh terms you get the same results or better, but the box (enclosure, chassis, board, card, chip, etc.) that delivers them is smaller and costs less. Remember the laser light show you attended (probably
sponsored by your local art or science museum as a fund raiser) with laser beams going
every which way and producing neat effects? The exact same technology, reduced to fit
inside your optical drive, is what makes the drive work.

Optical drives are technologically elegant. No electromechanical device interacts
with the media, there is nothing to wear out, and no risk of head crashes ever—it is all
done with a beam of light. Optical media has the longest shelf life of any media, in addition
to removability, portability, and large capacity. Optical drives are my first choice for a
backup device.

Notice I said backup device. Some optical media evangelists would have you believe
that optical drives are quickly going to replace hard drives (and all other media!). With all
due respect to these learned people, that is simply not going to happen. The same technol­
gy that lets you write tremendous amounts of data in a small space, that is impervious to
stray magnetic fields and head crashes, and that measures its media life in decades, also
guarantees that current optical drives will never be as fast as most current hard drives. But
this has never really been an issue. As a general rule of thumb, you buy hard drives to give
you performance, and back them up with optical drives whose removable cartridge media
give you access to unlimited volumes of data storage. Let's take a brief look at how the
three types of optical drives work.

How MO drives work

Magneto-optical (MO) or erasable optical drives get their name from the fact that they
utilize a combination of both magnetic and optical technologies to accomplish their mis­
ion of writing and reading. The MO media is a rigid disk inside a protective plastic 51/4-
inches cartridge that roughly resembles a removable magnetic media cartridge, as shown in
Fig. 2-23. The MO disk is constructed in layers: an active recording layer (a magnetic
alloy) on a glass or polycarbonate substrate is sandwiched between protective/enhance­
ment layers. The active layer of an MO disk is always magnetized, and when it comes
from manufacturing, every spot on it initially has the same magnetic orientation (think of
each spot as having a tiny magnet in it oriented with its north pole up). This is its default
condition.

When polarized laser light is reflected off any spot, that spot's magnetic polarity
alters or rotates the reflected laser light beam polarization slightly from the incident laser
light beam polarization, in either a clockwise or counterclockwise direction. This is
known as the Kerr effect, and involves a very small change—on the order of one percent—
so the optics required to detect it accurately must be rather massive and sturdy. The lower
part of Fig. 2-24 depicts the read process graphically.

Before an MO drive writes to a spot on its media, it must first erase it to ensure it is in
the default condition. A writer laser beam, much more powerful than the read laser beam,
heats that spot to above its “Curie point”—the point at which it loses its magnetic orienta­
tion. A small electromagnet on the opposite side of the disk from the read/write head is
turned on to magnetize that spot to its default condition—a condition the spot again
assumes as it cools down from its Curie point.

In order to write data to the drive you repeat the process—only this time substituting
the correct electromagnet polarity for the 1 or 0 condition you want the spot to assume.
The upper part of Fig. 2-24 depicts the write process graphically. Although optical drives
2-23 Sony 600Mb 5¹/₄-inch MO cartridges with media in foreground.

Write laser

Electromagnet

CCW="1" = + Kerr rotation

Read laser

CW="0" = - Kerr rotation

2-24 MO drive read-write cycle.

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typically rotate at the same speed as hard drives, this two-step erase-before-writing process—effectively doubling the write time—combined with the longer time it takes to move the more massive optical read/write head across the drive, makes MO drives two to four times slower than their magnetic media counterparts.

**The media is really the message**

On the other hand, because a laser can accurately focus its beam in an extremely small spot, optical drives can store more information in less space than hard drives can. Also, because they use a laser, the read/write heads of an optical drive don’t need to be as close to the surface of the optical media. As a result, optical drives are not subject to surface wear and head crashes. Although the MO drive uses magnetic media, it is virtually impervious to external magnetic fields or radiation, because you have to “heat” the media to change the magnetic state of its bits. The protective outer layers of the rigid MO disk protect it from fingerprints and dust, as does the plastic cartridge itself. Unlike magnetic media, surface dirt and scratches are ignored by the laser when it reads the data. The MO cartridge media has a shelf life of 10 to 20 years—several times that of magnetic media—because in its construction the magnetic layer is sealed by other protective layers, and not subject to oxidation or corrosion.

The 5 1/4-inch MO cartridges are double-sided, but you have to flip them over manually to access the other side (because of the two-pass write operation, and the need for the magnet to be on the side opposite the read/write head). But this is a small price to pay for having the ability to store 600Mb (300Mb per side, or roughly 600 floppy diskettes) on a cartridge that fits in your coat pocket, with access to virtually unlimited storage by loading other cartridges. Obviously, this 600Mb cartridge form is also very convenient for users who need to distribute large amounts of data to other Macintosh sites. Figure 2-25 makes

![Image of optical drives and floppy diskettes]

**Figure 2-25** 600Mb on one optical cartridge versus 600 floppy diskettes in 12 storage boxes.
the point graphically. The Sony 5¼-inch SMO-S501 external drive is shown in the foreground with its media resting on top of its case, next to an 800K floppy. Behind it are 12 floppy diskette storage boxes that store 50 floppy diskettes each (roughly 480Mb here—I'm being generous). Which would you rather carry around? The media is the message in this case.

MO cartridges are as easy to use as floppy diskettes. Like a floppy diskette, you can boot up your Macintosh from an MO cartridge. Figure 2-26 shows a close-up of the popular Sony 5¼-inch SMO-S501 external drive and its cartridge media. You load it just like a floppy diskette—only now you have 600Mb in your hand. Like hard drives, MO cartridges can be partitioned into smaller volumes, yet they are less prone to the debilitating failure-modes that affect removable magnetic drive mechanisms.

2-26 Sony SMO-S501 drive and 600Mb cartridge.

3½-inch MO—smaller is better

If a 5¼-inch cartridge is convenient, then a 3½-inch cartridge must be outstanding. Today's 3½-inch MO cartridges look almost exactly like a floppy diskette—they are only slightly thicker and easily fit in your shirt pocket. Figure 2-27 shows the Sony SMO-300 family of 3½-inch MO drives with SCSI controller and cartridges (the media inside a cartridge is also shown). While 3½-inch MO cartridges only store data on one side today—they typically hold 128Mb after formatting—I suspect this is a marketing rather than a technical problem. This means 256Mb on a 3½-inch cartridge! It makes your mouth water—doesn't it?

But that's not all. The 3½-inch MO drive technology moves some of the heavier optical components off the movable read/write head platform, and the media itself is smaller. Result: 3½-inch MO drives have faster access times than 5¼-inch MO drives—down in the 30 to 40 ms range. While this is not as fast as today's standard-setting Quantum LPS
family drives, it is exactly the same as the fastest 40Mb hard drives you could purchase for your Macintosh only two short years ago.

MO drive recommendation

The biggest favor I can do for you and you can do for yourself is to ensure that your equipment is not made obsolete by changing trends in optical technology standardization. No question your media will outlive the life of your cat or dog—but will it still be in standard use, and will you still be able to get new blank or replacement cartridges, as well as parts, for your particular model optical drive? You need to think about this when buying.

For your backup needs, MO drives have numerous advantages over magnetic drives. They are not subject to head crash and media wear. They are also highly resistant to strong magnetic fields, radiation, and deterioration of magnetic oxide coating with age—all problems that affect conventional magnetic media. Like magnetic removable, storage capacity is unlimited because MO drives also use cartridges. Removable MO cartridges also offer advantages over magnetic tape as a backup device: direct access and superior media life.

For these reasons, the MO drives have really begun to catch on. There are many excellent MO drives available, but I believe seeing is believing. After seeing and trying several models, you can then decide for yourself which best fits your circumstances and needs.

WORM drive benefits

For your archival needs, WORM (write once read many) or read-only optical drives have the same advantages over magnetic drives and tapes as do erasable optical drives: they are not subject to head crash and media wear, are highly resistant to strong magnetic fields,
radiation, and deterioration of magnetic oxide coating with age, and offer high capacity, random access, and removability. Like erasable optical drives, storage capacity is unlimited because WORM drives also use cartridges.

The magic word here is archival. While you can use WORM drives in place of MO drives for backup, you are not taking advantage of their finest properties: WORM cartridge media record everything you write on them, e-v-e-r-y-t-h-i-n-g, exactly as you wrote it, and preserve it that way for 25 to 50 years. They provide an audit trail of everything you wrote, when you wrote it, and your software allows you to examine selectively the version of the document you want. Of course, a drive to read the media might not be around in 25 to 50 years but that is another issue.

With their ability to store extremely large contiguous graphics and text files with ease, it is easy to see why WORM media are steadily encroaching on what was once exclusively the turf of microfilm and microfiche, and bringing along with it new applications and solutions not possible with the earlier technology. Banking, real estate, insurance, medical, and legal applications have led the way, all demonstrating the overwhelming performance gains so important in the early 1990s environment of maximizing productivity.

How WORM drives work

While the WORM media itself is closely related to its MO media kin, in write-once technology the write laser permanently alters the media in one of three ways: oblate (burns a hole in it), phase-change (heats a spot in the disk and changes its crystalline structure), or dye (heats a spot in the disk and changes its color). The WORM write process is depicted graphically in the upper part of Fig. 2-28. When the WORM read laser illuminates the

![Write laser](image)

![Read laser](image)

2-28 WORM optical drive read write cycle.
spot, a detector decides whether it is lighter or darker, and the WORM drive’s electronics assign either a 1 or a 0 value to it, as shown in the lower part of Fig. 2-28.

Because these multiple techniques are available, WORM standardization has lagged behind that of MO drives. Notwithstanding, the WORM market in units shipped is approximately twice as large as the MO market today. While WORM’s market growth rate is not accelerating as fast as the growth rate in MO drives—perhaps due to the standardization issue—it still exceeds 100 percent annually.

WORM drive recommendation

WORM cartridges are superb and unsurpassed choices for legal, accounting, programming, audit trail, and other archival needs requiring long-term, permanent storage. They are especially useful in automating any process that currently uses microfiche.

As with MO drives, the most serious issue to be concerned with in WORM storage is standardization. You should go with a drive vendor in the mainstream or even look at the multifunction technologies. Your objective is to adopt a hedging strategy in your purchase(s) that maximizes the chances of your drive (and vendor!) lasting at least as long as your data!

CD-ROM drive benefits

The exact same CD-ROM (compact disk—read-only memory) technology that has replaced the phonograph record and raised home music quality to near perfection is revolutionizing the way software and information is distributed today. Service technicians that once had to sort through reams of microfiche in their briefcase now make quick work of it with a portable CD-ROM reader attached to their laptop computer. Resellers can have an entire store full of software in a desk drawer—copying the software and documentation to the user’s diskette at the time of the sale. And anyone can have a library at his or her fingertips with a collection of CD-ROMs that occupy less than one shelf in a small bookcase. Talk about a revolution.

How CD-ROM drives work

A CD-ROM drive’s media basically looks like that of a WORM drive, except that it is not enclosed in a cartridge. A 650Mb storage capacity on a standard 4 3/4-inch audio CD-sized ROM diskette is typical. Information bits are stored on it permanently—its surface was already “pitted” or written to at the factory where it was made—but its read operation is identical to that of the WORM read operation shown in the lower half of Fig. 2-28. Toshiba, NEC, and a host of other manufacturers make the drives. Figure 2-29 shows the APS package containing the Toshiba XM-3200 drive, the process of loading the CD-ROM diskette into its caddy (which holds it in place and protects it inside the CD-ROM player), and the caddy with the CD-ROM as it is inserted into the drive.

CD-ROM drive recommendation

Here, you shouldn’t really concern yourself with drive speed. Chances are you are just going to transfer the information to your hard drive anyway. But you do want a reliable
2-29 (A) APS Toshiba XM-3200 CD-ROM drive package. (B) CD-ROM disk being inserted into caddy. (C) CD-ROM caddy being inserted into drive.
mechanism with audio controls, outputs, and so on, from a vendor you can trust. On the downside, you have to be careful to allocate some time to your CD-ROM acquisition because there is so much neat stuff to browse through that innovative, idea-oriented people can experience temporary information overload.

Tape drives record your favorites

Most people’s idea of magnetic tape on computers dates back to the mental image they filed away while watching early vintage sci-fi movies in which the spaceship, laboratory, etc., always included a generous supply of reel-to-reel tape units in constant motion.

Unfortunately, most Macintosh users’ ideas of magnetic tape date back to the mental image they filed away of their first Macintosh tape experience—the device was expensive, yet slow, the software was primitive, the media was unreliable or maybe they could never get it to work right at all.

Well, it’s a bum rap to have to live down but I am happy to announce that early reports of magnetic tape’s death on the Macintosh have been greatly exaggerated. It has risen, like the Phoenix from the ashes, to return triumphant. With all its flavors, improved drives, higher density media, lower prices, and greatly improved software, tape is a contender for your archival media of choice across the range of storage capacities.

How tape drives work

The reel-to-reel tapes from the larger computers and the sci-fi movies discussed earlier stored their data on parallel tracks that ran the length of the tape. The standard half-inch width tapes held nine tracks—eight for data and the ninth reserved for parity (for error checking). The downside of this technology is sequential-access—you have to search through the entire tape until you find what you are looking for—and you cannot overwrite new records over old. You have to locate new records on an unused portion of the tape.

Newer tape drives introduced for personal computers based on quarter-inch-wide tape, and employing the cartridge or cassette case form, utilized the same longitudinal recording techniques as the earlier reel-to-reel models, but popularized the streaming mode of tape backup in addition to the older file-by-file technique. This eliminated the gaps between records, allowed backups to be performed faster, and permitted more data to be stored on the tape.

The newest tape drives introduced for personal computers—8 mm videotape and 4 mm digital audio tape (DAT)—borrowed a technique called helical scanning from popular VHS videocassette technology. The read and write heads are mounted on a spinning drum that is located at a slight angle to the tape moving past it. This places the information in tightly packed narrow rows (which form a helix or helical corkscrew pattern—hence the name) so more data can be stored on the tape. In addition to higher storage densities, helical recording has the inherent advantage of putting less stress on the tape (DAT cartridges are rated at 1000 passes versus 100 to 200 passes for quarter-inch tape cartridges). Head wear, heat, and friction buildup are a lot lower because DAT tape speed is roughly 0.5 inches per second (ips) compared with 90 ips for tape cartridges, and DAT can record all its data in a single pass instead of the multiple passes required for quarter-inch tape.

Some tape technologies are better than others. Let’s get to the specifics.
Reel-to-reel

Reel-to-reel tapes still proliferate in the mainframe and minicomputer data centers; Qualstar and Blackhole Technology have made them available for the Macintosh. While reels are $10 to $20 each, drives are large and bulky, and software is primitive. Mainstream technology has clearly passed these by, and you should do the same unless you have specialized conversion needs.

DC 2000 and DC 600

Originally the most popular (and only!) quarter-inch tape format for the Macintosh, DC 2000 stores 40Mb on it, lets you pack 50 floppies worth of information onto a cartridge the size of a credit card, and was first popularized by Apple's Tape Backup 40SC. Today, compared to other tape alternatives, most DC 2000 drives are slow. If you do find a faster one, the extra money you spend on it is better spent on another tape alternative. The DC 600 tape drive is the DC 2000's bigger brother. Its media is twice the size, works 60 percent faster, and holds 150Mb. Newer extended-length tapes hold 250Mb, and newer DC 600 drives offer 320Mb or 525Mb capacity. A good mid-range offering, but higher in price and not as fast as the comparable TEAC model.

TEAC 150 and TEAC 600

TEACs are your best choice for Macintosh personal backup for hard drives up to 150Mb in size. TEAC data cassettes look like standard audio cassettes but are far different inside. Originally available in 60Mb flavors, they have now given way to the 150Mb variety. TEAC 150 tape drives are considerably faster than DC600 150Mb drives, hold just as much data, and are less expensive. Figure 2-30 shows the TEAC 155 drive from APS. With it you get a proven cartridge design and a fast and reliable tape drive. Vendors typically package it with Retrospect—a world-class archiving and backup software package that makes tape backups fast, reliable, and painless. The recently announced TEAC 600 is a superior solution for 300 to 600Mb hard drive owners who need high speed server backups, or want to back up or archive larger network, audio, or graphics files.

DAT's nice

If you want to play in the big leagues of tape backup, DAT or 8 mm tape is the way to go. The largest capacity DAT tape systems—based on 4 mm tape—hold 1.2Gb. The largest capacity 8 mm—based on videotape—hold 2.2Gb. And the future holds promise of greater densities to come. When you jump to DAT, you are going from the analog to the digital world—you get a higher level of reliability and data integrity than is available with its analog predecessors or with 8 mm tape that is still analog.

The TEAC 600 is great, but if my need was for heavy duty backup of networks, my choice would be the DAT—both for cost and performance. You're spending a little more for the drive but less for the media, and you can rest easier at night knowing that DAT is probably providing a more reliable tape backup for you, plus giving you longer tape life.
Going up to the 8 mm videotape format gives you still more capacity for increased drive and reduced media costs.

Tape drive recommendation

While very slow and not random access compared to drives, nor usable as a startup device, nor invulnerable to magnetic fields as are optical media, and still subject to the burden of existing in several incompatible formats—tape still finds widespread use as a routine backup device for personal Macintoshes and networks.

If you don’t need faster access to your backed up data, you get a lot more for your money with magnetic tape drives and media than with their disk counterparts. On a pure cost basis, tape is the best backup vehicle today. On networks, just start your tape backup, walk away, and let it do its thing overnight. Alternately, a single tape drive and multiple controller cards (one in each Macintosh) is another popular and economical way to do your backups. Just plug in, back up, and move to the next Macintosh. The idea is to tailor your tape drive size to your hard drive size. A DAT on your 40Mb hard drive wastes your money. A DC2000 on your 600Mb hard drive wastes your time and your money!

Whatever tape drive you might buy, recognize that its software must match it to fully exploit its features. Regardless of what type of software you finally get with your drive, you owe it to yourself to see all the performance benefits that a product like Dantz’s Retrospect can give your tape drive. That is why so many vendors bundle it with their tape drives—even Apple! Chapter 8 covers the subject.
Sources

Vendor names, addresses, and phone numbers for the products mentioned in the chapter are listed here and at the end of subsequent chapters to assist you in your quest for the best product and/or solution to meet your needs. The inclusion of a company on the list does not necessarily constitute an endorsement, nor should an inadvertent omission of a company from the list necessarily imply nonendorsement. Remember I said that this is a rapidly changing field, so I guarantee that some of these will be out of date before the ink is dry on the printed pages, and others will become dated later. The list should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

### Macintosh—used and parts

<table>
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<tr>
<th>Vendor Name</th>
<th>Address</th>
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<tbody>
<tr>
<td>Access II</td>
<td>26 Keewaydin Dr. Salem, NH 03079</td>
<td>(800) 662-5606</td>
</tr>
<tr>
<td>CRA Systems</td>
<td>700 S. University Parks Dr., Suite 650 Waco, TX 76706</td>
<td>(800) 950-8212</td>
</tr>
<tr>
<td>MacByte</td>
<td>22775 PCH Malibu, CA 90265</td>
<td>(800) 432-2983</td>
</tr>
<tr>
<td>MacSwap</td>
<td>1 Woodbridge Center Dr., Suite 707 Woodbridge, NJ 07095</td>
<td>(800) 622-7927</td>
</tr>
<tr>
<td>Maya Computer</td>
<td>Bridge Street Marketplace Waitsfield, VT 05673</td>
<td>(800) 541-2318</td>
</tr>
<tr>
<td>Pre Owned Electronics</td>
<td>205 Burlington Rd. Bedford, MA 01730</td>
<td>(800) 274-5343</td>
</tr>
<tr>
<td>Shreve Systems</td>
<td>3804 Karen Ln. Bossier City, LA 71112</td>
<td>(800) 227-3971</td>
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### Memory—SIMMs

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<tr>
<th>Vendor Name</th>
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<tbody>
<tr>
<td>Add-On America</td>
<td>433 N. Mathilda Ave. Sunnyvale, CA 94086</td>
<td>(800) 292-7771</td>
</tr>
<tr>
<td>Chip Merchant</td>
<td>9541 Ridgehaven Ct., Suite A San Diego, CA 92123</td>
<td>(800) 426-6375</td>
</tr>
<tr>
<td>Computer Care</td>
<td>420 N. 5th St., Suite 1180 Minneapolis, MN 55401</td>
<td>(800) 950-2273</td>
</tr>
<tr>
<td>Delta Research Laboratories</td>
<td>26802 Vista Terrace Dr. El Toro, CA 92630</td>
<td>(800) 999-1593</td>
</tr>
<tr>
<td>Diamond Computer Resources</td>
<td>1377 Pond Springs Rd., Suite 105 Austin, TX 78729</td>
<td>(800) 541-7126</td>
</tr>
<tr>
<td>MacSystems</td>
<td>118 W. Broadway, Suite 6 Altus, OK 73521</td>
<td>(800) 942-6227</td>
</tr>
<tr>
<td>Memory Plus</td>
<td>43 Hopkinton Rd. Westboro, MA 01581</td>
<td>(800) 388-7587</td>
</tr>
</tbody>
</table>
Peripheral Outlet
314 S. Broadway
Ada, OK 74820
(800) 332-6581

Shadow Technologies
1767 Morning Glory Rd.
Livermore, CA 94550
(510) 548-0130

TechWorks Inc.
4030 Braker Lane W., Suite 350
Austin, TX 78759
(800) 879-9739

Floppy drive
Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Applied Engineering
P.O. Box 5100
Carrollton, TX 75011
(214) 241-6060

Brier Technology
25 Mecca Dr.
Norcross, GA 30093
(404) 564-5550

Cutting Edge Inc.
97 S. Willow Rd.
Evanston, WY 82930
(800) 443-5199

Dayna Communications
50 S. Main St., 5th Fl.
Salt Lake City, UT 84144
(801) 531-0203

Fujitsu America Inc.
3055 Orchard Dr.
San Jose, CA 95134
(800) 626-4686

Insyte Peripherals Inc.
4433 Fortran Dr.
San Jose, CA 95134
(408) 946-8080

Kennect Technology
120-A Albright Way
Los Gatos, CA 95030
(800) 552-1232

Mirror Technologies Inc.
2644 Patton Rd.
Roseville, MN 55113
(800) 654-5294

Peripheral Land Inc.
47421 Bayside Pkwy.
Fremont, CA 94538
(800) 288-8754

Quadram
1 Quad Way
Norcross, GA 30093
(404) 923-6666

Hard drive manufacturers
Connor Peripherals
3081 Zanker Rd.
San Jose, CA 95134
(408) 456-4500

Core International
7171 N. Federal Hwy.
Boca Raton, FL 33487
(407) 997-6055

Fujitsu America Inc.
3055 Orchard Dr.
San Jose, CA 95134
(408) 432-1300

Hewlett-Packard
19310 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900
Removable drive

Advanced Gravis Computer Technology Ltd.
7033 Antrim Ave.
Burnaby, BC Canada V5J 4M5
(800) 937-0062

Bering Industries
240 Hacienda Ave.
Campbell, CA 95008
(800) 237-4641

CD Technology Inc.
780 Montague Expwy., Suite 407
San Jose, CA 95131
(408) 432-8698

Deltaic Systems
1701 Junction Ct., Suite 302
San Jose, CA 95112
(800) 745-1240E

EMAC Div Everex
48431 Milmont Dr.
Fremont, CA 94538
(800) 821-0806

ETC Peripherals
5426 Beaumont Center Blvd., Suite 300
Tampa, FL 33634
(800) 882-2863

Iomega Corp.
1821 W. 4000 S.
Roy, UT 84067
(800) 456-5522

Mass Microsystems
810 W. Maude Ave.
Sunnyvale, CA 94086
(408) 522-1200

Mirror Technologies Inc.
2644 Patton Rd.
Roseville, MN 55113
(800) 654-5294

Quantum Corp.
500 McCarthy Blvd.
Milpitas, CA 95035
(800) 624-5545
Tradewinds Peripherals Inc.
2633 E. 28th St., Suite 612
Signal Hill, CA 90806
(213) 595-7272

Wetex International Corp.
1122 W. Washington Blvd., Suite D
Montebello, CA 90640
(213) 728-3119

Optical drive
Cannon USA Inc.
One Cannon Plaza
Lake Success, NY 11042
(516) 488-6700

CD Technology Inc.
780 Montague Expwy., Suite 407
San Jose, CA 95131
(408) 432-8698

FWB Inc.
2040 Polk St, Suite 215
San Francisco, CA 94109
(415) 474-8055

Hitachi America Ltd.
2000 Sierra Point Pkwy.
Brisbane, CA 94005
(415) 539-8300

Iomega Corp.
1821 W. 4000 S.
Roy, UT 84067
(800) 456-5522

Liberty Systems Inc.
120 Saratoga Ave., Suite 82
Santa Clara, CA 95051
(408) 983-1127

Mass Microsystems
810 W. Maude Ave.
Sunnyvale, CA 94086
(408) 522-1200

Maxoptix Corp.
2520 Junction Ave.
San Jose, CA 95134
(408) 954-9700

MicroNet Technology Inc.
20 Mason
Irvine, CA 92718
(714) 837-0633

Microtech International Inc.
158 Commerce St.
East Haven, CT 06512
(800) 626-4276

Mitsubishi Electronics America Inc.
991 Knox St.
Torrance, CA 90502
(213) 217-5732

MOST Inc.
11205 Knott Ave., Suite B
Cypress, CA 90630
(714) 898-9400

O.C.E.A.N. Microsystems Inc.
246 E. Hacienda Ave.
Campbell, CA 95008
(408) 374-8300

Optical Access International
36 Commerce Way
Woburn, MA 01801
(617) 935-2679

Optime Division, Archive Co.
297 N. Bernardo Ave.
Mountain View, CA 94043
(415) 961-1800

Panasonic Communications & Systems Co.
2 Panasonic Way
Secaucus, NJ 07094
(201) 348-7000

Peripheral Land Inc.
47421 Bayside Pkwy.
Fremont, CA 94538
(800) 288-8754

Sources 53
Pinnacle Micro
19 Technology
Irvine, CA 92718
(800) 5553-7070

Pioneer Communications of America Inc.
600 E. Crescent Ave.
Upper Saddle River, NJ 07458
(800) 527-3766

Procom Technology Inc.
200 McCormick Ave.
Costa Mesa, CA 92626
(714) 549-9449

Relax Technology Inc.
3101 Whipple Rd., Suite 22
Union City, CA 94587
(415) 471-6112

Ricoh Corp.
3001 Orchard Pkwy.
San Jose, CA 95134
(408) 432-8800

Sony Corp. of America
655 River Oaks Pkwy.
San Jose, CA 95134
(408) 432-0190

Storage Dimensions
2145 Hamilton Ave.
San Jose, CA 95125
(408) 879-0300

**Tape drive**

ADIC
P.O. Box 2996
Redmond, WA 98073
(800) 336-1233

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

Bering Industries
240 Hacienda Ave.
Campbell, CA 95008
(800) 237-4641

Blackhole Technology Inc.
225 East St.
Winchester, MA 01890
(800) 227-1688

CMS Enhancements
2722 Michelson Dr.
Irvine, CA 92714
(714) 222-6000

Deltaic Systems
1701 Junction Ct., Suite 302
San Jose, CA 95112
(800) 745-1240

EMAC Division, Everex
48431 Milmont Dr.
Fremont, CA 94538
(800) 821-0806

FWB Inc.
2040 Polk St., Suite 215
San Francisco, CA 94109
(415) 474-8055

Irwin Magnetic Systems Inc.
2101 Commonwealth Blvd.
Ann Arbor, MI 48105
(313) 930-9000

Maynard Electronics and Archive Co.
36 Skyline Dr.
Lake Mary, FL 32746
(800) 821-8782

MicroNet Technology Inc.
20 Mason
Irvine, CA 92718
(714) 837-0633

Microtech International Inc.
158 Commerce St.
East Haven, CT 06512
(800) 626-4276
Mirror Technologies Inc.
2644 Patton Rd.
Roseville, MN 55113
(800) 654-5294

Novastor Corp.
31828 Village Center Rd.
Westlake Village, CA 91361
(818) 707-9900

Optima Technology Inc.
17526 Von Karmen
Irvine, CA 92714
(714) 476-0515

Peripheral Land Inc.
47421 Bayside Pkwy.
Fremont, CA 94538
(800) 288-8754

Personal Computer Peripherals Corp.
4710 Eisenhower Blvd.
Bldg. A4
Tampa, FL 33634

Procom Technology Inc.
200 McCormick Ave.
Costa Mesa, CA 92626
(714) 549-9449

Qualstar Corp.
9621 Irondale Ave.
Chatsworth, CA 91311
(818) 882-5822

Relax Technology Inc.
3101 Whipple Rd., Suite 22
Union City, CA 94587
(415) 471-6112

Techmar Inc.
6225 Cochran Rd.
Solon, OH 44139
(216) 349-0600

Tulin Corp.
2156H O'Toole Ave.
San Jose, CA 95131
(408) 432-9025

Sources 55
Buying your hard drive

Now it's time to put what you have learned in the first two chapters to practical use. The problem for most hard drive buyers is the confusion caused by the bewildering array of choices. In this chapter, I'll give you guidelines, check points, and check lists to make your job easier. You still have to make your own choices.

You need a plan

Before you buy your hard drive, always remember to keep your objective in view and have a plan (or a roadmap) of how to get to your objective.

Do not concern yourself with the fact that there are numerous types of drives, manufacturers for drives, drive packages, types of software, and multitudes of distribution sources to buy from.

Do concern yourself with formulating a clear idea in your own mind of your priorities, needs, and what's. Actually, buying a hard drive is no different than any other decision in life. You look at the alternatives and you take your best shot.

Your priorities affect the process, your needs affect the result, your "whats" affect the actual product you buy. These are not really rules—only three areas to think about—ranked in the order you should be thinking about them. Master them and you are home free as far as Macintosh hard drive buying is concerned. You have a plan. Then all you have left is how to do your actual buying. So the areas (in order) are:

1. Priorities
2. Needs
3. What's
4. How to buy

Figure 3-1 shows these areas in expanded graphic form. You probably already do this—I've just clarified the steps and the sequence to give you a more concrete formula or working guideline. Although I am discussing buying Macintosh hard drives here, this method also applies to buying other Macintosh upgrade items—it's a very practical formula to use. Let's look at the areas in more detail.
3.1 Plan for buying a Macintosh hard drive.

Priorities affect the process

A priority is actually a constraint—some criteria you have to meet—and is therefore the most important factor in your purchasing decision. Before you go into the buying process, you need to have a good idea of your priorities in mind because they directly affect both the process and the outcome. I offer three categories of priorities here (these are just to get you started, you will have others of your own):

- Performance—hard drive capacity or speed you must have
- Cost—a budget constraint you cannot exceed
- Time—a time constraint you cannot get around

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Performance constraint
You want to get the best hard drive setup you can and money is no object. (You probably
need a consultant to help you. Call me, my daytime number is . . .) An example here
would be a design engineer on a project deadline. You have to get the answers, they have to
be right the first time and equipment cost is the least of your concerns. You want the best.

If performance is most important, you need a consultant (seriously!) or someone from
a vendor or reseller you can sit down with and together map out a plan. You pay them for
their expertise to get you the best, and they save you time and guarantee you results. By
doing this you usually wind up getting “the best of the best” because you paid top dollar
and their professional reputation is on the line.

Cost constraint
You want the best hard drive setup but you have only a limited budget. An example here
would be a student (or teacher!) who has just so much money to spend and that’s it—
period.

If budget is most important, buying the best hard drive does not mean spending the
most money—if you buy wisely. It just means a little more time and legwork on your part.
A particular vendor’s hard drive mechanism is available from a reputable hard drive
repackager at your local computer reseller. That exact same hard drive mechanism is avail-
able from reputable mail order resellers, for hundreds (thousands on some models) of dol-
lars less, with a nice case, cables, and bundled software. You just have to shop around.

There is another aspect to the cost constraint. How much you have to spend, as much
as anything, definitely influences your purchase regardless of what size hard drive you’re
going to buy for your Macintosh. But it’s not as if you are buying a car or a house. It is a
capital outlay, but it isn’t an overwhelmingly large number. You’re typically looking at an
outlay of $500 to $2500. If you have to finance this amount to make the right buying deci-
sion to meet your other priorities, needs, and what’s, it’s probably going to be within your
reach to do so. In fact, you should strongly consider it in terms of making the right choice.

While cost might be a prime constraint, it shouldn’t be your overriding one because
there are ways to get around the cost aspect. Whether you buy, lease, purchase on an
installment plan, borrow to raise the money to buy, or tweak the company budget to make
your acquisition across fiscal years, one way or another you are going to be able to find a
way to raise the money that you need.

Time constraint
You want your hard drive setup to be optimized to save you time. An example here would
be the head of a creative department that has Macintoshes networked together from a com-
mon server. The server must be expanded but it cannot ever go down, and must be backed
up frequently by a backup process that does not take any time. Or you are a one person
office with half a dozen projects going at the same time on your Macintosh. You need to
get a larger hard drive, but want to minimize the time you spend backing up.

If time (in this case backup time) is most important, you need to devote half your
effort/budget to your hard drive search, and the other half to your backup drive and soft-
ware search. Of course, the two parts—working drive and backup drive—must function as
a matched set after you bring them together, so part of your time must also be spent verifying that this desired result can be accomplished—before you move the actual purchased boxes around in your office!

You are not constrained!

When you are starving, you don’t worry about the clothes on your back or the roof over your head, you solve your hunger problem first. Psychology textbooks call this a “Maslow’s hierarchy of needs example.” The same principle (though not as drastic!) applies when buying your hard drive—your biggest constraint will serve to put all the others in their proper perspective for you. All you have to do is act on solving it first.

While you might face a priority or constraint in your hard drive purchasing process, you are not constrained. There are always many ways to solve a problem—you just have to find the best way to meet your needs.

For example, the higher priority backup-time constraint given in the last example might mean that you need to reevaluate your other constraints: what you purchase (performance) and how much you spend (cost). You might have to reopen the budgeting cycle process to justify the additional equipment cost, acquire less expensive equipment, or acquire it from less costly distribution sources.

Needs affect the result

Your actual capacity/expansion needs in any of these categories is further defined by what kind of user you are. A heavy-duty user might typically need twice the hard drive capacity of a light-duty user on any given Macintosh configuration.

Before you can buy your hard drive (or make any Macintosh upgrade purchase), after you’ve established your priorities or constraints, you must formulate a clear idea of your capacity/expansion needs in these three areas:

- Present needs
- Future needs
- Rate of change

Present needs

Because hard drive prices are dropping rapidly, don’t buy a lot more storage than you need—particularly if your needs are not likely to change for the next year or two, i.e., you are a freelance writer (!), a student starting college, or a houseperson starting a side business.

On the other hand, if your department could double or triple in size in the next six weeks (you win both of those two proposal bids you just submitted), you need to buy more capacity then you need immediately in anticipation of a lot of near-term growth.

Future needs

Future needs are a little harder to get a handle on because accurate crystal balls either cost a lot more or have a string attached. In general, it gets back to Parkinson’s law applied to hard drive storage: “Data expands to fill the space available for it.”
Remember the adage, "Those that don’t learn from history are doomed to repeat it.” If you look backward at your own Macintosh hard drive growth pattern over time, you can learn from it. In my observation of many client data storage growth patterns over time, three years is the hard drive life-cycle (or “itch” cycle as Tommy Hopkins calls it in his sales seminars) before a client wants to (or has to!) buy a new hard drive. The new one typically has a 50 to 100 percent capacity increase over his/her present hard drive.

Rate of change
Rate of change is harder still to quantify. In general, it has to do with a corollary of Parkinson’s hard drive law: “You run out of data storage room before you expect to.” My observations have shown that medium- and heavy-duty users’ capacity needs grow at a faster rate than that of light-duty users, mostly because they wind up manipulating their larger files at an increasing rate.

A general rule of thumb you can use is: light-duty users should multiply their present capacity drive by a factor of two, medium-duty users by a factor of three, and heavy-duty users by a factor of four. I’ll build on this multiplier concept and add real-world data to it to help you make your actual hard drive capacity selection later in the chapter.

“Whats” affect actual product you buy

“Whats” are merely my handle for the four categories of decisions you need to make in buying your hard drive:

- What capacity and speed
- What kind—internal or external
- What drive manufacturer
- What distribution source

Most advisers start here, but it is really the third step in the process. While it’s easy to start with “whats” because choosing them is the most concrete part of the process, doing so is usually injurious, if not fatal, to your results. In other words, if you jump in and buy a given hard drive without first considering your priorities, where you are now, and where you are going, you’re usually unhappy with your purchase. So formulate a clear idea before you start on your “whats.”

What capacity and speed

In the previous two chapters, you learned about hard drive trends: hard drives are increasing in capacity, speed, and reliability, while declining in price. These trends tell you to buy a little more than you actually need, but don’t buy a much larger drive because that larger drive will cost you less in the future.

But the trends don’t tell you what to do in your particular case. What size hard drive should you buy? Let’s answer that question for the five Macintosh hard drive-user categories introduced in Fig. 1-8 of chapter 1: no hard drive, less than 80Mb, 80Mb to 200Mb, 200Mb to 600Mb, and over 600Mb. You will fit one of these categories.
Category 1—no hard drive

If you fit into this category description and don’t have a hard drive of any sort today, you’re in for a big pleasant surprise when you get one. It will make your work infinitely easier, and I really have no words to describe adequately the difference to you. How do you describe color to a blind man?

All new Apple Macintosh models are equipped with 40Mb or larger hard drives. You should follow the same guidance. As you already saw in Fig. 1-9 of chapter 1, a modern hard drive like a Quantum LPS52 (52Mb of capacity), provides you with more than 35 times the capacity and more than ten times the speed of an Apple 1.4Mb FDHD floppy drive, for about $250 today—the same as the floppy drive’s street price. How can you afford not to use a hard drive? Treat yourself to a hard drive as a present—you will never go back.

Category 2—less than 80Mb

If you fit in this category, you have a 20Mb to 80Mb hard drive, and your primary usage is probably word processing or text-related. This could include accounting, financial, office management, communications of all sorts, writers, lawyers, stockbrokers, businesspeople, secretaries, housewives, contractors, and so on. Using the capacity-versus-usage rule of thumb developed earlier, typical light- to heavy-duty users should step up to 40Mb to 160Mb drives in this category. Many users in this category have the legacy of 20Mb hard drive ownership. If you bought one of the first Apple Macintoshe s on your block, you probably got one of the first Apple 20Mb hard drives along with it. This was a novel innovation for its time, but is very slow by today’s standards. You too should increase your capacity to a 40Mb (or larger) model. Quantum’s LPS 52Mb capacity drive would be an outstanding choice here—its size and the speed that goes along with it will make you very, very happy.

Here’s another tidbit to help you justify your purchase. If you own a slower, first generation hard drive, consider this. On a disk-intensive database job, an older 20Mb 65-millisecond access time hard drive might take five minutes to do a sort or prepare a report that a newer 40Mb 15-millisecond drive could complete in one minute. How important is that to you? Is it worth the $500 or so it might cost for a new one? Let’s look at it in terms of a formula:

\[
\frac{\text{Cost of upgrade (})}{\text{Your cost ($/hr)} \times \text{Time you save (hrs/day)}} = \text{Time to recover (days)}
\]

Or for a hard drive that cost you $500 and saved you one hour per day and your burdened cost to the company including expenses is $20 per hour:

\[
\frac{\$500}{\$20/hr \times 1 \text{ Hr/day}} = 25 \text{ days}
\]

In other words, you recovered the cost of the upgrade in one month. That kind of puts it in perspective, doesn’t it?
Category 3—80Mb to 200Mb

As an 80Mb user, you have a lot of applications on your desktop and need more storage. Here you are either doing a lot of things with words—have full size books online and need to access them—or else you’re doing a considerable amount of work with graphics in addition to words. Of course, many other applications fit in this category as well. Using the capacity-versus-usage rule of thumb developed earlier, typical light- to heavy-duty users should step up to the newer 160Mb to 600Mb offerings.

Many users in this category probably had one of the early Apple or third-party 40Mb hard drives, and upgraded over time to 80Mb. You want speed, capacity, and rapid access to everything you’re doing. For these users, I would opt for Quantum’s Pro 210Mb drive or larger alternatives.

Category 4—200Mb to 600Mb

Color power graphics users, engineering workstations, or a network server for a medium-size organization would all be typical of this category.

If you are a user in this category, you probably started with a 150Mb to 300Mb drive and migrated upwards.

In the 200Mb to 600Mb category, I recommend you select from the new 400Mb offerings in the 3 1/2-inch form now being offered by several vendors, or choose a larger drive (or drives) all the way up into the gigabyte drive range.

Category 5—over 600Mb

This category of user is typified by real-time data-gathering operations, someone doing a large amount of number crunching or manipulation of numbers, those whose work depends on manipulating extremely large graphics files and images, and those who need large amounts of storage online—a database, BBS, or network operation.

If you are in this category of advanced power users, 600Mb and up, who work on the leading edge of larger hard drive technology, there is a wide variety of choices you can make and you already know exactly how to make them so I won’t pontificate further.

But can you back that up

An area that should become of increasing concern to you as you move from category to category up the capacity range is backups. In any category, automating your backups—stepping up from floppy drives to some other media—will definitely save you time. If you are in Category 2 (less than 80Mb) you should consider it. If you are in Category 3 (80Mb to 200Mb) or greater, you must consider it.

The third example given in the Priorities section was a backup time constraint. To solve it, I recommended you devote half your effort/budget to your hard drive search and the other half to your backup drive and software search. As your hard drive grows in size, it creates a different type of constraint priority for you—a backup drive priority.

As with the earlier backup constraint, you must divide your time looking for two products—your working and your backup drive—and making sure they function as a matched set after you connect them to your Macintosh.
Different from the earlier backup constraint, the backup drive you select here must be matched to your larger hard drive, and optimized for whatever criteria is most important to the function your Macintosh performs. Graphic artists might prefer a removable hard drive; power desktop publishing or engineering CAD professionals might prefer a removable and easily transportable MO drive; and network managers might prefer a fast cartridge tape or DAT drive to back up the server hard drive.

The point is, you must consider backup for your larger (over 80Mb) hard drives. You cannot put your substantial investment in your Macintosh system and your even greater (perhaps irreplaceable) investment in your Macintosh data at risk.

**What kind—internal or external**

Next you have to decide what kind of hard drive to get for your Macintosh. You have two choices: an internal or external drive.

The biggest factors differentiating the two are size and power. An internal hard drive is limited in size by the space available to mount it inside the Macintosh, and in power by what is available from the Macintosh's power supply. This is why you can only mount 5 1/4-inch hard drives inside Macintosh II, IIx, and IIfx models (actually you can mount them side-saddle inside a IIcx and IICl with a third-party adapter bracket), and can only mount low-profile, one-third height 3 1/2-inch hard drives inside the Macintosh Classic, LC, and IIsi models.

The Macintosh power supply restricts power available to an internal hard drive. All manufacturers' "low power" drives initially had problems with Apple's smaller, less costly power supply in the three new Macintosh Classic, LC, and IIsi models. Early third-party Macintosh Plus hard drive kits had their own power supply.

An external hard drive has no size and power restrictions. Put four full-height 5 1/4-inch hard drives in an external tower chassis or four "jukebox style" MO drives in a custom washing-machine size enclosure next to your desk. Knock yourself out!

The internal drive for your Macintosh will cost you less, is more convenient in terms of portability (it fits inside your Mac SE, SE 30, Classic, or Portable) or in terms of space (it fits inside your Mac IIxx family models and Mac LC) or in terms of convenience (one switch turns your Macintosh and hard drive on and off).

On the other hand, external drives offer you the convenience of moving your data and files between Macintoshes—unplug your hard drive from one and plug it into another. Plus, carrying your external hard drive around involves a lot less bulk and weight than carrying your Macintosh around unless you have one of the newer small portables. Finally, should anything happen to your Macintosh, you still have access to your data and you can move it to another Macintosh with no down time while yours is being repaired.

Let's look at your two choices in more detail. Figure 3-2 shows you the exact components of each. Notice you get the (identical) hard drive with each, but with the internal

1Size refers to the diameter of the disk inside the enclosure (its width—5 1/4-inch and increasingly 3 1/2-inch today). Height is a carryover from early IBM DOS PC days. Full height refers to a disk that takes up the entire height of the original PC front bezel opening designed to fit 5 1/4-inch-wide disk cases. Half height means half that dimension—you stack two drives in that space. For today's new Macintoshes, one-third height (approximately one inch high) 3 1/2-inch disk drives are the norm.
drive you get an installation kit, whereas with the external drive you get an enclosure. With both you get software, instructions and cables (obviously the internal cables are different from the external ones).

**Internal hard drive**

As Fig. 3-2 showed, with an internal drive installation kit, you get a bracket, cables, and software in addition to the hard drive itself. As for the bracket, you instruct the source you are buying it from whether you are installing it in a Mac SE or SE 30, Mac II, IIx or IIfx, or Mac IIcx or Mac IIci, and you get the appropriate bracket and cables. Your internal drive decisions are relatively simple, and your only additional investment is in the installation—which I’ll get to in chapter 4.
External hard drive

With the external drive you get an enclosure, and the only apparent difference is the housing substituted for the bracket of the internal kit, but this is not true. There are many more items you should look for. Figure 3-3 tells the story.

Let's backtrack a bit. As you will discover later in this section, hard drive repackager and reseller offerings are mainly distinguished by their external enclosure—identical manufacturer's hard drives are packaged inside. You want to make sure the attractive low price you pay for a particular repackager/reseller's drive isn't offset by a corresponding absence of needed features. The montage of Fig. 3-4 tells the story. Not every pretty outside has the same quality inside!

Obviously, the housing itself should be made of rugged, sturdy metal construction. If it is of the "zero-footprint" design which fits under your Macintosh, you don't want the weight of the Macintosh sitting on it to depress its case top onto the delicate hard drive and electronic components inside. A metal case also protects your hard drive from external radio frequency (RF) interference, as well as shielding its own RF emanations from your Macintosh. You will notice that quality plastic hard drive enclosures—mostly for hard
drives to be carried with the Macintosh Portable—have a protective metal coating sprayed on their inside surfaces, just like the Macintosh enclosures.

So much for the enclosure, here are the extra questions you need to ask. Don’t be afraid or shy—it’s not just the money you are spending, it’s the data you’re protecting!

**Power supply**
The most important question, of course, is the amount of power it provides. Your external hard drive power supply should be rated at a minimum of 30 watts. It should be shielded from the hard drive when mounted inside the housing. It should also have a quiet, yet large enough fan mounted inside so as to permit an unobstructed lifetime-extend ing cooling air flow over both the power supply and hard drive. Its other amenities should include a circuit breaker or fuse (must have), capability for universal 110/220 volt 50/60 cycle operation (should have) and extra plug-in sockets for other peripherals (nice to have).

**SCSI ID switch**
This switch enables you to externally change your hard drive’s SCSI ID number—any number from 0 to 6—without having to open your enclosure and change jumpers on your hard drive. Most better enclosures use an arabic numeral thumbwheel switch, a few use external DIP switches (a tiny switch, normally found on a circuit board—not intended for heavy use) that you must tediously set with a small screwdriver or ballpoint pen, and a very few provide no external switch at all.

**SCSI termination**
The connection of your hard drive to the Macintosh’s SCSI bus must obey certain rules. These will be covered in chapter 4. One of these is proper termination of the bus. This is done using either external or internal termination resistors.

Almost all internal Macintosh hard drives are shipped with the internal terminating resistor in place (check to be sure). Almost all external Macintosh hard drives are shipped without the internal terminating resistor in place (again, check to be sure). The better vendors tape the internal terminating resistors in place—inside your case—while providing you with an external SCSI terminating connector. This way you have the best of both worlds and maximum flexibility.

Better vendors also provide an external access slot on your hard drive enclosure for access to your hard drive’s internal terminating resistors—so you don’t have to open your enclosure to add/remove terminating resistors on your hard drive.

**SCSI cable**
Internal hard drives require only a 50-pin ribbon cable of the proper length for the Macintosh model the hard drive is being installed in. External hard drives require a 3- to 6-foot cable with a 25-pin connector for connection to the Macintosh SCSI port on one end, and a 50-pin connector for connection to the hard drive connector on the other.

Do not buy a hard drive enclosure that has a 25-pin SCSI connector on it. The extra 25 pins on a 50-pin connector are tied to ground and provide extra shielding in the cable.
Inside of external hard drive enclosure is more important than outside.
In addition, a 50-pin connector is rated for ten times the number of insertion/removal cycles as a 25-pin connector—exactly the rating you need if you are shuttling your external hard drive enclosure back and forth between Macintoshs.

**Documentation**

Last, but by no means least, is the documentation you get with the drive. The composite of Fig. 3-5 tells the story. The offerings range all the way from the APS drive product’s 45-page manual in addition to the external (plus internal) terminators, formatting software, and other literature, to a single sheet of paper and a formatting diskette—with everything else in between!

**What drive manufacturer**

There are three major drive players in the Macintosh hard drive market, with a number of smaller participants. The market is dominated by Quantum, Conner, and Seagate, with other vendors appearing at specific places in the capacity spectrum—for example, Micropolis primarily offers Macintosh products at the upper end of the capacity range. In the always interesting Macintosh hard drive market, you also have manufacturers like IBM and Sony providing drives directly to Apple, and manufacturers like Hewlett-Packard, Toshiba, Fujitsu, and a host of other players providing drives to the Macintosh upgrade market. This market is not for the faint of heart. Rodime, once a major player, has slipped into chapter 11 again, Priam is gone, and Maxtor, which acquired its ailing competitor Miniscribe last year, is itself having difficulties digesting its catch. Even the leading players can suffer overnight fortune reversals as major contracts are awarded or pulled.

3-5 Not all vendors provide same level of hard drive documentation.
"What's affect actual product you buy"
Quantum Corp., ranked fourth with eight percent of the overall 1991 hard drive market revenues, is the leading player in the Macintosh SCSI hard drive market. To appease the market of highly individual yet critical Macintosh hard drive buyers, you have to deliver a product with high capacity, low access time, low price, and high reliability. Quantum has obviously done the job. Quantum is also the dominant supplier to the Macintosh upgrade market because they offer the fastest drives at the best pricing. I have never had a problem with any Quantum 3½-inch drive (knock on wood!). The only Quantum 5¹/₄-inch drive I ever owned gave me long and faithful service, and now makes an excellent doorstop!

If you have already installed a hard drive in your Macintosh, chances are you have already become acquainted with the Quantum Pro 105S 3½-inch model (or its cousins), shown on the left in Fig. 3-6, or the Quantum LPS52S low-profile 3½-inch model (or its cousins) shown on the right. Both families have recently grown. The Pro family was enhanced by a 7-platter 1050Mb model (an industry first), and the LPS family by a 3-platter 450Mb model (another industry first).

In the future, you will more than likely be dealing with a Quantum LPS drive, like the one shown on the left in Fig. 3-7 and a Quantum Go•Drive 80Mb 2¹/₂-inch model (or its cousins) shown on the right. The Go•Drive family was recently enhanced by 1-platter 60Mb and 2-platter 120Mb models—Quantum again displaying industry leadership in announcing these products first. Regardless of where you buy it from, you will most likely encounter a Quantum LPS drive in your future first—shown right side up this time in Fig. 3-8—so chapter 5's formatting discussion will use this model as the example. But chances are equally good that you will encounter Quantum's Go•Drives—shown right side up with the covers removed on Fig. 3-9. Put one in your shirt pocket and keep all your work files close to your heart when you travel!

72 Buying your hard drive
Quantum LPS52 drive (on left) and Quantum Go•Drive 80.

Quantum LPS52 drive from top.

“Whats” affect actual product you buy
At the upper end of the capacity spectrum, Micropolis Microdisk 1 gigabyte-class drives, shown in Fig. 3-10, packaged with Spot On Macintosh formatting software from MacPeak can really be workhorses for you. The Micropolis people pay attention to the little items that make a difference and the result is an extremely rugged and reliable product.
What distribution source

The hard drive you buy involves three levels of vendor functions: manufacturer, repackager, and distributor. The original "manufacturers" of Macintosh hard drives were just discussed. By the way, no hard drive manufacturer "controls" its distribution. If it does have a reselling outlet, only a small percentage of its drive volume is moved through this source. Macintosh hard drive buyers, voting with their dollars, "pull" hard drives through a very broad distribution channel that—as one of the last bastions of free enterprise in action—is very difficult to "push" or "hype" product through. Loser's drives just gather dust on distributor's shelves until marked down or sold at bulk auction.

All the other vendors repackaged the manufacturers' disk drives. The distinction between vendors who package ("repackage") versus those who distribute ("resell") hard drives has become increasingly blurred because the market has become lowest-cost driven as more purchases are made through the mail order channel.

In a sense these vendors are also victim to today's better quality products. The quality of the raw disk drives along with that of external drive enclosures, power supplies, internal mounting brackets, SCSI/power cables, and formatting software has somewhat eliminated the need for a middleman.

Repackagers do it first

The "repackagers" of Macintosh hard drives are people who earn their living from it, such as LaCie, MicroNet, Microtech, and GCC Technologies. They put a manufacturer's hard drive into their case with power supply and cables, add formatting software (and frequently additional bundled software), and offer it for resale.

Resellers do it better

There are two types of Macintosh hard drive "resellers." One type merely resells the products made by the "repackagers" just mentioned, and includes ComputerLand, superstores, industrial distributors, and mail order. The other type, who could justifiably be called a repackager in their own right, includes mail order hard drive resellers such as Alliance Peripheral Systems (APS), Club Mac, Hard Drives International, and Wholesale 54. This second type offers you repackaged drives with either internal brackets or external housings. The drives are already formatted and ready to go, and you get formatting software as well as an instruction manual, cables, and everything you need to get started out of the box.

The original Macintosh hard drive "repackagers" are at a disadvantage in that the economies of scale of the mail order houses are staggering. But when you can get the exact same manufacturer's hard drive at one-third less in cost, there's no way that power supply, packaging aesthetics, and bundled software can make up the difference.

I am not kidding here—the exact same drive. Both drive repackagers and the mail order resellers buy the same batch of drives from the same manufacturing production line at Quantum. (If you don't believe me on this, ask Quantum—I did.) There is no difference

"What's" affect actual product you buy
in product between what IBM, Apple, one of the other computer manufacturers, a repackager, or a mail order reseller gets from Quantum’s production line.

How to buy

Now that you have a good idea of your priorities, needs and what's, all that remains is to actually go and buy your hard drive. Here I offer advice in five areas:

- Who to buy from
- How much to spend
- Checking out specification claims
- Buying checklist
- Buying used hard drives

Who to buy it from

Buy a quality product (a mainstream hard drive with a good reputation and specifications), from a high profile, quality vendor (someone you asked around about and who checks out). Then be sure you are getting at least a one year warranty (some vendors offer more), and a full return privilege if the product for any reason doesn't meet your specifications. None of the quality distributors would hesitate to honor these terms. By taking these steps, even if this is your first attempt, you can sleep nights!

Sitting with a client in a real world situation, I can advise them exactly. Not knowing your situation, I cannot give you specific advice sight unseen—so while you can expect consistently good results from the drives listed in the table that follows, you must make your own vendor choice.

Also, as they say in the sales game, "the next person who speaks, loses." There are numerous other quality manufacturers of hard drives besides those listed in the table that follows. I am not interested in offending anyone but space does not permit including every offering. Excuse me if I have not included your favorite product, but sources are given at the end of the chapter, and there are hundreds of additional hard disk manufacturers, distributors and resellers. The best places to begin your vendor search are in the Macworld, MacUser, MacWEEK magazines, and the additional references mentioned in chapter 12.

How much to spend

How much should you pay? Get the best drive from a reliable vendor, but don't spend more than you have to. Drive pricing has dropped drastically since the early days of the Macintosh. The last few years have provided an acceleration of this trend as newer 31/2-inch drives take over the spotlight from older models; 51/4-inch models are now mostly sold for higher capacity applications.

Table 3-1 shows a comparison of current hard drive pricing for popular models taken from MacWeek. This table changed considerably from a similar table prepared for another book only six months earlier. The most remarkable change was that Apple is no longer in the hard drive business (it dropped all of its drives except for an 80Mb model that uses a Quantum mechanism and is assembled by Microtech). Please consider the table only a
Table 3-1  Macintosh hard disk price comparison—September 1991 prices

<table>
<thead>
<tr>
<th>Manufacturer/model</th>
<th>Capacity (Mb)</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliance Peripheral Systems:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantum LPS 52</td>
<td>52</td>
<td>249</td>
<td>339</td>
</tr>
<tr>
<td>Quantum LPS 105</td>
<td>105</td>
<td>359</td>
<td>449</td>
</tr>
<tr>
<td>Sysquest SQ 555</td>
<td>45</td>
<td>659</td>
<td>479</td>
</tr>
<tr>
<td>Quantum 210</td>
<td>210</td>
<td>699</td>
<td>749</td>
</tr>
<tr>
<td>Maxtor LXT 340</td>
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<td>1099</td>
<td>1189</td>
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<tr>
<td>Wren 300—half height</td>
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<td>52</td>
<td>235</td>
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<td>Quantum 210</td>
<td>210</td>
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<td>340</td>
<td>995</td>
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<td>300</td>
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<td>Warehouse 54:</td>
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<td>Quantum LPS 52</td>
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<td>229</td>
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<tr>
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<tr>
<td>Wren 1200</td>
<td>1200</td>
<td>1999</td>
<td>1999</td>
</tr>
</tbody>
</table>

This snapshot in time, subject to change early and often, and refer to your actual hard disk supplier for current pricing. Table 3-1 also shows you that it pays to shop around. Notice the same drive varies widely in price among the different suppliers—reflecting their own supply/demand and competitive situation at any given point in time.

The table also shows that more costs less. Looking at the 52Mb versus 105Mb situation, you get 2.5 times the capacity for only $100 more. Buy the bigger drive if your budget allows it.

Today you can buy a Quantum 105Mb with two year warranty mail order—shipped to you the next day—preformatted, with system and public domain software already loaded on it, ready to run for under $500! Numerous similar choices await you in the pages of the Macintosh magazines.
As mentioned, get the best deal you can from a high-profile vendor that gives you a good warranty and a liberal return privilege. And no matter what investment you have made in your hard drive, the relentless march of technology will make it obsolete. Just think about how you are going to back up your 6 gigabyte 3½-inch hard disk in the year 2000. Time marches on . . . .

Checking out specification claims

While not accusing anyone of outright fraud, let’s just say that the specmanship game is played to the hilt in the hard drive marketplace. To be honest, hard drive manufacturers are under extreme pressure to distinguish their products from their competitors. “Truth is in the eyes of the beholder,” as they say. Or perhaps the point is better served by a used car analogy, “I can get you a great deal on this model, sir. Did you want that with wheels?” Two areas that are particularly fraught with peril for the novice buyer are average access time and MTBF specifications. Let’s take a brief look at both.

Average access time

Average access time refers to the amount of time it takes, on average, to position the read-write heads over the track that holds the data. Technically, it is defined as seek time (time to find the track) plus settling time (time to stabilize over the track) plus latency time (time to bring the sector data on the track under the head). Some manufacturers ignore one or more of these factors to publish better times. Average latency is the time for data to rotate under the heads—half the disk revolution time. On a typical Macintosh hard drive that rotates at 3600 rpm, the average latency would be 8 ms.

Quantum, which is scrupulously honest about such things, tells you in their manual that worst case full-stroke seeks can be 43 ms, single track seeks can be 5 ms, average seek time is 19 ms, and that latency is not included in the figures. When you buy their hard drive, attach it to your Macintosh, and time it with the utility software I’ll describe in chapter 10, lo and behold you measure it at 27 ms which is their quoted average seek plus 8 ms latency. It’s nice to know that there are still some honest people left in the world.

MTBF (mean time between failures)

MTBF is another area some manufacturers take license with. While access time is tangible—you can eventually tie it down—MTBF is a total intangible. Manufacturers are able to spec anything they want because the worst that can happen is you bring your prematurely failed drive back and they say, “Gee, that one fell outside of the probability curve.” Fortunately, most manufacturers do not wish the PR nightmares and attendant public outcry that accompany poorly performing products in the close-knit Macintosh marketplace. That factor alone more than keeps Macintosh hard drive manufacturers conscientious in producing quality products.

Basically, every manufacturer uses an MTBF scheme that puts its products in the best light. To most hard drive manufacturers, MTBF is a calculated statistical figure, although, incredibly, some merely count the returned “failed” drives. An MTBF rating of 50,000 hours does not mean each hard disk will last that long before needing repair. It means that
in a population of 50,000 hard drives, 1 will fail every hour, 24 hours per day, or about 18 percent of the drives will have to be repaired before year’s end. Over a 3-year period, over one-half (54 percent) of the original 50,000 hard drives will require some amount of service.

How many working hours are in a year? You could say 40 hours times 52 weeks; or about 2080 hours (for comparison, 50,000 hours translates to 24 years of 8 hours per day use). Used at that rate, Bob Brant’s rule of thumb says you should expect your hard drive to give you about 3 years of service—maybe 5—before needing “something.” This is the real world and I’ve got a lot of data to prove my claim. Bottom line: buy the hard disk with the higher MTBF, but independently check other manufacturer’s claims and reputation first, and disregard the actual MTBF number. Besides, with technology changing so rapidly, you will need another hard drive in 3 to 5 years anyway!

**Buying checklist**

It’s time to package everything into a buying checklist for you. Here’s the list you ought to have in your pocket before you go hard drive shopping. Use Fig. 3-3 as a reminder of what to look for when choosing an external hard drive.

**Priorities**
- What are your performance constraints?
- What are your cost constraints?
- What are your time constraints?
- Any other constraints?

**Needs**
- Are you a low-, medium-, or heavy-duty user?
- What are your needs today?
- What are your needs for the future?
- How fast are your needs changing?

**Whats**
- What capacity and speed do you need?
  ~ Less than 80Mb?
  ~ 80Mb to 200Mb?
  ~ 200Mb to 600Mb?
  ~ Over 600Mb?
- What kind of hard drive do you need?
  ~ Internal?
  ~ External?
- What manufacturer makes the drive mechanism?
  ~ Is it one of the top three?
  ~ If not, does it have a good reputation?
  ~ Is the manufacturer still in business?
  ~ What is the MTBF rating on the drive?
  ~ What warranty does the manufacturer offer?
• What distribution source are you buying from?
  ~ Do they sell another vendor's product or repackage their own?
  ~ What are their return privileges?
  ~ What is their warranty?
  ~ What are their support policies?

How to buy

• Who to buy from
  ~ Do you trust the vendor?
  ~ Are you familiar with vendor? If not, have you asked about them?
  ~ Are their return, warranty, support policies competitive?
  ~ Is their pricing competitive?

• How much to spend
  ~ Have you priced the same model with several different vendors?
  ~ What's the best model for its features?
  ~ What's the best model for its price?
  ~ Who offers the best combination of price, features and support?

• Specification claims
  ~ Average access time
  ~ MTBF

• Buyer checklist?
  ~ Do you have a buying plan?

• Buying used?
  ~ Don’t buy a used hard drive, but if you must...
  ~ Is it a well-known brand, manufacturer still in business?
  ~ Is it a discontinued or current model?
  ~ Can you get a one year warranty?

If purchasing an internal hard drive

• What Macintosh is it for?
  ~ SE or SE 30
  ~ Mac II, IIx, or IIfx
  ~ Mac IIcx, IICi

• Does hard drive come with internal terminating resistors?

• Does vendor supply:
  ~ Correct type of internal bracket?
  ~ The internal cables required?
  ~ Software?
  ~ Instructions?

If purchasing an external hard drive (Fig. 3-3)

• Does it have the basic housing features?
  ~ All metal housing? RFI coating on inside if plastic portable case?
  ~ Heavy-guage metal so covers on zero-footprint cases don’t flex?
  ~ External access to SCSI terminating resistors?
• Does it have at least a 30-watt power supply?
  ~ Quiet cooling fan and good internal airflow?
  ~ Circuit breaker or fuse?
  ~ Universal 110/220 volt, 50/60 Hz operation?
  ~ Extra plug-in power socket?
• Does it have SCSI ID switch?
  ~ Thumbwheel, DIP switch, or none?
• Does it have SCSI termination?
  ~ Does it have internal SCSI terminating resistors?
  ~ Are they installed?
  ~ Does it have external SCSI cable terminator?
• Does vendor supply SCSI and power cables?
  ~ Is SCSI connector to housing 50-pin type?
• Does vendor supply software?
• Does vendor supply instructions?

Used hard drives
Don’t buy a used hard drive. You don’t really know who used it, how they used it, or how long they used it for. Worst of all, you don’t know if it has ever been repaired. While I have nothing against hard drive repair shops and they serve an enormously useful function as I mention in chapter 9, it’s very difficult for a repair shop to reproduce the manufacturer’s Class 100 or Class 10 clean room environment in which the drive was first made. And dirt, in any form, is death to hard drives.

Under the best of circumstances, any hard drive is a perishable commodity. With a new one at least you know you are getting three to five years of operation for your money. A used hard drive is more like a ticking time bomb—you might get a couple of years out of it (about one year is the maximum I’ve usually seen for repaired drives!) or it might just make it past your 90-day warranty period.

Speaking of warranty, it is probably your best defense if you have to buy a used hard drive. At least you save some face after losing all your data when your warranty vendor exchanges it for a working used hard drive. But if your used drive vendor says 90 days or gives you no warranty at all, just politely say thank you and walk away. Many other vendors do give warranties and (at least) one year just makes good business sense.

Pricing is so competitive and vendors are so hungry because of the glut of product in the new hard drive market, taking the much greater risk on a used hard drive just doesn’t make sense to me. If you insist on buying a used hard drive despite my strongest warning to the contrary—just remember “caveat emptor” (buyer beware) before you buy and “I told you so” after it breaks.

Closing thoughts
Here’s an additional potpourri of items on hard drive buying to think about:

Speed  Buy the fastest speed for the storage size because time is money and speed saves time. A 40Mb drive with a 12-ms access time is just as reliable as a 40Mb drive with a 48-ms access time, and offers you four times as much speed.
Cache  A cache is a small pocket of memory comparable to the change purse in a woman's handbag which saves her from searching through the whole handbag for change. Mainframe and minicomputer manufacturers have for years used high speed memory in front of regular processor memory to speed up their computers. Blocks of information written to main memory are also written to cache. On looping, iterative programs, when the CPU goes to fetch the next instruction from memory, it finds it much more quickly because it is already in cache. If it finds the data there, it doesn't bother to look in main memory, thus saving time. The overall effect is faster performance. All larger drives and most of the better new mid-range Macintosh hard drives also come with some sort of cache buffering. Hard drive cache performs a beneficial service identical to memory cache, and if you are reading contiguous sectors from a nonfragmented hard drive you will really enjoy a performance boost. Ask for it when you buy.

Software  What comes with the drive is important but not that important. While drive repackagers use it to justify a higher price, you can probably buy the software and the equivalent hard drive package for less via mail order.

Support  First, what kind of support does the manufacturer offer? You want a one year warranty minimum, and two or more is great. If not—look someplace else. Then, what kind of support do you get from where you buy the hard drive? You're usually not going to rely on their service too much except when first setting up. But if something goes wrong, you want to know there is somebody you can call to get help.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

Hard drive repackagers
Advanced Gravis Computer Technology Ltd.  
7033 Antrim Ave.  
Burnaby, BC Canada V5J 4M5  
(800) 937-0062

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

Bay Microsystems Inc.  
210 Columbus Ave., Suite 108  
San Francisco, CA 94133  
(415) 563-8392

CMS Enhancements  
2722 Michelson Dr.  
Irvine, CA 92714  
(714) 222-6000

Deltaic Systems  
1701 Junction Ct., Suite 302  
San Jose, CA 95112  
(800) 745-1240

Ehman Engineering Inc.  
P.O. Box 2126  
Evanston, WY 89231  
(800) 257-1666
EMAC Div Everex
48431 Milmont Dr.
Fremont, CA 94538
(800) 821-0806

FWB Inc.
2040 Polk St., Suite 215
San Francisco, CA 94109
(415) 474-8055

GCC Technologies Inc.
580 Winter St.
Waltham, MA 02154
(800) 422-7777

IDS Systems Inc.
2107 N. First St., Suite 280
San Jose, CA 95131
(408) 441-0500

LaCie Ltd.
19552 SW 90th Ct.
Tulatin, OR 97062
(503) 691-0771

Liberty Systems Inc.
120 Saratoga Ave., Suite 82
Santa Clara, CA 95051
(408) 983-1127

MicroNet Technology Inc.
20 Mason
Irvine, CA 92718
(714) 837-0633

Microtech International Inc.
158 Commerce St.
East Haven, CT 06512
(800) 626-4276

Mirror Technologies Inc.
2644 Patton Rd.
Roseville, MN 55113
(800) 654-5294

Optima Technology Inc.
17526 Von Karmen
Irvine, CA 92714
(714) 476-0515

Peripheral Land Inc.
47421 Bayside Pkwy.
Fremont, CA 94538
(800) 288-8754

Personal Computer Peripherals Corp.
4710 Eisenhower Blvd.
Bldg. A4
Tampa, FL 33634
(800) 622-2888

Procom Technology Inc.
200 McCormick Ave.
Costa Mesa,
CA 92626
(714) 549-9449

Relax Technology Inc.
3101 Whipple Rd., Suite 22
Union City,
CA 94587
(415) 471-6112

Ruby Systems Inc.
930 Thompson Pl.
Sunnyvale, CA 94086
(408) 735-8668

Storage Dimensions
2145 Hamilton Ave.
San Jose, CA 95125
(408) 879-0300

Tulin Corp.
2156H O'Toole Ave.
San Jose,
CA 95131
(408) 432-9025

Retail sources

Your friendly local Authorized Apple Dealer or Apple Macintosh specialist

Sources 83
Mail order—drive specialists
Alliance Peripheral Systems
2900 S. 291 Hwy.
Independence, MO 64057
(800) 645-5401

Club Mac
3 Musick
Irvine, CA 92718
(800) 258-2622

Hard Drives International
1912 W. 4th St.
Tempe, AZ 85281
(800) 767-3475

Mail order—general Macintosh
Mactel Technology Corporation
3007 N. Lamar
Austin, TX 78705
(800) 950-8411

Mac & More Inc.
11266 W. Hillsborough Ave.
Tampa, FL 33635
(800) 846-4622

MacCenter
812 San Antonio St., Suite 406
Austin, TX 78701
(800) 950-3726

MacWarehouse
47 Water St.
South Norwalk, CT 06854
(800) 622-6222

MacDirect
60 E. Chestnut, Suite 145
Chicago, IL 60611
(800) 621-8461

Wholesale 54
2415 S. Roosevelt Ave.
Tempe, AZ 85282
(800) 927-3179

Software That Fits
610 S. Frazier
Conroe, TX 77301
(800) 972-3018

Third Wave Computing
1826B Kramer Ln.
Austin, TX 78758
(800) 284-0486
This chapter shows you how to put your newly purchased hard drive together with your Macintosh. Either you've purchased a hard drive to go inside your Macintosh, or an external hard drive which plugs into your Macintosh. In either case, my objective is to get you to that warm, "Welcome to Macintosh" screen message and friendly bong or chord sound that greets you—signaling everything is okay—as quickly and painlessly as possible, so you can begin working with it.

Although it's simple to install your internal or external hard drive, the whole area of SCSI cabling, termination, and opening your Macintosh has been made out to be quite intimidating and complicated. I'll cut through the chaff in this area to give you a better understanding.

**SCSI rules of order**

Before you can play, however, you need to know the rules. In Macintoshland, high speed devices external to the Macintosh logic board are connected to it via an Apple adaptation of the Small Computer System Interface (SCSI). The SCSI interface (or SCSI-1 as it is now called to distinguish it from the newer SCSI-2 specification) was first introduced with the Mac Plus in 1986. It tremendously improved the way the Macintosh was able to perform with hard drives and other fast peripherals, because it was a faster (1.5Mb per second) parallel bus, working over shorter cable lengths, compared to the slower (230 kilobits per second) serial connection used over longer cable lengths on the pre-Mac Plus models. It was also very flexible, in that you could accommodate numerous different device types: hard, removable, optical, tape drives and scanners, multimedia, and I/O devices. All these advantages led to its becoming the Macintosh standard in the first place, and the de facto PC industry standard in its latest incarnation, SCSI-2.

If you obey only a very few well-defined rules, you will have few or no SCSI problems. Many SCSI problems occurred when using the Macintosh Plus—whose initial SCSI implementation did not include a timeout signal or faster hardware handshaking modes—with older SCSI devices that implemented a marginal reset signal design. The 20 percent of the users who had 80 percent of the problems because of this configuration told others...
and that's how rumors of SCSI problems got started. When you put a new hard drive on a Macintosh SE or newer model whose other SCSI peripherals are "current vintage," your odds of instant SCSI success are extremely high. Let's get to the rules.

Cable me in the daisy chain

Your Macintosh's SCSI interface allows you to connect up to seven SCSI peripherals to it. They can be hard drives, CD-ROM drives, backup drives, printers, scanners, etc., in any combination. Your Macintosh is physically always the first SCSI device in the chain. You cable from the Macintosh SCSI port into the first device's SCSI port. Then, using their respective SCSI ports, you connect from the first device to the second, the second device to the third, and so forth, in a serial fashion.

The drawing of Fig. 4-1 shows one arrangement, where a Macintosh system is connected in turn to its hard drive, an optical drive, and a CD-ROM drive. Figure 4-2 shows the real world. In this case, three devices (hard, SyQuest, and CD-ROM drives) are physically stacked on top of one another and cables tie their 50-pin SCSI connectors to one another. Let's talk more about SCSI cables and connectors.
**SCSI system cable** This cable, shown in Fig. 4-3, has a 25-pin connector on one end—to connect to your Macintosh SCSI port—and a 50-pin connector on the other to connect to your hard drive, etc. This cable is always the first cable in the chain, and the only one in configurations with a Macintosh and a single external SCSI device.

![SCSI system cable](image)

**SCSI extender cable** This cable, shown in Fig. 4-4, has a 50-pin connector on both ends, and is used for interconnecting all the other devices on your SCSI chain.

![SCSI extender cable](image)

**Maximum SCSI cable length** The SCSI specification says total cable length should not exceed six meters—about 20 feet—but try to keep your overall SCSI cable length at 10 feet or less. The shorter the better is a good rule of thumb.

**SCSI cable lengths** SCSI cables, either system or extender, are available in various common lengths: 18 inches, or two, three, four, six, eight, ten, and even twelve feet. This does not mean you have to use them. Longer lengths are for specialized applications—typically high speed SCSI I/O where the measuring equipment must be located some distance from the Macintosh itself—and usually require special attention at setup. Use the...
SCSI system cable—usually six feet or less—your vendor provided with your external hard drive, and keep your SCSI extender cables short—two to three feet. A little quick math—20 feet divided by 7 devices maximum—tells you your average cable length must be under 3 feet when working with the maximum possible device configuration.

**Cable neatness** While some fastidious individuals buy shorter SCSI cables just to keep wiring neat and tidy, others insist on “folding” their SCSI cables and tying them off with a heavy rubber band or cable tie. While there is nothing wrong with this technique applied to serial printer, modem, Appletalk, or RJ11 telephone cables, it usually spells disaster—either instant or (worse for you) delayed—to your SCSI cable. Folding a cable with 50 wires in it inevitably breaks, crimps, stretches, or shorts some of them, and creates problems for you. Resist the temptation to be too neat—don’t put sharp bends in your SCSI cables.

**Cable quality** If you do want to be fastidious, focus on buying only “high quality” SCSI cables that are the “same type” of construction. High quality means the wire pairs inside the cable are twisted and shielded with foil, and the entire cable bundle is shielded with braid that is tied off to the SCSI connector shell. “Same type” means you match all your cables by buying the same brand, preferably from the same vendor. In a multiple device SCSI chain, it is worse to mix excellent quality cable with inferior quality than it is to use all inferior cables. Good quality SCSI cables give you no problems. Mixed and inferior quality SCSI cables almost always give you problems over time.

**Apple’s DB 25 SCSI connector** Apple adhered very closely to the ANSI SCSI specification. Actually, the main point of difference is that Apple opted to use a 25-pin DB-25 connector on the back of all Macintosh models—I presume to save room. The signals on the Apple external 25-pin SCSI connector and the internal (logic board) 50-pin SCSI connector are identical except for the grounds.

**SCSI connector warning** Although the 25-pin SCSI port on the back of your Macintosh looks exactly like a DOS PC RS-232 serial port (except that this is a male connector) or a DOS PC parallel printer port (for which it is a dead ringer—same shape, number, and type of holes), it is not. *Never, never, never connect RS-232 type devices to your Macintosh SCSI port or you will cause its instant and painful death!* Specifically, you will smoke the SCSI chip on your Macintosh’s logic board and put a several hundred dollar (or more) dent in your wallet. The delicate 0 to +5 V TTL logic levels of the signals on your Macintosh SCSI interface connector were never designed to endure the RS-232 −25 V to +25 V signal levels.

**Pick a number, any number from 0 to 6**

The SCSI protocol requires that each device attached to the bus have its own unique identification number—its SCSI ID number—so that it can keep track of which device information is going to and coming from. A rough analogy is the number you get when standing in line at the Motor Vehicle Bureau . . . “Now serving number 1, now serving number 2,” and so on.

Other than your Macintosh, which is permanently assigned SCSI ID number 7, any device can be assigned any number from 0 to 6—because only 7 devices can be “physi-
cally” connected to your Macintosh at one time. This SCSI ID number has nothing to do
with a device’s physical location in the daisy chain. Refer back to Fig. 4-1. Although the
hard drive is SCSI ID number 6 and the CD-ROM is SCSI ID number 0, these two num-
bers could be interchanged just by changing their SCSI ID number switch settings. The
cables and the drives don’t have to be moved! To use the earlier analogy, it’s just like you
gave your number slip to another person waiting in line. On the other hand, the Macintosh
polls its attached SCSI devices in descending order from SCSI ID number 6 to SCSI ID
number 0. SCSI ID number 6 gets asked, “Are you there?” first. That is why your main
hard drive should always be assigned SCSI ID number 6—your Macintosh will always
look to it first when booting up.

Your main hard drive can also be assigned a different number, but there are no free
lunches. For example, Apple assigns its factory installed Macintosh internal drives SCSI
ID number 0. This gives them more flexibility in working with older, slower SCSI perip-
ernals because all SCSI devices have to be polled before talking to the hard drive. But this
also creates an inconvenience—your Macintosh will always boot from any attached exter-
nal hard drive first because its SCSI ID number has to be SCSI ID number 1 or higher.

Most of the time you plug an external hard drive into a Macintosh already equipped
with an internal hard drive only because it has some data on it that you want. On internal
(SCSI ID number 0) hard drive Macintoshes, you first have to spend time returning con-
trol to your internal drive’s desktop because it has booted to the external drive instead.
Macintoshes that have video or accelerator boards installed require specific software to be
present in the System folder, so they don’t work at all when they don’t find it on the exter-
nal drive. A heck of a mess to get into for just wanting some data, and that can be avoided
by just setting your internal hard drive to SCSI ID number 6.

The terminator

The terminator merely tells your Macintosh where its SCSI bus ends and begins. Look
back at Fig. 4-1. Since you can only have one beginning and one ending to the SCSI chain,
you only need two terminators on a Macintosh SCSI bus chain. Keep the picture in Fig.
4-1 emblazoned on your mind—it’s all you’ll ever really need to know as far as termina-
tion is concerned. The Macintosh, the beginning of the SCSI chain, has its own SCSI ter-
minal and you don’t have to worry about it except for Mac IIcx models. The terminator
at the end of the SCSI chain can come in several flavors. All you must make sure of is that
the last terminator is physically located at the end of the SCSI chain and that no other ter-
minalare “accidentally” in the middle of the chain. A few examples will make the
point clear. First, let’s discuss terminators.

What’s a terminator? You tell the circuit the line stops here by putting a resistor across
it, and this is called a terminator in electronics parlance. Terminators come in three types:
those that go on the hard drive, or internal hard drive terminators, those that go on the
Macintosh motherboard, or internal motherboard terminators, and those that plug into the
external SCSI daisy chain, or external SCSI cable terminators. Let’s take a look at each
one.

Hard drive, or internal hard drive terminators Since a SCSI bus has many signal
lines in it and they all have to be terminated, terminating resistors are packaged into tiny
circuit packages with multiple leads coming out of them called—you guessed it—resistor packs! Figure 4-5 shows one between my fingers and a few others laying next to the hard drive.

4-5 Hard drive resistor terminator pack.

**Internal motherboard terminators (Mac IIfx only)** Because of the faster SCSI transfer speeds possible with the Mac IIfx, the SCSI rules change slightly in the termination area. If you have a Mac IIfx with no internal hard drive, then you must install an internal SCSI termination block into its logic board SCSI connector (it's removed when a Mac IIfx internal hard drive is present).

**External SCSI daisy chain or external SCSI cable terminators** Figure 4-6 shows the two variations: end of SCSI chain (on left), and multipurpose (on right). In addition, special external terminators are used with the Mac IIfx called SCSI II or, more commonly, "black" terminators because they have black plastic around the connector contacts rather than the blue plastic normally used in the 50-pin connectors and terminators.

**It's a SCSI job but someone has to do it**

There is a big difference between internal and external hard drives as far as termination is concerned. Vendors normally ship hard drives intended for internal use with termination installed. Vendors normally ship hard drives intended for external use without termination installed, but they include both the resistor packs and an external SCSI cable terminator.
Your mission is to carefully examine every device going into your Macintosh SCSI chain for its termination status before you cable it into the SCSI chain and apply power. (Assume a factory-installed hard drive in your Macintosh is terminated.) Your objective is to place only two terminators in the SCSI chain, and you’re mainly concerned with the end of the chain.

Closing SCSI rules and final warning
Although I would like to make this tidy for you, the real world does not always function that way. While the above rules will serve you well and you will encounter no problems in the overwhelming majority of cases—particularly with the newer Macintosh models and peripherals—some of you will encounter configurations that require tinkering and no rules apply. I’ve seen many things: short cable configurations working with no terminators, and long cable configurations working with three terminators, so don’t take anything for granted in your tinkering. All I know is there has never been a SCSI problem that couldn’t be solved. If you run into a SCSI roadblock, just ask someone with more SCSI experience for help.

The final warning is simple: Please turn off the power before working on your SCSI cable chain or installing/removing terminators. This means power to your Macintosh and also to all of your external SCSI peripherals.

Opening your Macintosh
This section covers myths and disclaimers, and the tools you will need to open your Macintosh. It then gets into the specific steps for opening the various models from the Macintosh SE to the IIfx, including the new Macintosh Classic, LC, and IIsi models.

I specifically recommend that you do not install a hard drive in your Macintosh Plus or earlier model. You can do it (you can also jump a motorcycle across the Grand Canyon), but, because it was never designed for this, you overstress your Mac Plus both in...
terms of temperature and power. While you can add fans and additional power supplies to compensate, you create a mess, waste a lot of unnecessary time and set yourself up for additional problems down the road. Use an external hard drive with the Mac Plus and earlier models, and only put internal hard drives into those Macintosh family members that were designed for them: SE, SE 30, Classic (and Classic SE 30 when it is introduced). Trust me on this one.

I also specifically recommend you do not install or upgrade a hard drive in your Macintosh Portable by yourself—take it to a dealer. It will cost you a few dollars and it will come back working. Putting a hard drive in any other Macintosh (except Mac Plus and earlier) is like hooking up your stereo—it’s a snap. Trying to do the same with your Macintosh Portable is like working on your Swiss watch—you get it all together but it never works right or else, “What’s this little piece over here—I wonder where it goes.” Believe me, while you could do it, you’re much better off paying a professional to do it and guaranteeing the results in the process.

Myths and disclaimers

If you’ve been around a Macintosh for any length of time, upgraded one, or just read various Macintosh and upgrade manuals, three nonsubliminal, “stamped-on-your-forehead” warnings stick out in your mind:

- If you open your Macintosh you void the warranty.
- Danger, there’s high voltage (on Macintoshes with built-in CRT screens).
- Danger, there’s static electricity.

They are all disclaimers. Let’s examine each one in turn.

When you open your Macintosh, you go from a rugged enclosure that you’re unlikely to damage in normal operation to an environment containing delicate electronic components that are not designed to be handled a lot. Apple (or any third-party vendor putting a similar disclaimer on its product) has no idea who is opening the Macintosh case—the gorilla depicted in the Samsonite luggage commercials or a trained electronics technician. To prepare for the worst in a safe, sane, and legal way, they say if you open the box you void the warranty. That eliminates the whole problem—for them.

Unlike a “stun-gun,” the Mac’s high voltage charge is provided by a capacitor—not a battery. If you can tolerate the discomfort and keep your fingers across the anode lead long enough—a few seconds—you just totally discharge it. So the Mac’s internal high voltage is a discomfort as opposed to a lethal threat. Can it harm you? Yes. Is it probable? No. I’m not advocating that you go in and boldly snatch the anode wire off the CRT and touch the middle of your palm with it, but I am saying that should you inadvertently brush against it, you’re talking about an uncomfortable, not a life-threatening, experience. It’s not a giant cause for alarm and not even in the same league as sticking your finger accidentally into an electrical outlet. May God and Apple forgive me for telling you this.

With static electricity, you can generate extremely high voltages (50,000 V or more—much higher than that stored inside your Mac’s high voltage area) but at such extremely low currents you just feel the barest of pinpricks. Your jolt is determined by your personal
body resistance—if you are shuffling across the rug in the middle of winter in a dry cli­
mate and drawing three-inch static discharge arcs off your door knobs you might disagree
with me! Although you are not harmed at all by these occurrences, they are literally a bolt
of lightning to the one-micron-wide circuit paths on the delicate electronic chips inside
your Macintosh. You need to set up your working environment to be as free of static as
possible. Thoroughly discharge yourself before handling any board or component, and
always hold such components by their edges. I also recommend a static guard wrist strap.

Tools you will need
The tools you need to install an internal hard drive in your Macintosh—particularly any
Macintosh without a CRT in it—are very simple:

- medium Phillips head screwdriver
- spreader tool and long-handled Torx-T15 screwdriver (CRT Macintoshes)
- antistatic wrist strap

Figure 4-7 tells the whole story. You can change the SCSI ID jumpers and terminating
resistors on your hard drive with your fingers (though a small pair of tweezers or needle-
nose pliers makes it easier), but even the smallest of tool kits is overkill for the job.

4-7 All the hard drive installation tools you need.

You need a plan
To get the maximum enjoyment out of this brief exercise of opening up your Macintosh,
installing your hard drive, and closing it again, involves some meager (but essential!) plan-
ning and organization steps. There are also a few common sense warnings to observe.

Set up your work area Think at least in terms of a 30-by-60-inch desktop in a low traf-
cic area (so no one knocks your opened Macintosh onto the floor while answering the
doorbell!) with plenty of light. It’s also ideal if this work area is located on a tiled floor as
opposed to a carpeted one for obvious static reasons.
Let your Macintosh save face  Provide a mat (nonstatic!) or a soft work surface area—not cardboard or wood—so that when you rest your Macintosh face down to work on it, it doesn’t scratch the front bezel. This kind of work surface is desirable for any Macintosh.

Your hard drive is not a sandwich  Never pick up your hard drive like you would grab your ham and cheese sandwich—you might inadvertently damage or zap a component in the middle of its delicate SCSI controller board. Handle your hard drive by its edges and you’ll be safe.

Unnecessary force unnecessary  Don’t force anything when you’re opening and closing your Macintosh. If the spreader tool is not opening your Macintosh the way it should, check to see whether you have fully loosened all the screws. If you’re putting the cover back on your Macintosh, check to see that one of the edges of the back case is not overhanging the front bezel and preventing it from closing further. Same thing for the cover for your NuBus Macs. There’s no need to force or jam anything.

Be well grounded  If you’re in a high static environment, use the wrist strap. If you’re not sure whether you are or not, use the wrist strap. Other than that, make sure you’re on a tile floor, discharge yourself first, pay attention, and handle your hard drive by its edges. You can bypass the wrist strap but you proceed at your own risk.

Unplug your Macintosh  Plug your single-prong wrist strap into the Macintosh power cable instead. This applies both before and during the time you’re installing your hard drive. If your Macintosh is plugged in while you put your hard drive in, you can zap your hard drive and/or your Macintosh if you accidentally turn on the power.

Don’t plug or unplug any cables with the power on  Neither SCSI (hard drive) nor ADB (mouse and keyboard) cables like to have their +5 V shorted to ground. You run the risk of ruining both your Mac’s logic board and/or those peripherals attached to it.

Don’t shock your Macintosh  While your Macintosh is up and running, don’t drop your ten-pound notebook or your coffee mug onto the surface that holds your Macintosh. Organize your workspace to avoid such accidents.

Don’t turn off power while your Macintosh is reading/writing to its drives  You could lose your data. Wait until the whirring sound stops (floppy drive) or the drive activity light goes out (hard drive) before turning off power.

Back up your existing hard drive  If you are replacing an existing hard drive with a larger one, back up your existing hard drive before you move it. That way a simple restore gives you back all your data on your newly installed hard drive. Make two or three back-ups to be sure. If you have extremely valuable or mission-critical information on your hard drive, I would suggest you back it up to another hard drive or removable media, verify it is all there and working, and only then consider moving it from its present safe “home.”

The opening process

Opening any Macintosh to install your hard drive is very straightforward: remove your Macintosh’s rear cover (Macintosh SE, SE 30, Classic) or top cover (Macintosh II, IIx, IIfx, IICx, IICi, IIsi, LC). If you are upgrading an existing hard drive, then you also dis-
connect its power and SCSI cables and remove the hard drive still installed in its bracket. Think you can handle it? I’m sure you can.

Opening the rear cover models

The process of opening any of these models is basically the same:

1. Disconnect all cables. Turn off your Macintosh, unplug and/or disconnect all cables to it, and wait approximately 30 minutes before beginning the cover removal process to allow the high voltage components inside your Macintosh to fully discharge via an anode bleeder resistor.
2. Remove the reset switch. Before you can take your Macintosh apart, the reset switch located at its lower left side must be removed. Lift its bottom edge out and slide it down until the two hooks at the top disengage.
3. Remove the two top and bottom rear cover screws and the rear cover. Figure 4-8 shows the sequence. Place your Macintosh face down and remove the upper two screws from the back cover using a long-handled Torx T-15 screwdriver. After the top screws are removed, go back and remove the bottom two screws. Notice that the bottom two screws differ from the top two screws in that they are dark, close-threaded, and designed to hold in metal, whereas the top two are bright, coarse-threaded, and designed to hold in plastic. Remember this distinction and keep the screws separate when you lay them aside on your work surface. Next, use the spreader tool to pry the rear cover apart from the front bezel approximately 1/4 inch all around. (If a spreader tool is not available, a wide-bladed putty knife can be used, but be extremely careful not to slip and scratch your Macintosh.) Then use both hands to lift the rear cover straight up, and let the Macintosh’s weight assist you in removing it from the front bezel attached to the chassis. At this point the foil RFI shroud should also come off (except on the Classic; it’s permanently attached to the back cover).
4. If high voltage still bothers you, pay attention. In Fig. 4-9, notice the suction cup attached to the CRT with the single large wire coming out of it. This is the high voltage CRT anode wire. If you waited 20 to 30 minutes after disconnecting your Macintosh, this area should be fully discharged. To make absolutely sure of no inconvenience to yourself, just stay away from the CRT anode wire area when working inside your Macintosh.
5. Remove the video card from the anode neck as shown in Fig. 4-9. Just lift it straight up and set it off towards the power supply side of the Mac without disconnecting it. By doing this, you lessen the chance of either damaging the video card or breaking the neck of your CRT while removing a hard drive or its cables.
6. Remove the expander bracket (SE and SE 30). In the interest of making things easier to work on, remove the three Phillips-head sheet metal screws holding the expander bracket onto the chassis.
7. Remove the memory (Classic) or Option (SE 30) card. Once more in the interest of making things easier to work on, remove the vertically mounted memory card that mounts on the right side of the Classic. If you have an SE 30, it has an option card (color video board, etc.) mounted in the same location which should also be removed.

Opening your Macintosh 95
8. Disconnect all cables from the logic board, and then remove the board itself. Actually, you don’t have to remove your logic board to install your internal hard drive. It’s just a good idea—you minimize the risk to your logic board and have more room to work in during hard drive removal/installation. Before you can remove the logic board from the chassis you first need to disconnect all cables going to it from the chassis and drives. But do this carefully—under no circumstances do you want to pull on a cable and have your hand suddenly come loose and fly up and strike the neck of the CRT.

~Logic board handling warning. Your logic board is extremely sensitive to static electricity (and it’s also expensive!). Handle it only by its edges during the removal process and set it aside in a static-free, protected part of your work area.

~Logic board chassis warning. Unlike the SE and SE 30 chassis, the Classic chassis is U-shaped rather than fully enclosed. It is very delicate (as well as hav-
Remove the video card—stay away from wire on suction cup to CRT tube.

9. Remove logic board. Once you have disconnected the cables, slide your logic board up and tilt it out (SE and SE 30). The Classic logic board is half-size, compared to SE or SE 30 boards, so you just slide it up and out and there is no speaker wire to disconnect.

10. Remove existing hard drive. After you remove your logic board, the type of Macintosh you have determines your next step. There are four alternatives:
- three drives, hard drive on top (SE only)
- two drives, hard drive on top (all models)
- two floppy drives (SE only)
- one floppy drive (Classic only)

11. Only the first two alternatives require the existing hard drive be removed. After you remove the SCSI ribbon and power cables attached to it, the hard drive bracket on any Macintosh model is removed by removing the two rear-facing Phillips head screws as shown in Fig. 4-10. Most of the time, you will simply be able to reinstall your new drive into the old bracket and reuse the old cables.
Opening the top cover models

The process of opening any of these models is basically the same, and much easier than the rear cover models. Let's get started.

1. Disconnect all cables. Turn off your Macintosh and unplug and/or disconnect all cables to it.
2. Remove the single rear cover screw. With the rear of the Macintosh facing you, remove the single Phillips head screw in approximately the center of the rear panel (this is the same for all models) as shown in Fig. 4-11 for the Mac IIcex.
3. Remove the top cover. This is slightly different for different models, and most easily done with your Macintosh turned around so that it faces you. In every case there are two tabs that must be disengaged:
   - Mac II, IIX, IIfx: Press the tabs at the outer edges of the rear panel gently inward and lift up the back of the top cover upward.
   - Mac IIcx, IIci: Flip up the two cover tabs upward and lift the cover off the cabinet starting at the rear.
   - Mac IIxi, LC: While holding the rear cabinet tabs down with your thumbs, flip the cover tabs up with your index fingers and lift the cover off the cabinet, starting at the rear.

That's all there is to it, you are now inside.
4. Remove existing hard drive (this is the next step in the majority of cases, since most models will already have an existing, but smaller capacity drive). The hard drive bracket is only bolted down in the Mac II, IIx and IIfx models. On all the others (Mac IIcx, IICi, IIsi, LC), the bracket just snaps into place. After your Macintosh is open and turned to face you, get your bearings by first locating the power supply, then the hard drive. There are three alternatives:

~ On Mac II, IIx, IIfx models, the power supply is the long, shiny silver box that runs the length of the chassis from front to back on the left side. The drives are attached to the platform that occupies the right half of the inside of the chassis. The front half of this platform is reserved for floppy drives (there can be a total of two) and the rear half is reserved for the hard drive. The platform and its drives are shown in Fig. 4-12. The original Apple hard drive is mounted in a bracket that is attached to the platform via two screws. Disconnect the existing SCSI and power cables from the hard drive, remove the two Phillips head screws, and remove the hard drive in its bracket. If you have a non-Apple drive bracket, or if you are installing a larger, full-height 5 1/2-inch hard drive, the platform will also have to be removed by removing the four screws that attach it to the chassis—two screws on either side.

~ On Mac IIcx and IICi models, the power supply is the square, shiny silver box (or cube) at the right rear of the chassis. The plastic drive housing is directly in front of it on the right side. The floppy drive is mounted in the lower half of the housing (you can’t see it from above). The hard drive is mounted in the upper
half of the housing, and is visible at the right front of the chassis. The metal hard drive bracket is removed from the plastic housing by pressing its two metal clips inward on either side and lifting it out, as shown in Fig. 4-13. Once out, the drive activity light wire can be disconnected from the front of the hard drive, also shown in Fig. 4-13, and the SCSI and power cables disconnected at the hard drive’s rear.
On Mac II/II+ and LC models, the power supply is the rectangular, shiny silver box that occupies the right rear of the chassis. The hard drive is mounted at the left front of the chassis in both models. To remove the hard drive, first detach its SCSI and power cables from the logic board. Then remove the hard drive bracket assembly by pressing outward the four plastic chassis clips that hold it (two on either side), and lifting it out, as shown for the Mac LC in Fig. 4-14.

4-14 Removing hard drive from Mac LC.

Installing your internal hard drive

Now that you have opened your Macintosh, you’re more than halfway home. While a few of the remaining steps will be model-specific, most will apply to all installations. All you have to do to finish your hard drive installation is verify your hard drive’s termination and SCSI ID number, reinstall the hard drive and mounting bracket in your Macintosh, connect its SCSI and power cables, and button-up your Macintosh (the opening procedure in reverse).

Your hard drive vendor is going to furnish you with detailed instructions for installing the hard drive and mounting bracket you have purchased into your Macintosh. My objective here is not to give you all the details—just to overview the process.

Verify terminator status

You learned about terminators earlier in this chapter. When you purchase a hard drive intended for internal use from any vendor today, it is usually shipped with the terminating
resistors already installed. Verify this before you install your hard drive by turning your hard drive over and looking at its SCSI controller card near the 50-pin SCSI connector—the area to which my finger points in Fig. 4-15. If the resistors are installed, you will see three resistor packs plugged into the holes just behind and parallel to the area where the SCSI connector is attached to the controller card.

If they are not installed, you need to look around your shipping container for them and install them yourself. Frequently they are in a little plastic bag taped onto the hard drive. If you don’t find them, tell your hard drive vendor to send you a set of three for the particular hard drive model you’ve purchased. Before installing them, observe that one side of the pack has writing on it, and one end of this side will have an obvious “dot” marking on it. This is the polarity dot. The pen points to it in Fig. 4-16. Now look at the tiny resistor pack mounting holes on the SCSI controller card. You will notice three arrow or “>” marks, one for each resistor pack. The wire lead under the dot on the resistor pack goes into the hole with the arrow or “>” mark. Install all three resistor packs using either your fingers, a pair of tweezers, or a small pair of needle-nose pliers.

**Set your SCSI ID**

You learned about SCSI ID numbers earlier in this chapter. Vendors usually ship hard drives intended for internal use with their SCSI ID jumpers already installed—but maybe not with the SCSI ID number you want. To verify your hard drive’s SCSI ID jumper, turn it over and look at its SCSI controller card. Figure 4-17 shows the SCSI controller card of
4-16 Pen points to polarity dot on resistor termination pack.

4-17 Pen points to SCSI ID jumpers A0, A1, A2.
a Quantum LPS 52 3¹/₂-inch hard drive—the pen points to the SCSI ID jumper block location. The installation manual furnished with most hard drives will provide its jumper block location. Now refer to Table 4-1. Since the maximum number of jumpers you need is two (the “110” pattern is equivalent to a SCSI ID number 6), the drive is usually shipped this way. If you want to change it to something else, use Table 4-1 to guide you. You’ve now set your internal drive’s SCSI ID.

Table 4-1 Hard drive SCSI jumpers

<table>
<thead>
<tr>
<th>SCSI ID number</th>
<th>A2</th>
<th>A1</th>
<th>A0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>1</td>
<td>0</td>
<td>0</td>
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<td>2</td>
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<td>3</td>
<td>0</td>
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<td>1</td>
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<tr>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 A “1” means jumper in, “0” means jumper is out.
2 Quantum uses this, A2, A1, A0 designation for their on-drive jumper pins. Conner uses E3, E2, E1 instead.
Find your vendor’s SCSI ID jumper designations and location from their installation manual.

Install hard drive in mounting bracket, reinstall in Macintosh

Here you have several permutations depending on what hard drive you will be installing into which Macintosh model. Any hard drive is removed or installed in its bracket via four Phillips-head screws. The only concern you must have (and I’ll mention it as a warning) is—don’t overtighten the mounting screws on 3¹/₂-inch one-third height hard drives during installation in the mounting brackets or you can ruin you hard drive.

Let’s quickly sort out the mounting bracket possibilities.

Macintosh SE and SE 30 You can only accommodate 3¹/₂-inch drives in these models. There are numerous brackets to help you here available for half-height drive sizes up to 500Mb (you are most likely upgrading to a 100 or 200Mb hard drive) or the new one-third height style drives (you are most likely upgrading to a Quantum’s LPS 52 or 105 model).

Macintosh II, IIx, IIfx These models have the greatest flexibility to accommodate a wide variety of hard drives. The 3¹/₂-inch and 5¹/₄-inch half-height drive brackets fit onto the existing Apple platform. The 5¹/₄-inch full-height drive and its bracket requires the U-shaped platform shown at the rear. In most instances, you are replacing your existing hard drive with your new model in its adapter bracket—reinstall the new bracket and drive on the platform and replace the two bracket hold down screws. That’s it, you’re done. If you’re installing a 5¹/₄-inch full-height drive in your Macintosh, the procedure is slightly
different. You must install your new 5 1/4-inch full-height drive, its bracket and its new U-shaped mounting platform before you’re done.

**Macintosh IIcx and IIci** Normally, you can only accommodate 3 1/2-inch drives and their mounting brackets in these models. (MicroNet makes a special bracket and floppy housing that allows you to mount 5 1/4-inch half-height hard drives—rotated 90 degrees from the normal Macintosh IIcx/IIci hard drive mounting position.) Attach the hard drive to its bracket with the four Phillips-head screws. Next, reinstall the hard disk cables. Then grab the bracket’s two protruding tabs, lift the hard disk and bracket assembly back into your Macintosh, and gently push down on it until it snaps in place.

**Macintosh Classic, LC, IIsi** You can only accommodate one third height 3 1/2-inch drives in these models (e.g., Quantum’s LPS 52 or 105 hard drives), in which case you use the bracket already shown in Fig. 4-14. My first recommendation would be to upgrade these models using an external hard drive in whatever size you need, keeping the internal 40Mb hard drive as is until you hear that the Apple power supply problems in these models have been permanently solved.

**Connect power and SCSI cables**
Reconnect the SCSI and power cables. The order of connection is not important—do whatever is most convenient. In most cases, if not all, it is easiest to do this while holding the drive bracket in one hand and the power or SCSI cable in the other. Also reattach the drive activity light wire in this manner.

The power cable is keyed: the top of the connector is rounded, and the bottom is square, so it is very difficult to install backwards unless you have the strength of a gorilla and are not paying attention. On some newer (i.e., Maxtor) drives, the drive has a 3-pin power connector instead of the usual 4-pin, but your drive vendor will always furnish you an adapter and the usual wire color conventions still hold: yellow is +12 V; red is +5 V; black is ground.

The 50-pin internal SCSI ribbon cable is also keyed. If you are not sure, the convention is usually that pin number 1 on the hard drive’s SCSI connector is closest to its power connector. On your mating ribbon cable connector pin number 1 is always the red wire. Always reverify this with your vendor’s installation manual to be sure. Figure 4-18 shows the power and SCSI connectors for a Quantum LPS drive.

**Button up your Macintosh**
This is just the reverse of the opening process and varies from only a few minutes with the SE, SE 30, and Classic models to the almost trivial (putting the cover back on and attaching one screw) with all the others. Backtrack over the opening instructions just to be safe. Be sure to reattach the video card you removed in the SE, SE 30, and Classic models. The important caveat here is still *don’t force anything.*

**Installing your external hard drive**
External hard drive installation on your Macintosh is much simpler: check your hard drive’s termination, verify its SCSI ID number, and connect SCSI and power cables to it.
Again, your hard drive vendor is going to furnish you with detailed instructions for connecting the hard drive and mounting bracket to your Macintosh. My objective here is not to give you all the details—just to overview the process.

**Verify terminator status**

You learned about terminators earlier in this chapter. When you purchase a hard drive intended for external use from any vendor today, it is usually shipped without termination—but you usually receive both terminating resistors and an external SCSI cable terminator. To verify your external hard drive is not terminated (or that it’s in the termination condition you want it to be), turn the external drive case over and look underneath it. Most quality hard drive vendors provide a window or door plate in this area that you can look through (or remove) to check drive termination—without having to take the drive out of its enclosure. If your drive enclosure does not provide this feature, you will have to open it to examine your hard drive’s termination status. If you have a door plate, remove it as shown in Fig. 4-19 and verify your hard drive’s termination status as shown in Fig. 4-20.

If termination is not installed and that’s the way you want it—great, you’re home free. If you want termination installed, your choices are external and internal. Refer back to Fig. 4-2. Notice the external terminator plugged into the SCSI connector slot of the last drive (the top one) in the chain. This is the position where you would install your external terminator, although it might be located on the first or third or seventh SCSI device. If you
4-19 Remove external hard drive termination access plate.

4-20 Pen points to terminator pack mounting holes—notice polarity arrows.
want to install internal termination, the procedure is identical to that described in the previous section, but you have to do it through the access door as shown in Fig. 4-21. Here, a pair of tweezers or a small pair of needle-nose pliers comes in very handy.

4-21 Installing terminator packs in external drive.

Set your SCSI ID
For external Macintosh hard drives, this is merely a matter of setting a number on a switch. The switch itself, usually a thumbwheel type, can be found somewhere on your hard drive enclosure back panel. The pen points to its location in Fig. 4-22. Dial in the number you want from 0 to 6. When another drive is added, it must also be assigned its own unique number. Remember that SCSI ID number 6 gets the highest priority, SCSI ID number 0, the lowest.

Connect SCSI and power cables
Connect your external SCSI cables following the rules mentioned earlier in this chapter. Notice that all the drive enclosure connectors have clips on both ends. When you have your SCSI daisy chain set up the way you want it, double check one last time that all SCSI connectors are snugly in place, and their connector clips are holding them that way. It beats doing a whole lot of running around to figure out why your SCSI setup doesn't work only to find out the cause is one single SCSI connector loose from its socket by a fraction of an inch. The power cable should be the last item connected—after verifying everything else is the way you want it.
A few points can make a difference

That's it—you're done. At the last internal or external installation step, you're either greeted by a fully functioning desktop (if you purchased a pre-formatted hard drive—as most are these days), or you must format it yourself, the subject of chapter 5. If you had problems, chapter 9 covers troubleshooting.

Just a few more important points to cover before leaving. In addition to how you install your internal or external Macintosh hard drive, it is important to purchase a backup power source. Also important are where you locate your drive and how you treat it.

Order a UPS—the box, not the company

I strongly recommend that you purchase an uninterrupted power supply (UPS) to go along with your new hard drive if you don’t already have one. This is a simple device that provides backup power (from batteries) to your Macintosh and hard drive in the event your regular power lines go down. Just as backing up your hard drive is an important step, having an uninterrupted power supply to plug your Macintosh and hard drive into is another important step that can save your sanity and many gray hairs. After your hard drive, it’s probably the most important gift you can give to yourself. One single power hit (which would otherwise cause loss of data and could scramble your entire hard drive) can be completely alleviated with a UPS, which allows you to work through the loss of power as if nothing had happened. Trust me on this one, you’ll love yourself for having made the purchase.
Location and setup tips

Smoke and computers just don’t agree with one another, so put your Macintosh and hard drive in a smoke-free environment and let them have some room around it to breathe.

Don’t put books or other items on top or on the sides of your Macintosh or hard drive case(s) so they can’t ventilate properly. More than any other factor, heat is the cause of component failures inside your Macintosh. While fans in newer Macintoshes somewhat compensate for the problem, if you block the air flow so the fan can’t circulate it, you defeat its purpose and ensure a shortened lifetime for your Macintosh. On its way to a premature death, an “air-circulation starved” Macintosh exhibits all manner of ills which people blame on faulty hard drives or even Apple design capabilities, when the root cause is the Macintosh/hard drive being improperly ventilated.

If you are unusually static prone, I would also suggest that you place your Macintosh and hard drive on a desktop antistatic mat, or put a floor antistatic mat under the desk and chair that you work at.

Put your Macintosh and hard drive in a location where they are not going to be accidentally or periodically bumped by somebody walking by or jarred by somebody dropping something on your desk or work surface. While your hard drive is on, a jolt can pit or scrape the media surface under the hard drive’s head, causing temporary or permanent loss of data.

Move carefully

After you have turned the power off, wait a few minutes and let its platter(s) stop rotating before you move your hard drive. All of today’s current vintage hard drives have their own self-parking mechanisms, so you can feel free to move your drive and take it with you—after the platters stop rotating.

Speaking of taking your drive with you, if you’re in Alaska in winter, it’s minus 30 degrees below outside, and you’ve just moved it out of the trunk of your car . . . relax, have a hot cup of coffee and let your hard drive warm up to heated room temperature before turning it on. Same thing if you’re in Arizona in summer, it’s 110 degrees in the shade outside, and you’ve just moved it out of the trunk of your car . . . relax, sip a cold drink and let your hard drive cool down to air conditioned room temperature before turning it on. Although most of today’s drives have temperature-compensating circuitry, it’s not good to use them at a very cold or very warm temperatures.

That about covers the hardware and physical aspects of setting up your hard drive. The next chapter, chapter 5, begins coverage of the software aspects, starting with formatting your hard drive.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.
UPS manufacturers

American Power Conversion
132 Fairgrounds Rd.
W. Kingston, RI 02892
(800) 541-8896

Chloride Power Electronics
1 Technology Pl.
Caledonia, NY 14482
(716) 538-4421

Clary Corp.
320 W. Clary Ave.
San Gabriel, CA 91776
(818) 287-6111

Emerson Computer Power
15041 Bake Pkwy., Suite L
Irvine, CA 92718
(714) 380-1005

Sola
1717 Busse Rd.
Elk Grove, IL 60007
(800) 879-7652

Tripp Lite Manufacturing
500 N. Orleans
Chicago, IL 60610
(312) 329-1777

Topaz div Square D
9192 Topaz Way
San Diego, CA 92123
(619) 279-0111

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Formatting your hard drive

Now that you have purchased your hard drive and hooked it up, you have to format it before you can use it. You have to put the pattern of pockets, bins, or locations on your hard drive—any of these analogies is accurate—to instruct it how you want your data to be stored.

If your drive came to you preformatted, it saved you this step. Maybe it also came with system, applications and utility software on it—further helping you along. If so, you merely need to load your additional system, applications, and data software on it and go to work. Chapter 6 can help you in this area if you’re using Apple’s System 6 software, or go to chapter 7 if you’re using Apple’s new System 7 software.

But your hard drive might have been formatted only partially or not at all, or might not have been formatted in exactly the way you want. Also, it might have been formatted, but not partitioned (further subdivided) to meet your particular data storage needs.

My primary objective in this chapter is to give you the tools to help you meet your formatting/partitioning needs. I’ll provide you with a detailed look at one vendor’s software product, a casual look at several other vendors’ formatting software products, and leave you with information about where you can find additional products.

You bought your hard drive to increase speed and capacity. My other objective is to show the value of partitioning—how using it correctly can help you obtain more speed and capacity from any hard drive you own or buy.

An introduction to formatting

Today’s Macintosh hard drive formatting process is a far cry from its counterpart in the earliest Macintosh models, and still far easier than hard drive formatting—then or now—on DOS PCs. There is no need for you to concern yourself about the physical characteristics of your hard drive. You don’t have to worry about tracks, sectors, file allocation tables, or setting aside bad tracks. This is all done for you, transparently, by your formatting software.

If you had to design your Macintosh before using it (and delve deeply into the inner workings and timings of the individual chips on your logic board), you might have a very
different attitude about working with it. Yet that was how cumbersome and tedious the original formatting software packages were compared to today's offerings. They made life miserable for you—needlessly. But formatting software design had to take small steps before it could take larger ones, and the earlier products laid the basic foundation for those to follow.

Chapter 2 mentioned two types of formatting: low level and high level. Low-level formatting puts the tracks and sectors on the drive. High-level formatting—often called initialising—puts the directory information on it.

Today, your drive comes to you already formatted. You don't have the old problem of buying your hard drive from one vendor and your formatting software from another, and finding that each vendor used different rules—with the result that vendor A's high-level formatting software overwrote the low-level format on the hard drive you purchased from vendor B. Any of today's packages perform an enormous amount of work for you at the click of a mouse, and are about as far removed from the earliest Macintosh hard drive formatting software packages as a space shuttle from a horse-drawn carriage.

I've worked with the specific software products I am about to describe, and I would not hesitate to recommend any of them. They are by no means the only products available to you. I have provided a list at the end of the chapter for your further research. The Macintosh market changes constantly and rapidly, so use this list only as a starting point.

Formatting 1991—bundled software and hardware

Today, all hard drive vendors package their formatting software with the drive, and also go through the step of preformatting the drive for you. This section describes how to use the typical formatting software bundled with hard drive vendor's offerings.

The bundled advantage—load and go

Typically, all you need do after you buy a drive is connect it to your Macintosh (if it's an external drive), plug in power, and you're ready for business. If it's an internal drive, you have to install it first, but again you're ready to go to work. Chances are when you turn on the drive for the first time, it has already been formatted for you, and has system software on it. Some of the better vendors also provide you with additional utility or even public domain software which is already loaded on the hard drive in stuffed format (you have to unstuff it to use it).

As suggested in the previous section, there is an overwhelming advantage to you in receiving a bundled hardware/software hard drive package from the same vendor. First of all, you are pretty sure everything is going to work, or is working already because the drive was formatted and pretested at the vendor's facility. There is also a tremendous advantage to the vendor in bundling the formatting software: a controlled environment that results in fewer trouble calls and more easily diagnosable ones (because the software is familiar).

Figure 5-1 shows the external hard drive in a portable-style case from Alliance Peripheral Systems (APS)—built around a Quantum LPS 52 hard drive mechanism. You receive an additional formatting software diskette with it—even though software has
already been loaded on the drive and it’s ready to run. Figure 5-2 shows the desktop that opens when you first turn on the drive and it boots up. The desktop has folders for public domain software, tools, utilities, and the system. When you double-click on the Alliance Power Tools icon inside the tools folder, the window shown in Fig. 5-3 opens. Notice that it is preconfigured as one 49Mb volume.

One size fits all, but if you need to . . .

A single, maximum size volume is the default for any vendor’s Macintosh hard drive offering, since it is the easiest to use. Formatting software is included so that you can change the default formatting (or other parameters) if you wish, or reproduce the formatting if anything happens to it.

In addition to the hard drive and startup diskette, APS also provides you with an instruction manual, as previously shown in Fig. 3-5. The startup diskette contains a minimum size Apple system folder and the formatting software—everything shown on the desktop in Fig. 5-2 except the public domain software folder.

Your first step is to make a copy of the APS startup diskette. Don’t use the original diskette from the vendor; this is your backup copy, and should be set aside in a safe place! The startup diskette copy becomes your main startup and formatting diskette. You use it to format your hard drive initially, later if anything ever goes wrong, and anytime you want to change any of your hard drive’s parameters.

Let’s talk about change for a moment. Look at Fig. 5-3 showing the main APS formatting and partitioning software window. Using this window, you can format, test, partition, or password protect your drive.
5-2 Desktop on APS drive, already formatted with software installed.

5-3 Alliance Power Tools window.

Formatting your hard drive
Notice the four areas of the window. In the upper left is an area describing the drive volumes attached to your Macintosh and their status. In this case, you have a single 49Mb volume that is open, autobooting, and unlocked. In the upper right are eight buttons that cause a particular action to occur: Open/Close, Auto/Manual, Lock/Unlock and Create/Delete. In the lower right is the Disk Info area showing that you have a Quantum LPS 52 drive with 49Mb of storage attached to your Macintosh at SCSI ID number 4 with an interleave of one. Finally, at the lower left is the Status area, shown here in the ready state, waiting for you to select the volume you want to perform an action on (and to select the action by pushing one of the buttons).

In addition, on the menu bar above the window you have the File, Edit, and SCSI menus. The menu bar and the opened File menu are shown in Fig. 5-4.

To reformat your drive (which you don't need to do now but might in the future), select the SCSI ID location for the drive from the list in the SCSI menu. In this case you want the drive at SCSI ID number 4. Be extremely careful to pick the right drive. Highlight the 49Mb drive in the APS window and select Format from the File menu. You will receive a warning that you will erase all data if you continue and be given the choice OK (go ahead) or Cancel. You will be asked to select an interleave factor for your drive. A default interleave for your Macintosh model will appear in the window. For Mac SE 30s, Mac IIs and up (i.e., 68020 and 68030-based Macintoshes) an interleave of 1 will be suggested. An interleave of 2 will be suggested for the Mac SE and an interleave of 3 for the Mac Plus (and upgraded Mac 512 KE models). You can accept the suggestion or override it, but in the case of all Quantum drives, they are "hard-interleaved" to 1:1 and will remain set that way regardless of any choice you might make.

Formatting usually takes several minutes, after which you have the opportunity to create one partition that takes up all the available space on the drive. If you select OK, you are then asked to name this partition before it is initialized. If you select Cancel, you can set up multiple partitions, except when using a SyQuest cartridge product.

In order to boot from any partition as a startup device, that partition must be set to Auto. If you have done this correctly, the Auto button is grayed (because you are already in Auto—the next logical choice is to switch back to Manual). If you don't want a partition or volume mounted at startup, but want to manually mount it later, select Manual.

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The Open/Close and Lock/Unlock buttons work together. The Open/Close buttons are used to mount or dismount volumes on the Macintosh desktop (to make their icons visible so they can be used). At least one volume with a system folder in it must be Auto for your Macintosh to be able to boot from your hard drive at startup. If you previously selected manual for any volume, the Open/Close buttons are what you use to mount it.

The Lock/Unlock buttons have a password option on them so that you can not only “hide” your volume by removing it from the desktop, but also anyone wanting to access your volume must first know your password to “unlock” it before they can “unhide” it. This gives you two levels of protection plus the obvious one of not having the volume on the desktop to begin with—a casual intruder would not even know of its existence. By the way, the anyone in the “know your password” reference includes you, so be sure to write your password down somewhere. Otherwise you will have permanently denied yourself access to your own data.

If you chose the Cancel option when asked whether you want the drive partitioned with only one partition, you can use the Create button to set up multiple partitions. You can set up any number of partitions of any size up to the capacity of your drive (except on SyQuest-based drive mechanisms where only one partition on a cartridge is allowed). If you’ve made a partition too large or too small, you can use the Delete button to delete it and start over. Any data in the partition will be lost, but you can set up a new partition of a different size using any available space on your drive. You cannot shrink or expand APS partitions, and deleting them causes the loss of all data in the partition, but this is not a big deal—you just have to back up your data and restore it to the new partition. Figure 5-5
shows the window display that results when you create three partitions: one of 4Mb, the second of 15Mb and the third of 30Mb (the default name of each partition is Alliance Drive plus the partition number).

Figure 5-6 shows the results back on your desktop. You have now placed your software into your three volumes: system software in the first, smallest volume; applications, tools, and utility software into your second, medium-sized volume; and all your data (in this case, your public domain shareware) into the third and largest volume. This strategy is one of the most effective for organizing your Macintosh partitions. You'll find out why in this chapter's section on partitioning. Let's talk more about other vendor's formatting software first.

5-6  APS drive desktop with three volumes mounted.
The needs of the many outweigh the needs of the few

You've just been introduced to the APS formatting solution. Every vendor has added its own wrinkle to its formatting software package, yet the results are about the same. Let me prove the point. Look at Fig. 5-7, the SCSI Director software provided by Club Mac. Do you notice anything familiar about the buttons? In Fig. 5-8, the StorWare software provided with Unimac kits is shown. Again, don't the buttons look just slightly familiar? Figure 5-9 shows the FormatterOne software provided by some of Sony's MO drive vendors. The needs are more specialized in this case—i.e., an Eject button—but there is nothing too unfamiliar about the overall landscape.

```
  File  Edit  Setup

<table>
<thead>
<tr>
<th>OEM Mfr.</th>
<th>Product ID</th>
<th>Firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>QUANTUM 100</td>
<td>P1655 910-10-94x A.3</td>
</tr>
<tr>
<td>6</td>
<td>QUANTUM 100</td>
<td>P1055 910-10-94x A.3</td>
</tr>
</tbody>
</table>

Select ID and operation to perform.

ID Search

Auto Setup...
Format...
Partition...
Install...
Mount...
Unmount
Test...
Quit &Q
```

5-7 SCSI Director formatting software.

I could go on for dozens of examples, but I believe you get the point. Every vendor, for its own reasons, needs to package a certain type of formatting software with its drives. While there are better and worse bundled formatting software products, on balance the offerings are pretty similar.

They all make the formatting task totally transparent and eliminate any need to be a technical guru in order to get your hard drive up and running. The bundled products differ only in how they format and the appearance they present to you in offering the options. Your primary mission is to find out if they do an adequate job in the particular area that's of importance to you, like partitioning. And speaking of partitioning, let's find out why it should be important to you.
5-8  StorWare formatting software.

5-9  FormatterOne formatting software.

The needs of the many outweigh the needs of the few
Partition me, please

You bought your hard drive to give you more speed and more capacity. By proper use of partitioning, you can increase that speed and capacity even more. Since it costs you no money—only a few minutes of your time—it really is a way to get something for nothing. All you are doing is better organizing what you have.

Subdividing your hard drive into smaller volumes has many additional beneficial aspects. You gain speed because the drive has to search through a smaller physical space. Since you are not making it work as hard, you are extending your drive’s useful life. Having multiple volumes gives you more capacity because you can optimize your partitioned drive so as not to waste space by storing smaller files in one area and larger files in another. Startup time is reduced if you put all your system files into the first small partition (4Mb to 5Mb) on your hard drive as suggested in the APS example discussed earlier. Your Macintosh literally jumps to the desktop on startup and after quitting an application—because everything it needs is all together on one small part of your hard drive. Backup time (and backup media space required) are reduced because you only have to back up the partitions you are working in rather than the entire hard drive. Fragmentation is reduced (and speed correspondingly increased) because you can quickly defragment the smaller subvolume of your total hard drive that you have designated as your main work area—as opposed to the longer time it takes you to do the same process with your entire hard drive. You can also put system and other files that don’t change very often in their own partition, and have no need to defragment that partition very often. Security is increased because you can password protect and unmount volumes with sensitive data on them. Casual users looking at your Macintosh desktop don’t even know that volume is there—much less how to get to it! Efficiency of network server hard drives is increased; for example, engineering and administration can keep their own separate data in two separate AppleShare partitions on the same hard drive—yet neither has access to the other’s data. Your work efficiency is increased: you can store all your word processing in one partition, desktop publishing in another, graphics in a third and spreadsheets/financial in another. I cover organizing more fully in chapter 6.

The choice is always yours to make, but I hope I’ve made a case for the overwhelming benefits of partitioning your hard drive and the zero downside in doing it. At least experiment and try it on a second hard drive you might have lying around—you might never return to your prehistoric prepartitioned days! Let’s look briefly at why partitioning gives you speed and capacity before moving on.

Partitioning gives you speed

Partitioning—dividing the single large volume of your Macintosh hard drive into smaller volumes—is done for the same reason you put dividers in your three-ring notebook or clothing drawers. It makes it faster for you to retrieve your hard drive’s data, your notebook’s subject information, or your socks. For a visual analogy of partitions on your hard drive, imagine Saturn’s rings superimposed onto it. No question that you are going to find your data faster when it is all located in only a thin band or ring on the hard drive’s platter—rather than strewn all over its entire 50Mb or 100Mb disk surface area. But seeing is
believing, so I took the hard drive shown in Fig. 5-1 (an APS packaged Quantum LPS 52 hard drive), formatted with APS Power Tools software, and ran some timing tests on it. Table 5-1 shows the results.

Table 5-1 Comparison of partitioned versus nonpartitioned times

<table>
<thead>
<tr>
<th>Hard drive model</th>
<th>Partition number</th>
<th>Latency (ms)</th>
<th>Seek (ms)</th>
<th>Access (ms)</th>
<th>Read/write xfer rate (kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum LPS 52</td>
<td>One 49Mb Volume</td>
<td>8.16</td>
<td>21.84</td>
<td>30.00</td>
<td>524/561</td>
</tr>
<tr>
<td>Alliance PT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantum LPS 52</td>
<td>1-4Mb</td>
<td>8.16</td>
<td>13.34</td>
<td>21.50</td>
<td>533/561</td>
</tr>
<tr>
<td>Alliance PT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantum LPS 52</td>
<td>2-15Mb</td>
<td>8.25</td>
<td>16.83</td>
<td>25.08</td>
<td>533/561</td>
</tr>
<tr>
<td>Alliance PT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantum LPS 52</td>
<td>3-30Mb</td>
<td>8.25</td>
<td>19.91</td>
<td>28.16</td>
<td>533/561</td>
</tr>
<tr>
<td>Alliance PT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Latency was computed from rotation time, seek is average of 200 tries, access is seek plus latency time and transfer rate is actual over SCSI bus. All times were measured with the hard drive connected to a standard Macintosh SE and timed with Disk Timer from LaCie.

The first line of Table 5-1 shows the results for the hard drive partition as one volume—49Mb in size. Average access time is 30 ms. The next three lines of Table 5-1 show the results after subdividing the drive into 4Mb, 15Mb and 30Mb partitions. Average access time for the 4Mb partition is 21.5 ms. That’s almost one-third less time! Think of how much money it would cost you in hardware to get that speed gain. Here all you did was divide the drive into smaller parts. Notice the speed gains for the other partitions too; average access time for the 15Mb partition was 25 ms, and 28 ms for the 30Mb partition.

What else does Table 5-1 show you? Notice that the read/write transfer rate was not significantly affected by the repartitioning. Partitioning only affects how fast you get to where your data is located—not how fast you can read or write it once you are there. Also, notice that speed is directly proportional to the size of the volume. Going back to the ring or band analogy, the smaller the width of the band in which the data is stored (the smaller your partition) the faster your hard drive’s read/write is going to be able to get to it. It’s that simple.

Partitioning gives you capacity

Whether your hard drive is small or large, it stores its data in units called allocation blocks. The size of an allocation block is directly related to the size of volume used. Larger volumes have larger allocation blocks. The minimum space a file can consume is one allocation block—this is regardless of the actual size of the file within the allocation block. A 2-byte actual size file is allocated 1K on a 50Mb (or smaller drive) but can consume 5K on a 300Mb drive! Two hundred tiny 2-byte files, 400 bytes total, can consume—or more correctly waste—almost one million bytes of space on a 300Mb drive.
To show the principle at work, imagine you were storing gasoline in two different sized containers, a 3-gallon can and a 30-gallon drum. In the first case, one-third empty or the top third of gasoline in the can refers to one gallon. In the second case, one-third empty or the top third of gasoline in the drum refers to 10 gallons. You have a fixed indexing system, in this case thirds, applied to two different container volumes.

Your hard drive works the same way. The fixed indexing system, the allocation bit table, uses a 16-bit word. So you have $2^{16}-1$ or 65,535 possibilities ($2^{15} + 2^{14} + 2^{13}$, etc., down to $2^0$). This is roughly 64K. Your hard drive can be a volume of 50Mb, 100Mb, 300Mb, 600Mb or more. So your file allocation size is determined by the formula:

$$\frac{\text{Volume size (Mb)}}{64K} = \text{File allocation size (K)}$$

Table 5-2 shows the results for both calculated and real volume sizes. Notice that file allocation sizes don’t affect smaller hard drives nearly as much as they affect large ones. But seeing is believing, so try this experiment. Using Microsoft Word or another application that allows you to save a file in pure ASCII text format, create a document, type a single character into it (e.g., the letter a), and save it in text only format on your LPS 52 hard drive (or on a floppy diskette) as a file called “test.” When you do a Get Info (from the Macintosh File Menu) on your newly created test file it says, “2 bytes used, 1K on disk.” Now move that file over to your 100Mb hard drive and it says, “2 bytes used, 2K on disk.” Move it to your 300Mb hard drive (I used one side of a Sony MO 600Mb cartridge for the test) and, as shown in Fig. 5-10, it says, “2 bytes used, 5K on disk.”

<table>
<thead>
<tr>
<th>Volume size (Mb)</th>
<th>Multiplier (Kb)</th>
<th>File allocation size (Kb)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Calculated volume size</td>
</tr>
<tr>
<td>64</td>
<td>64</td>
<td>1</td>
</tr>
<tr>
<td>128</td>
<td>64</td>
<td>2</td>
</tr>
<tr>
<td>256</td>
<td>64</td>
<td>4</td>
</tr>
<tr>
<td>512</td>
<td>64</td>
<td>8</td>
</tr>
<tr>
<td>1024</td>
<td>64</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available hard drive size</td>
</tr>
<tr>
<td>100</td>
<td>64</td>
<td>2</td>
</tr>
<tr>
<td>150</td>
<td>64</td>
<td>2.5</td>
</tr>
<tr>
<td>300</td>
<td>64</td>
<td>5</td>
</tr>
<tr>
<td>600</td>
<td>64</td>
<td>9.5</td>
</tr>
<tr>
<td>1000</td>
<td>64</td>
<td>16</td>
</tr>
</tbody>
</table>

1Data taken from H.B.J. Clifford, Stephen Satchell, and MacUser Labs Staff, “Gigadrives: The 1,000 Megabyte Solution,” MacUser 7/91, p.140.

The way partitioning helps you save space—particularly on larger drives—is to place your largest files into the largest partitions. If you had a 1000Mb drive you might divide it into 100Mb, 300Mb, 600Mb partitions. The first 100Mb partition contains your system
and application files, the 300Mb partition your medium-sized files, and the 600Mb partition your large sound, image, video, or database files.

Although I didn’t mention it as a Macintosh software benefit, another benefit of partitioning is that the same hard drive can have various partitions with different operating systems on it that function independently. For example, you can load Macintosh, Apple’s A/UX, Apple ProDOS, and DOS PC software in four different partitions of your hard drive and none knows about the other. Each can operate as if it owns your Macintosh hard drive, without knowing the others are there.

**Behind every cloud, there is a . . .**

Now let’s spend a little more time with one product that will enable you, regardless of the drive you own, to do almost anything that you’d want to do in terms of formatting and partitioning it. Although there are many kinds of formatting software, there are only a few like Silverlining from LaCie.

**One product fits all**

I’ve lumped the benefits Silverlining delivers into four areas: speed, capacity, backup/security, and utility. Its greatest benefit to you is that you buy one product, and it works with many drive types, speeds, and sizes from many manufacturers, doing just about everything you’d ever want to do. The following paragraphs describe Silverlining’s specific benefits in each area.

**Increase speed** Silverlining lets you partition your drive into as many as forty separate volumes to keep fragmentation low and greatly reduce seek times. It lets you choose from
one of six different SCSI read/write routines for matching your drive to different types of Macintosh computers—it automatically tests your hard drive/Macintosh combination and shows you the fastest routine. You can optimize your drive by compacting data, thus decreasing access time. Finally, you can choose your drive formatting interleave to maximize transfer rate.

**Increase capacity** With Silverlining, you can maximize free space on your drive by compacting data (i.e., move all unoccupied areas to the end of the volume). You can set aside volumes on your hard drive for use by other operating systems (Silverlining provides multiple “startup” drivers so you can boot different operating systems from the same hard drive). You can specify the allocation block size for each volume to give you maximum flexibility in resizing your volumes. Finally, you can make partitions that span multiple drives to create much larger volumes.

**Increase backup/security** Silverlining lets you protect each volume with a password that is required when either the volume is mounted or the write-protect status is changed, or both. You can create a SUM (Symantec Utilities) parameter file for each volume, greatly simplifying the task of recovering files. You can also relocate files that reside on bad sectors before proceeding to map those sectors out.

**Increase utility** Silverlining provides a drive activity indicator in the upper left-hand corner of your Macintosh screen. It parks your drive heads at shutdown, if your hard drive does not automatically park its heads upon power interruption. It lets you control volume boot sequence by assigning names to system documents before placing them in the default volume’s alphabetical order boot list. Finally, you can use the Cirrus INIT file for auto-mounting removable SyQuest drives (also helps other drives that have startup mounting problems).

**Silverlining at work**

There is no question that it is an overwhelming advantage to have one product do all, just like having a Swiss army knife beats carrying around a knapsack full of other tools and utensils on a camping trip. Now let’s look at how Silverlining works.

When you purchase Silverlining from LaCie, you receive two diskettes. The Program diskette, shown in Fig. 5-11, has Silverlining, Disk First Aid, and a Mini System Folder on it. The Support diskette, shown in Fig. 5-12, has Silver Init, Silver Volumes, Time Drive, Disk Dup+, and a real System Folder on it. You’ll find every one of these programs handy. Once again, make a copy of these, lock the originals, and put them away in a safe place.

Let’s begin by reformatting the APS Quantum LPS 52 drive used earlier in the chapter with the Silverlining software. Figure 5-13 shows the Silverlining Select Drive screen you get after you choose Select Drive from the File menu. It identifies and gives you the SCSI ID numbers for all the connected devices it encounters in its scan. Carefully, select the device you want and click OK.

By the way, if you are using software on your main hard drive to format, initialize, or partition another hard drive (rather than using a separate diskette), shut off all screen savers, inits, or cdevs you might have so they don’t accidentally clobber your formatting software program in the middle of its work.
In Fig. 5-14 the top window has changed to show you the device you have selected. Your first step is to reverify that you are indeed working on the SCSI ID number device you want. If not, go back to the “Select Drive” window shown in Fig. 5-13 and select again. This is very important because the next few steps are irreversible and fatal to any data on your drive. Be sure you are working on the right drive!

*Behind every cloud, there is a...* 127
This disk appears to have been initialized by a program other than Silverlining. Silverlining features only work if you install Silverlining.

Sorry, Silverlining is not able to "take over" this particular type of drive without completely initializing the drive.

Initialize for Silverlining software.
Discard all current volumes and their data.
Once you are sure you have selected the right drive, you can now focus your attention on the lower window. Silverlining has detected that this drive has been initialized with something other than Silverlining software and has asked your permission to initialize for Silverlining. Click Initialize to give Silverlining permission to reinitialize. Notice that there is no need to reformat—the drive is already formatted—only to reinitialize. Reinitializing in this case installs Silverlining's driver software on your hard drive.

Figure 5-15 shows the next screen that comes up, which again asks if you are sure you are initializing the drive at the right SCSI ID number. Click OK if you are. Just in case you have had a three martini lunch, are still learning the English language, or are still out to lunch while sitting at your Macintosh, the next screen that comes up—shown in Fig. 5-16—asks for a third and final time (at this point, I have no sympathy for you!) if you are sure you want to initialize this drive and lose all the data on it. Click OK if you do.

![Initialize Drive Screen](image)

**5-15** Silverlining asks to be sure you want to initialize it.

Figure 5-17 shows the Customize screen that comes up during the initialization process for drives previously initialized with other software. By toggling the icon arrow in the middle of the screen, you get to look at a variety of icon options—what your hard drive icon will look like on the desktop. I choose the conservative icon shown because it most closely resembles the actual hardware item. Other options in this window include naming your hard drive, and a check box if you decide you want a drive activity light to be displayed in the upper left hand corner of your screen.

Figure 5-18 shows the SCSI Read/Write Loops screen. You are given six sets of data transfer routines to optimally match your hard drive/Macintosh configuration for speed. Silverlining chooses the best setting for you and asks permission to install the loops. If you wish to experiment, click Time the Loops and Silverlining will display the loop timings as

*Behind every cloud, there is a...* 129
Silverlining asks again just to really be sure you want to initialize it.

Silverlining Customize screen.

shown in Fig. 5-19. You do not have to choose pairs; for example, a fast blind write and a hardware handshake read might actually work better. When you're happy with the combination you have, click Install. This brings up the verification window shown in Fig. 5-20. If you do indeed want to install the new drivers, click OK.
Read/Write loops determine how the drive moves data:
- "Blind" loops are faster, but fail on some drives.
- "Handshake" loops are safer, but run more slowly.

<table>
<thead>
<tr>
<th>Write</th>
<th>Read</th>
<th>for your Mac SE.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Macintosh software &quot;Handshake&quot;</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
<td>Macintosh hardware &quot;Handshake&quot;</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
<td>Silverlining's slow &quot;Handshake&quot;</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
<td>Silverlining's fast &quot;Handshake&quot;</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
<td>Silverlining's slow &quot;Blind&quot;</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
<td>Silverlining's fast &quot;Blind&quot;</td>
</tr>
</tbody>
</table>

Numbers shown have only relative significance. (smaller is better).

5-18 Silverlining SCSI Read/Write Loops screen.

5-19 Results after invoking the Time the Loops option.

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If you've proceeded according to directions, your hard drive has now been reinitialized with Silverlining software, and you have a new icon (maybe an on-screen drive activity light), new transfer loops, and are now presented with the Volume Manager screen shown in Fig. 5-21. If this one volume is what you want, click Update and Silverlining will update the partition information and install the file system for the volume(s) you have selected.

The Volume Manager is one of the most powerful features of Silverlining. The main area of the window allows you to mount at startup, mount in this current session, lock/unlock and set passwords, and change volume names. Clicking in the size (K) column boxes (click in the 51000 box or any of the boxes in the column) immediately expands your window to include the subdialog area below the main area as shown in Fig. 5-22. Now you are really in business. You can create, delete, expand, and shrink your partitions in exact amounts with the data provided. You can then initialize them by checking the box and clicking Update or go back to the earlier version by clicking Revert. The Maximum Size option lets you select partition sizes larger than the current physical volume size so you can add another drive later and have one contiguous volume. Or the extra space can be used to create and delete new volumes on the fly without having to disturb or reinitialize or lose data in other partitions—a very handy tool.

To use the Volume Manager to create three partitions as shown earlier in the chapter, type the size of the first partition volume you want in the first Size (K) box as shown in
5-21 Silverlining Volume Manager screen.

5-22 Sub-dialog area on the Volume Manager's screen.

Behind every cloud, there is a . . .
Fig. 5-23. There is more space on this drive, so the first partition is 5Mb (5000K) this time. Notice that this step immediately increases your free storage and gives you guidance on the amount of space you have to make the next partition. Make the next two partitions about the sizes used earlier in the chapter, and the result is shown in Fig. 5-24. Since you've used all the space, the initialize box is automatically checked for you at this point. This window gives you an enormous amount of power and flexibility to custom tailor your hard drives with up to 40 partitions! And if you don't like your creations, just quit the window without making any changes, click the Revert button to go back to your previous change level, or type zeros in all the Size (K) boxes below the top one and type 51000 in it as before. The Volume Manager returns you to the state you were at in Fig. 5-21.

If you want a more detailed view that shows exactly how all the information is arranged on your hard drive, sorted by physical location, clicking the Detailed View button in the Viewing Style dialog box on the Drive menu provides it to you as shown in Fig. 5-25. While you are mostly interested in the mounted partition checked, this view shows you exactly how all the space on the drive is allocated—even nonMacintosh partitions.

Let's take a look at the menus: File, Edit, Drive and Volume. Edit has the usual Cut, Copy and Paste selection options.

The File menu is shown in Fig. 5-26. You were introduced to the Select Drive option in Fig. 5-13. Figure 5-27 shows the Select Volume option; in this illustration it looks identical to the drive selection option, but if either of the drives were further partitioned into additional volumes, this window would be the one from which you could directly access them for some Volume Manager operation you wanted to perform.
Mounting | Password | Size (K) | Volume name
--- | --- | --- | ---
✔ Mount | Set... | 5000 | Cirrus 50-Q
☐ Mount | Set... | 15000 | Untitled #1
☐ Mount | Set... | 31029 | Untitled #2

Volumes to be mounted after Update.
Volumes to be mounted at Startup.

For Size, K = 1024 bytes.

5-24 Recreating the three partitions created earlier with Alliance Power Tools software.

Mounting | Password | Size (K) | Volume name
--- | --- | --- | ---
☐ | | 31 | Apple (partition_map)
☐ | | 16 | Macintosh_SL (Driver)
✔ Mount | Set... | 51000 | Cirrus 50-Q (HFS)
☐ | | 29 | Extra (Free)

Volumes to be mounted after Update.
Volumes to be mounted at Startup.

For Size, K = 1024 bytes.

5-25 Detailed view of Volume Manager window.
The Drive Menu is shown in Fig. 5-28. You have previously been introduced to the Viewing Style, Initialize, SCSI Read/Write Loops, and Customize options. The Tests & Format window is shown in Fig. 5-29. It allows you three options. Run the short tests on 16 sectors reserved on the drive expressly for that purpose, run the full test suite on the
5-28 Silverlining Drive menu.

5-29 Silverlining Tests & Format window.

entire drive, or run the Format option. The Driver Select option allows you to see which software drivers are currently present on your hard drive and to specify the one to be used at startup—the default selection is the Silverlining driver. The Set SCSI ID option sets the SCSI ID only for the Quantum drives that support this software feature. The Park Heads
option also does exactly that—manually. Be careful with this one: parking the heads will shut down your Macintosh if it is running from that drive. The Drive Info window is shown in Fig. 5-30. It occasionally comes in quite handy because you have all the main drive parameters at your fingertips without having to go searching through manuals.

![Drive Info window](5-30 Silverlining Drive Information window.)

The Volume menu is shown in Fig. 5-31. The Optimize option, shown in Fig. 5-32, enables you to defragment your drive’s files and move them to one contiguous space. This is a newly initialized drive so there’s nothing to do! You also have the option to Clear Free, which means to overwrite unused space with zeros so that no one can recover your sensitive data. The Auto Park option does exactly that—this time automatically at shutdown—on older drives that don’t have the autoparking capability. The Test Sectors Option is similar to the Tests & Format option on the Drive menu, but if a bad sector is found, it enables you to recover its data to a good location. The Create SUM File option allows owners of Symantec Utilities for the Macintosh to create a backup parameter file on a partition-by-partition basis. The Partition Type window is shown in Fig. 5-33. It allows users who work in a multiple operating system (Macintosh, ProDoS, UNIX) environment to make optimal use of their hard drive and set aside manual and auto-booting drive partitions on the hard drive. The Partition Info, shown in Fig. 5-34, gives a visual on the physical location of your partition, its exact size and its relation to other sectors by toggling through the arrows in the upper right of the screen.

A lot of ground has been covered quickly. While you can appreciate the features of Silverlining at this point, you can’t really appreciate what it can do for you until you start
using it. Obviously, Silverlining’s instruction manual is a good place to start. But you must use the software itself. Who would ever believe that the innocent little drive icon shown on the desktop in Fig. 5-35 had such a powerful and flexible creator!

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Drive Setup configures the disk with 1 or more partitions for a particular requirement. Partition sizes are chosen to utilize the entire disk.

The information listed are low level parameters that indicate the type and location of a volume or partition.
Beyond Silverlining

There is quite a long shopping list of formatting software products. They fall into two major categories: bundled products that hard drive vendors package with their drives, and stand-alone products that must be marketable in the channel on their own merits. In terms of function, they can be classified as limited, optimized, or full-featured. While there are many exceptions (Silverlining being the most obvious), bundled offerings from hard drive vendors are limited, and stand-alone products are either optimized or full-featured. Limited products are designed to get you up and running in the shortest possible time. Optimized products place powerful and/or precise tools at your disposal that focus on some aspect of formatting. Full-featured products offer multipurpose tools and give you both functionality and flexibility. While Silverlining offers much more, depending on your needs, three other products might also be of interest to you: FWB’s Hard Disk Tool Kit, Casa Blanca Works’ Drive 7, and MacPeak’s Spot On.

Hard Disk Tool Kit

Above and beyond Silverlining at the top of the hard drive stand-alone software offerings lies Hard Disk Tool Kit (HDTK). This product does it all with panache and is simply the best in the market as of this writing. HDTK is fully System 7, A/UX, and AppleShare compliant, and supports all SCSI hard drives, removable drives, and optical drives via a powerful and sophisticated set of modules that give you total control over your SCSI world while remaining easy-to-use. You also receive FWB’s Guide to SCSI with the package—over 100 pages that cover SCSI bus architecture, SCSI-2, and how to get the most out of...
your hardware. Its five main modules are HDT Primer, Prober, World Control, Extension, and Bench Test:

- HDT Primer formats and installs SCSI devices, offers the fastest (and the only intelligent) SCSI driver available (enables hand-tuning of SCSI drivers for maximum performance), creates true low-level partitions, installs impenetrable password protection, performs high-speed SCSI copies, and provides comprehensive diagnostics that run 15 different diagnostic tests.
- HDT Prober determines the make, model, revision level, and online status of all SCSI devices on your system, mounts off-line devices, and diagnoses problem SCSI devices.
- HDT World Control customizes your drive’s microcode, controls caching and error handling, accesses your drive’s factory specifications and defect information, and enables you to access SCSI-2 advanced diagnostics and information.
- HDT Extension mounts removable media automatically, and uniquely configures your Macintosh to mount slower SCSI hard drives and other devices.
- HDT Bench Test provides precise benchmarking that measures real world drive performance and maintains a library of results for a wide variety of devices such as floppy drives, hard drives, removable drives, optical drives, network volumes, and RAM-disks.

Drive 7
This product provides nearly all the features of Silverlining at a much lower price. Originally designed, as the name implies, to ease the hassle of migrating to System 7, it lets users install a fully compliant System 7 driver with a single click on any drive (including any SyQuest drive, optical drive, or tape drive) that conforms to Apple’s SCSI guidelines, and requires reformatting only for drivers keyed to a specific vendor’s firmware. It has the cleanest and most user-friendly interface of any formatter, and also features Mac and A/UX partitioning, disk-testing with automatic bad block set-aside, and your choice of over 30 desktop icons, including the handy option to display your drive’s SCSI ID on the desktop. Drive 7 features built-in Balloon Help—a new feature of System 7—and is fully backwards-compatible with System 6. In its newest version, it supports extensions that mount SyQuest drives, display a screen-mounted access light, and benchmark applications in real time.

Spot On
Although not in the same league as either of the two products just described, if you want to optimize your drive for speed, Spot On delivers that capability. Micropolis bundles Spot On (described as “formatting and caching software that allows you to maximize the performance of your SCSI drive”) with its 1500-series high-capacity, high-performance drives for precisely this reason. While Spot On also provides the standard features of formatting, partitioning, locking, interleave control, testing, and bad block set-aside for a
wide range of hard, removable, and optical drives, its forte is utilizing your Macintosh’s RAM for caching. Its multiple cache algorithm choices (repetitive, general purpose, scattered access, and historical) allow you to custom-tailor your SCSI drive setup for speed, whether you own a Mac Plus or one of the high-end Mac II models.

That’s all folks . . . now it’s your turn

Although you can expect distinctions between formatting software products to blur with time as hard drive vendors improve their limited offerings, bundle stand-alone products with their drives, and introduce new packages, it becomes increasingly important for you to have an idea of your future needs before you purchase your formatting software—especially if you are responsible for many SCSI drives. Having the right product that works across multiple drives can make your job heaven. Having the wrong product . . . well, you get the idea.

Sources

As promised, here is the list of formatting software vendors. Because time marches on and newer hard drive utility packages appear continuously, the following list is intended neither to be all-inclusive, all-knowing, nor the final word on the subject. Please treat it only as representative of a snapshot in time, and excuse me if I inadvertently omitted your favorite product or vendor.

Formatting software

Alliance Peripheral Systems
2900 S. 291 Hwy.
Independence, MO 64057
(800) 645-5401
(Alliance Power Tools)

Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
(HD Setup)

Casa Blanca Works Inc.
148 Bon Air Center
Greenbrae, CA 94904
(415) 461-2227
(Drive 7 Hard Disk Formatter)

Dantz Development
1400 Shattuck Ave., Suite 1
Berkeley, CA 94709
(415) 849-0293
(DiskFit)

FWB Inc.
2040 Polk St., Suite 215
San Francisco, CA 94109
(415) 474-8055
(Hard Disk Toolkit)

LaCie Ltd.
19552 SW. 90th Ct.
Tulatin, OR 97062
(503) 691-0771
(Silverlining)
MacPeak Research
P.O. Box 163104
Austin, TX 78716
(512) 327-3211
(Spot On)

Software Architects Inc.
19102 North Creek Pkwy.
Bothell, WA 98052
(206) 487-0122
(Formatter 5 Hard Drive Tuneup)

Seagull Software
2435 Faber Pl., Suite 100
Palo Alto, CA 94303
(415) 361-0928
(Jasmine Driveware)
If you've used your Macintosh for any length of time, there is little I can tell you about Apple's System 6 software—I can probably learn a few tricks from you. On the other hand, you have been working mostly with your own desktop and environment, while earning my livelihood causes me to look at many desktops on an ongoing basis. My synthesis of these findings can certainly be of benefit to you.

I can also help you answer the question of whether to stay with System 6 or go to System 7. The food I put on the family table is directly related to my ability to do this across a wide spectrum of users. Because what I recommend has to work, System 7 is not always the solution. My rationale can also benefit you here.

This chapter covers System 6 from your hard drive's point of view. You will learn three key areas you can focus on to improve your own and your hard drive's performance. You will also learn that System 6 is far from the dying beast the media has depicted in the wake of all the System 7 announcements, and why there are several classes of users whose Macintosh needs will continue to be fully satisfied by System 6 well into the next century.

My objective in this chapter is to extend your current knowledge of System 6, give you a well-rounded awareness of applications for it, and assist you in making your own decision to stick with it or move on to System 7.

Something more for Macintosh users who have everything

First of all, you've just plunked down some nice money to get yourself a hard drive with more speed and capacity. Let's talk about speed first. You've spent the money to buy a few more milliseconds of speed in your new hard drive. You can easily waste seconds of speed when your Macintosh software performs basic operations (booting up, saving/retrieving files) and minutes of speed finding something on the desktop to tell it what to do. How you organize your hard drive can make gigantic improvements in its performance, or can waste your entire investment. The same is true for capacity. Except here, you can lose your entire hard drive investment plus your data in an instant, at any time, due to acts of God, Murphy, or just plain carelessness. Talk about incentive to take precautions...
In writing this section I asked myself what I could tell you that you hadn't already read in thousands of books, magazine articles, newsletters and online bulletins. After pondering it for awhile and reflecting on the hundreds of user desktops I have worked at closely, three things stood out in my mind: Tools, Organization, and Incentive.

Everyone is always imploring you to work smarter, not harder. These three items all fall into the same vein. By the way, the category headings: Tools, Organization, and Incentive abbreviate to TOI—a memory device. It is my deliberate intention to provide your Macintosh and hard drive (TOY) with the best ground rules (TOI) to get the most return on your investment (ROI). Okay, I'm done now.

**Tools**  It makes no sense to dig the foundation for your house with a garden trowel. Obviously, it is equally ludicrous to work in your garden with a D-9 Caterpillar tractor. You need to use the right tool for the right job. Macintosh users are an emotional and gung-ho lot. Many position themselves at the extreme ends of the scales—either having every possible tool known in Macintoshland on their desktop or else using none at all. Having too many tools on your desktop not only wastes your time, but also slows down your Macintosh and can prevent it from working at all. With your Macintosh, as in all life, you need to strike a balance. Actually, all you need to do is pay attention to the old 80/20 rule. Find out which software tools you are using most of the time and hang the others back on your workshop pegboard.

**Organization**  You've got the world's greatest tool sitting on your desk in front of you—your Macintosh. But without organization you might never put it to use. You have icons and folders and view-by-name windows and more. But if it takes you five minutes to find a file because you forgot what you named it in addition to where you put it, you're not taking advantage of what you have. Invest just a little time in reflecting about how you work and change the present organization of your Macintosh to best support your style. Keep on making changes until you get it right! The Macintosh is almost unique in its fantastic ability to accommodate your changing needs.

**Incentive**  When you were little, your parents told you not to put your fingers in the fire or you would get burned. Until you actually got burned, you had no idea what they were talking about. Same with backups. Most users never think about backups until after the first time they lose some or all of their data. Until you have had this experience, you just don't know why all the fuss is made about backups. Afterwards, you get religion. Hard drives compound the problem because rather than just losing the contents of one itty-bitty 1.4Mb floppy, you are talking about losing 20Mb upwards to 1000Mb or more. Think about how long it would take you to replace the different kinds of data you've got stored on your Macintosh's hard drive. If you can easily key in yesterday's receipts or have kept a paper hard copy that's one thing. But if you've just completed the great American novel and the only copy is on your hard drive—please don't turn off your Macintosh and hard drive until you make a backup copy of it. Your incentive to back up should be directly proportional to your sense of bereavement over a possible loss. Take steps to take care of your valuable data.

Attack your Macintosh as you would any other business or personal problem—have a plan. Use the TOI blueprint. Use a few well-chosen tools. Take the time to organize and back up. And don't be afraid to change anything at any time if it gives you better results.
Enough theory—now for the practical examples. Let’s begin by installing Apple’s System 6 software on your newly formatted hard drive.

Installing Apple System 6 software

Although your hard drive most likely came with System 6 software already installed on it, I am going to begin with that step for three reasons: it might be useful if you have to do it in the future; it provides a comparison benchmark to the System 7 installation in the next chapter; and you might actually have to install it on your hard drive (as your next step after formatting) because your drive vendor did not.

The most recent incarnation (at the time this book was being written) of Apple System 6 software is version 6.07. It is available on public information networks (Compuserve, et al), BBS systems and user groups without documentation, and from Apple dealers with a full documentation set for $49.95. It might or might not be found bundled with new Apple Macintosh models depending on their shelf life.

If you buy it from your Apple dealer, you get it on four 800K diskettes. When bundled with a new Macintosh, you get the same items on two 1.4Mb diskettes. I’ll use the more generic four-diskette set: System Tools, Printer Tools, Utilities 1, and Utilities 2. Let’s take a closer look at them starting with the System Tools diskette shown in Fig. 6-1.

The System Tools diskette gives you a System Folder and the all-important Installer software. All important because Installer not only makes quick work of the installation process but also shortens the cleanup time necessary after switching software versions, and prevents you from having problems later due to accidentally leaving incompatible versions of support software (i.e., printer drivers) in your System folder. The choice is (use it) always yours to (use it) make but I hope (use it) you take my subtle suggestion to use it.
The Read Me document on the System Tools diskette is also there for a purpose. It provides you with additional information above and beyond what the documentation set contains.

The contents of the Printer Tools diskette is shown in Fig. 6-2. Notice that it includes every printer driver Apple makes, as well as color and a Print Monitor. The standard Apple Laserwriter driver is version 5.2 in this set, but the new version 6.02 color Postscript Laserwriter driver is also included in the color folder (5.2 is the default version when loading on a newly formatted drive). The only concern you should have about Laser drivers is to ensure that everyone on the network uses the same version. The installer will load in the whole set, and you can later remove everything except what you need—the rest are always available to you on the Printer Tools diskette.

6-2 System 6.07 Printer Tools Diskette.

Tools comprise the contents of the Utilities 1 diskette, shown in Fig. 6-3. The System Folder is there so you can use them independent of your hard drive should you have to.

The contents of the Utilities 2 Diskette are shown in Fig. 6-4: System Folder Additions, MacroMaker Folder, Apple File Exchange Folder and Font/DA Mover Folder. You can either add or ignore these additional items according to your needs.

Let's install Apple's System 6 on a 20Mb hard drive formatted to one volume with Silverlining software per the instructions in chapter 5. This is the smallest hard drive you would use today, but many users still have and use them, and it provides a good comparison for the installation of System 7 in chapter 7. Plus it just happens to be the drive Apple provided in numerous Macintosh SE/20 models.
To begin your install after the formatting step, first lock your System Tools diskette (lock all diskettes to be safe), insert it in your floppy drive, and double-click on the installer icon on the diskette as shown in Fig. 6-5.

The next screen that appears is the installer screen of Fig. 6-6. Here you are informed of two variations: easy install and customize. When you click OK, the default Easy Install screen of Fig. 6-7 appears. Double check to make sure you are installing on the correct
Insert the locked diskette and double-click on Installer to start.

Welcome to the Apple Installer

Your Macintosh needs certain software to start up.

The Installer places this software on your disk in the System Folder.

"Easy Install" chooses the software Apple recommends and creates a disk which can be used to start up your Macintosh.

("Customize" if you are sure you want to override those recommendations.)

Installer screen.

drive () and then click Install to proceed with the show. If you are curious or have a genuine need, click Customize and you will bring up the screen shown in Fig. 6-8. You can scroll down through this screen's list until you find just the right combinations for your installation, or return to the previous screen by clicking on Easy Install. Either way, once
you click Install, you’re in for a good time. The self-running script goes through its motions, ejects and asks you to insert new diskettes at the appropriate times and is actually quite entertaining. The result is shown in Fig. 6-9—a new System folder for your freshly formatted and initialized hard drive.
Organizing your desktop

My basic assumption here is that you already own or are using a Macintosh so I won't spend any time covering familiar operating territory. Instead, this section will cover some basic—but important—System, Finder and desktop subjects, and move into the organization-related topics outlined in Fig 6-10.

The System and Finder that you never meet

Although the System and Finder icons are visible to you in the System folder and both (or a Finder substitute) are required for your Macintosh to operate, you can't open them (without additional tools) in normal operation. And you really don't want to. The System file contains mostly information that you cannot change—programming code that, along with the code stored in your Macintosh ROM, tells your Macintosh what to do. The part of the System that stores information that you can change, desk accessories, fonts, and function keys is accessed via additional software. The Finder file contains the application program that creates the desktop.

The System folder is simply the folder that contains your System and Finder icons (files). It functions exactly like any other folder until your Macintosh boots or uses that System-Finder pair. Then it becomes "blessed" as it's called in Macintosh parlance, and a
6-10 Installing, organizing and customizing System 6 diagram.
little Macintosh icon appears in it as shown in Fig. 6-9. If you insert application diskettes into your Macintosh which also have a System folder on them, the Macintosh can switch-launch to the diskette's System folder from your hard drive's System folder. You can avoid this by copying the application onto and starting it from your hard drive, or by moving the Finder on the diskette out of its System folder. You can invoke switch-launch or switch desktops anytime (except to an older Finder version) by holding down the Command and Option keys while double-clicking on the Finder you want to be used with your Mouse.

*Never have more than one System and Finder* (in or out of a System folder) on your hard drive at any time, because it can confuse your Macintosh and cause it to fail to start up at all. This is probably the number one cause of failure for new or inexperienced Macintosh users.

By the way, *don't be a pioneer with new System releases.* Apple’s System 6.04 was the first really stable version of System 6. Version 6.05 and 6.07 just added minor enhancements to it. This alone should really make you think a moment about switching to System 7.0.

### The desktop, visible and invisible

The Finder creates the desktop, the familiar arrangement of menu bar, icons, and trash can along with windows for files, folders, and disk (or diskette) volumes. The Finder is charged with maintaining the desktop’s organization. Yet nowhere do you find a desktop file—because it is an invisible file! This invisible desktop file has a very visible and direct impact on you. If it becomes damaged, the Finder cannot display it at all and your Macintosh crashes or won’t boot. If you load it up with hundreds of icons scattered all over in hundreds of folders, it has to sort through all of them before it can redraw the desktop and your Macintosh’s speed becomes visibly slower. The only solution is to rebuild your desktop by restarting your Macintosh and holding down the Command and Option keys until the “Do you want to rebuild your desktop?” dialog box appears. The benefit to you is that you regain speed. The penalty is that the information in all your Get Info box windows is erased.

While there are some excellent Finder alternative products—particularly useful for managing large numbers of files—Apple’s Finder will continue to be the first choice for most users. When you speak of organizing your Macintosh, you are really speaking of organizing your desktop and keeping it in trim, tiptop shape by periodically rebuilding it. Let’s move to the first organization topic of Fig. 6-10.

### Finder versus Multifinder

The Finder is great for running single applications. Apple developed Multifinder (Switcher was its earlier incarnation) to run multiple applications concurrently. If you are running Multifinder, the top window becomes the active one running in the foreground. Other applications might be running in the background. The total number of concurrent applications you can launch is limited by your Macintosh’s installed RAM—more memory, more applications. Multifinder is great for going back and forth between applications when you have a lot of copying, cutting, and pasting to do. Unfortunately, it quits unexpectedly even in its latest, most stable versions. You could be doing nothing at all and get a
bomb! While it's great to have the flexibility, it's annoying to have your Macintosh bomb or lock up on you—just prior to an interim save—after having typed (or drawn) half a page or more of work.

My simple recommendation is to stick with Finder. It runs error free all day long. Use Multifinder only when you need it, then switch back to Finder. You can launch Multifinder at any time by holding down the Command and Option keys while double-clicking on the Multifinder icon. You go back to Finder by selecting “Finder only” in the Set Up window on the desktop’s Special menu and rebooting.

If you really need the capabilities of Multifinder all the time, you are a genuine candidate for System 7, and I recommend you make the change unless there is some other overriding reason not to do so.

Icon views versus list views

Too much of a good thing is no good, and the same applies to icons. Up to a point they are easy to use, make a great impression, and are no problem to keep track of. Once you get beyond that point, you are better off using the list by name, date, size, and kind views of the files in your folders, rather than the “View by Icon” or “View by Small Icon” options. The other handy thing about non-icon views is that they are easily sorted into a meaningful sequence. You can accomplish the same thing with icons—it’s just more tedious and time-consuming.

Figure 6-11 shows the View menu. View by Icon, selected here, is the one most commonly used when working at the desktop or root level window. Unfortunately, View by Icon and its brother, View by Small Icon, are also the slowest because the Finder has to retrieve the desktop file, sort through it, then draw all the icons and folders in the proper places. So as your files grow in number, you are advised to adapt one of the other directory views. Besides, they have additional benefits, described in the following paragraphs.

By name Files (documents, folders) are sorted alphabetically. By Name is best used for viewing files in folders—because it closely resembles the paper alphabetized filing system—but it combines high retrieval speed (if you don’t make the window list too long) with highest utility (if you are creative in your naming scheme you can sort a window in any order you want).

By date Files are sorted by date, most recent first. By Date is best used for backing up—because the most recently used files usually have the highest need for immediate backup as the next step. It is also useful for, “let me see, I don’t remember what I called it, but I knew I wrote that in the last week of July.”

By size Files are sorted by size, largest first. By Size is also best used when backing up because you might only have so much room on your floppy and this view lets you pick the files to fit.

By kind Files are sorted by type: applications first, followed by documents, and then folders. Sorting by Kind has several interesting uses. If your method is to pile everything into your desktop or root level, this view handily sorts all your stuff into categories. It is also useful when applied to your System folder because it will likewise group the different kinds of items (cdevs, inits, rdevs, etc.) appearing there into categories.
Regardless of which approach you take, you can also make life easier for yourself by adopting a standardized naming convention for your files and folders. Your Macintosh keeps track of files and folders using the ASCII numbering scheme. In the real world, three icons labeled 1, 2, 15 would be sorted in that order. In your Macintosh world, they are sorted 1, 15, 2. To preserve the correct order, you should always add zeros so that every number in the sort has the same number of digits. In this example, you would label the icons 01, 02, 15 to ensure a correct sort. You can also accomplish the same correct ordering of the files just mentioned by using characters other than numbers. Naming them #1, $2, %15 where the #, $, % signs (uppercase 3, 4, 5 on your keyboard) is really naming them 035, 036, 037 in the Macintosh 256-character ASCII keyboard alphabet, and therefore they sort in that sequence.

Any ASCII printing character is fair game except the colon (:) which is reserved for pathnames—just as it is on DOS PCs. A pathname is how your Macintosh remembers each file’s location. If you have a file called Letter in your Word folder on your Cirrus 20 hard drive, its pathname would be Cirrus 20:Word:Letter. This is why you cannot include a colon in a folder or file name.

Also file and folder names can be up to 31 characters long, although 22 characters are all you can see in most dialog boxes. You are best served by keeping your names short, although you are certainly not restricted to 8 characters as in DOS PCs.

AAARdvarksteinblattgronkdink#1 is as acceptable as any other name in its family (#2, #3, etc) except when you go to sort or display it, you are not going to see the number
at the end in the dialog window. So yet another side to the naming game is to put the important differentiating part of the name first. Put the #1 first in the name so that it is easy to tell which is which no matter how many AAARdvarksteinblattgronkdinks you have!

Please get me that folder

With the introduction of Apple’s Hierarchical Filing System (HFS) in 1986, which quickly replaced Apple’s early Macintosh (flat) Filing System (MFS), you got the keys to the kingdom but also opened Pandora’s box in one fell swoop. The keys to the kingdom because you could, in theory, have 65,535 files and folders on your HFS volume. Actually, you can only have 2,727 concurrent resources in any volume or the desktop manager won’t work properly. Pandora’s box because even 1,000 files and folders can obliterate your desktop if you don’t have a plan.

The fact that HFS creates folders in true nested fashion (root level, sublevel 1, sublevel 2, sublevel 3, etc.) is both a blessing and a curse. If you approach this system sensibly, you can use it to organize yourself better. If you approach it carelessly or in an overorganized fashion (e.g., with too many nested sublevels and folders), you can lose a file even with the Find File utility, or just have a heck of a time looking for it.

There are really only five general ways you can organize your Macintosh desktop. All other ways—including your particular way—is only a derivative or offshoot of one of the five general ways. The five ways are:

- Applications
- Tasks (Categories)—What Mode
- Projects (Customers)—Who Mode
- Frequency—When Mode
- Hybrid—Real World Mode

Application mode oriented

Let’s begin with Fig. 6-12, which shows that I’ve loaded the standard distribution software set for Microsoft Word 4.0 and Excel 3.0 onto the desktop last shown in Fig. 6-9. Notice that by loading only two applications, I now have 5,630K of stuff stored on the 20Mb hard drive. Older versions of these two applications, occupied less space, and were less complicated, so their icons could easily be placed on the desktop by themselves. Not so today. Virtually every popular application has grown to the point where it requires attendant supporting files included either in its folder or in the System folder. So you are better off leaving every application in its own folder. If you don’t, every time you use the application or a certain part of it (for example, Word’s dictionary, glossary, or thesaurus), you get a dialog box requesting you to tell it where that part is.

Most of us are programmed to be application oriented. The “what do you want done—great, I’ll get to it” routine. So most users’ immediate inclination is just to start right off, open their application folder, and get to work. Figure 6-13 shows the results. Without too much effort, I’ve begun to accumulate a number of document files in my application folder in addition to my application and its supporting files. No problem, I can still see things pretty well.
If I continue this way, the pattern of Fig. 6-14 develops. Here I’m definitely getting cluttered and in need of help. HFS to the rescue. Look at Fig. 6-15. All it takes is a few folders—loosely identified in this case by subject—and I am out of the clutter problem. But what have I really done? Look inside the Memo folder in Fig. 6-16. All that has happened is the clutter has been moved to another level were it can continue unchecked. The four memo icons are in a neat row now, but it’s doubtful that will still be the case with 20 memos in the folder. A new plan is needed.

View by Name to the rescue. An obvious faux paux I’ve committed is to break my name-making guideline mentioned earlier: always put the variable part of the name first (memo #1 should be #1 memo). This not a problem when you have a few files (or folders) and short names but it can definitely get you into trouble later. Better to nip it in the bud and build good habits instead of bad. So a few keystrokes later, with the names the way they should be, I’ve clicked on View by Name and the result is shown in Fig. 6-17—already sorted for me. This method should serve you equally well. In the future, to keep life simple, logically divide this folder into subfolders at the point when you reach two many items in it.

Once you get too many subfolder levels though (nested four or five levels deep or beyond), your efficiency begins to decrease. Figure 6-18 shows where you are heading. Sooner or later your folders begin looking like your files did in Fig. 6-14. At this point you need either to rethink your organizing process or to move the extra or infrequently used items from your hard drive into archival storage.
6-13 Word folder with created document files.

6-14 Word folder with many created document files.
Word folder with document files arranged by subject folder.

Memos folder with created document files.
6-17 Memos folder with created document files in view by Name order.

6-18 Word folder with many created subject or data folders.

Organizing your desktop 161
Regardless of your personal efficiency, intentions, or speed, pure application-mode organization of your desktop—the direct placing of data files into the same folders with your applications—is a limited and inefficient way to organize. The problem is, you don’t realize it until you’ve used this method for a long time, and habits are sometimes hard to break. So you are better off not using it, even at the beginning. Form good habits instead.

The other side of the coin is backup. Initially, you can back up by manually copying your files to floppies. After a certain point, it’s much easier to let a backup software program do the work for you. But with your files intermingled with your data, your options are either to back up everything, or to go into every folder and select the data you want backed up. Either option wastes your time unnecessarily. You need a better plan.

Task (what) mode organization

Figure 6-19 shows what happens when you take your data folders out of your application folders—separate your data from your applications—and put them back on the desktop. It also makes sense, at this point, to move all your applications into their own folder.

![Image of System Folder with applications moved](image)

6-19 Data folders moved out of application folder on to desktop.

Figure 6-20 shows the results. Now you are organized by task, category, subject, etc. I call this “what mode” organization because these items represent different categories of what you are working on. By putting all these data folders into one folder called Tasks as shown in Fig. 6-21, you’ve immediately solved another problem—backup. Whenever you
Applications all put together into own Applications folder.

All data folders moved into one Tasks folder.
back up, all you need to back up is the data in your tasks folder. Obviously you can be selective here too—you don’t have to back up all of it. Whatever backup method you choose will be faster and easier. And all you did was slightly change your organization.

There are no limits on your creativity here, either. Open the most important of these folders to Name View windows and put them on the desktop, as shown in Fig. 6-22. I like vertical name list windows because they enable you to use the entire vertical height of your Macintosh screen, if necessary, before scrolling. Task mode organization should be your default method of choice—until you need something more. It gives you speedy access to your files, easy expansion of your files, and makes the all-important backing up step easy.

Project (who) mode organization

When something more is necessary, it’s usually because you are doing a lot of different what’s for several different whos. Or, another way of looking at it is, your project folder has expanded in importance until it’s much bigger than all the rest. I call this “project” or “who mode” organization. Figure 6-23 shows a possible approach. Here, all the projects appear in a name list window on the right while the different tasks within a project (and its subfolders) are tracked in their own separate View by Kind window on the left. Once again, all the important tasks you are working on appear at your fingertips, yet whenever you back up, all you need to back up is the data in your projects folder. Again, all you did here was to change slightly your organization.

Project mode organization should be your choice when you have a large selection of customers or clients to do tasks for. It also gives you speedy access to your files, easy expansion of your files, and makes the all-important backing up step easy.
Frequency (when) mode organization

Another case when something more is necessary usually occurs because you are doing a lot of different whats on critical timelines. Here, your meetings or events folder dominates all the rest. You've got a lot of to do todays, to do tomorrows, to do next weeks, etc. I call this "frequency" or "when mode" organization. Figure 6-24 shows a possible approach. Here, all the events appear in a name list window on the right while the different tasks within an event (and its subfolders) are tracked in their own separate name-list window on the left. Notice the all-important schedule is moved to the top of the left hand window by using the exclamation point (!) character first in its name. Once again, everything you need is at your fingertips, yet you only need to back up the data in your events folder. Another problem solved with just a small change in your organization.

Frequency mode organization should be your choice when you have a large number of events, meetings, or announcements to do tasks for. It also gives you speedy access to your files, easy expansion of your files, and makes the all-important backing up step easy.

Hybrid (real world) mode organization

The real world seldom fits your model of it. It is at once simpler and infinitely more complicated. The same applies to your Macintosh desktop. This is not a Zen lesson, by the way—only the words of a person who has looked at thousands of Macintosh desktops.
Seriously, you rarely meet an example that is pure task or project or frequency. It is almost always a mixture of all three as shown in Fig 6-25. In a way, you've almost come a full circle—Fig 6-25 resembles Fig. 6-20 to a certain extent. But each of the three data folders in Fig. 6-25—tasks, projects, and events—is in itself a much more organized and efficient collection of subfolders than the ones in Fig. 6-20 with data files just dropped into them.

Figure 6-26 takes the organization to its logical conclusion. Keep the picture emblazoned in your mind that system, application, and data should be segmented on your desktop for most efficient operation of your Macintosh. You will be much happier with the results: speed and access will be there, expansion will be logical, and backups will be easy and take minimum time because you are backing up only the data, or only the data that changed.

Figure 6-26 is also the role model for a still more powerful Macintosh organization scheme—partitioning. When you combine the HFS structure and the power of partitioning you get the best of both worlds. If you take the three elements (system, applications, data) and place each in its own separate Macintosh volume or partition on your hard drive, you obtain the best possible performance out of your Macintosh. Chapter 5 proved smaller partitions are both faster and more efficient for data storage. So you put your System folder in the smallest partition or volume because it rarely changes. Put your applications into the next partition. Put your data into the last partition—or into several data partitions as your needs dictate. What have you done? Backups are a snap. Your files don't trip over your applications or system's stuff. Everything runs faster because it's more organized. You've laid the foundation for solid future growth. What more can I say...
6-25 Organized by Tasks, Projects and Events.

6-26 All Tasks, Projects, Events folders moved into Data folder.
Customizing your desktop

Now that you've organized your Macintosh desktop, the next step is to customize it to fit your requirements. As you saw in Fig. 6-10, there are numerous tools available to help you customize your desktop and control your Macintosh's functions. They help you do the two types of customizing you can do: functional and stylistic.

I highly recommend functional customizing—done either with the tools Apple provides or those provided via hundreds of commercial products and thousands of public domain shareware and freeware products. My only caution is don't overdo it. I recommend stylistic customizing—done via ResEdit, etc.—only with the greatest of trepidation.

You can accidentally grab two tools at one time (two forks, two hammers, etc.) and neither one is of any use. Put one down and you do just fine. Cdev and init tools are the same way—you can usually clear up the problem by taking them out and starting over. Using ResEdit is more like major surgery. One slip of the knife and the patient is dead.

My objective here is to cover the use of tools in general, not every one in detail. I'll again assume your overall familiarity with tools as a current Macintosh owner/user. Products and sources are provided at the end of chapter 10. There are three classes of tools:

- Tools—Apple/third party provided: desk accessories, fonts, Fkeys
- More tools—third party provided: Finder alternatives, inits
- Still more tools—third party provided utilities for formatting, backup, recovery, virus and more.

Tools—the magnificent 7 desk accessories

Figure 6-27 is our starting point. These are the 7 desk accessories (DA) provided by Apple in the System 6.07 installation done earlier in the chapter. You have apples and oranges here. Not all of these are of the same utility to you. Two are essential: Chooser and Control Panel. One is very handy for hard drive owners: Find File. Two are useful for everyday: Alarm Clock and Calculator. Two are useful for specific needs: Key Caps and Scrapbook. The biggest benefit of any DA is access—regardless of what application you are running you can pull down the Apple menu and call up your DA. Let's look more closely.

Chooser The Chooser is the very essential DA that you use to select your printer resource. Figure 6-28 shows the Chooser window with the default icon set provided by the Installer. In the Fig. 6-28 window, the Imagewriter printer icon has been selected and connected through the Modem port, and AppleTalk is active and using the Printer port. The Chooser can also be used to select network servers, communication servers, or any other device on an AppleTalk network. The Chooser can "choose" to communicate through any device connected to your Macintosh by selecting the software program or driver that communicates with it. These programs are called Chooser Resource Devices (rdevs). They must always be located inside the System folder, and you select one by clicking on its icon as was shown in Fig. 6-28. As opposed to inits and cdevs (to be discussed shortly), rdevs are rarely dangerous to your Macintosh—they won't cause it to crash. If not working, your rdev will simply deny you access to that resource until you figure out the cause of the problem and fix it.
By the way, the six rdevs in the window of Fig. 6-28 consume 321K of space on the hard drive. While 321K is not a lot of space, it is still a good idea to begin housekeeping here by removing all unused rdevs. This keeps the Chooser window uncluttered so that you can select what you want faster without scrolling, and frees up space on your hard drive.

**Control Panel**  The Control Panel is the other essential DA that you use to control your Macintosh preferences. These are the stylistic or esthetic virtues of your Macintosh that you can customize to make it uniquely your own. Figure 6-29 shows the Control Panel window with a few of the other Installer-provided default icons in the window on the left. The main Control Panel window allows you to customize your desktop pattern’s appearance, menu and insertion point blinking, sound level, and RAM cache selection, and offers a 24-hour clock alternative to standard 12-hour time. Clicking on the keyboard, mouse and sound icons to the left allows you to select additional preferences for them.

The icons in the left window of Fig 6-29 are Control Panel Devices (cdevs). Like rdevs, they must always be placed in the System folder. Once you do this, they appear in the Control Panel’s window.

**Find File**  This is an essential DA for Macintosh hard drive owners. Figure 6-30 shows the version installed with Apple’s System 6.07. This DA makes quick work of finding your data or, as in Fig. 6-30, the Excel application nested several layers deep in your HFS folder stack. Even if you only remember a few letters of the name, this DA can save you a
6-28  Chooser window.

6-29  Control Panel window.
lot of time as opposed to hunting through folders. If you find yourself limited by using it, GOfer, On Location, and a host of other products offer additional capabilities.

**Alarm Clock and Calculator** While not in the essential class as the DAs previously discussed, the Alarm Clock and Calculator DAs, shown in Fig. 6-31, are frequently used by many Macintosh owners. Those not utilizing these two have probably further customized their Macintoshes by selecting one of the dozens (if not hundreds) of more feature-rich clock and calculator DA options available instead.

6-31 Alarm Clock and Calculator DAs.
Key Caps  Another type of DA in the very useful but not essential category is the Key Caps DA, shown in Fig. 6-32. This DA gives you instant access to all the printing characters on your keyboard for each of the different installed font families via combinations of the Shift, Option and Command keys. In Fig. 6-32 are shown the key options available in the Chicago font with the Option and Command keys pressed.

![Image of Key Caps DA](6-32 Apple Keycaps DA)

Scrapbook  Still another type of DA in the very-useful-but-not-essential category is the Scrapbook DA, shown in Fig. 6-33. Actually, I cannot recall ever seeing a Macintosh without a Scrapbook DA (or some equivalent program) installed. It is really a premier customizing tool because your personal Macintosh Scrapbook winds up containing your unique stuff. Periodically looking through your own Scrapbook—depending on how often you clean it out—is like taking a trip down memory lane. Scrapbook housekeeping is important. The default version provided by the installer, shown in Fig. 6-33, is 12K. Average in use Scrapbooks weigh in at around 200K—and can get much larger! Beyond the capabilities of the Apple's Scrapbook are products like Smart Scrap, MultiScrap, Picture Base, Glue, Super Glue II—all of which offer additional powerful features if you are a heavy Scrapbook user.

Other DAs  Beyond the magnificent 7 DAs that Apple provides to get you started, there are many, many more DAs to fit every need: Word, Graphics, Database, Dialers, Utility, and Game. Although the DA extender programs like Suitcase II and Master Juggler eliminate the standard 15 DA limit and give you access to hundreds with a standard DA suitcase icon, my counsel is to find the DAs that you really need to do your work. Load these important ones on your hard drive—use Suitcase II, etc., if you have more than 15—but keep the others offline in your archival storage. Use only the DA tools you need to keep your hard drive lean, trim, and fast.
Tools—fonts

Fonts, or more correctly, the screen fonts your Macintosh uses to display text information on the screen (versus downloadable Postscript printer fonts) are also provided by Apple in its System. These screen fonts were one of the original Macintosh’s most distinguishing features. You could get any font and type at the click of a mouse on the Macintosh. You could hardly come close to replicating this in any fashion on its contemporary DOS PC machines. Fonts are really text and graphics tools to help you do your word crafting and layout. You customize your Macintosh by adding the font families you need to it.

You saw the default set of font families (loaded by the System 6 installer) when looking at the Key Caps menu in Fig. 6-32: Chicago, Courier, Geneva, Helvetica, Monaco and Times. Figure 6-34 shows the Font/DA mover, the handy tool for moving fonts and DAs in and out of your System. The Font/DA mover screen shows to/from windows on either side that you can use to add, remove, or copy items. The same features serve both fonts and DAs. When in the font mode, the Font/DA mover shows both the font name and its point size. Your System requires Chicago 12, Geneva 9 and 12 and Monaco 9 fonts to draw its screens. Other font families are usually included in sets of 9, 10, 12, 14, 18 and 24 point sizes—like the Courier family set shown in Fig. 6-34.
Both screen and downloadable fonts from other sources can be added to Apple's font family (Apple's fonts are resident—permanently loaded into its LaserWriter's ROM chips). The screen portion uses the Font/DA mover to get loaded into the System. The downloadable fonts, in addition, have a downloadable portion which must stay in the System folder in order to print. Even more important with Fonts than with DAs, because font families typically take lots more room, is the matter of good housekeeping. Even though programs like Suitcase II, Master Juggler and Font/DA Juggler enable you to remove printer fonts from the System folder and still use them, you will want to keep online font sets pared down to what you're really using. When you can't fit your System icon by itself onto a 1.4Mb floppy, it is time to take matters in hand. Don't laugh, I've seen graphic artists whose System folder took 30 seconds to scroll through on a Mac IIci—because of all the loaded fonts.

Tools—Fkeys
Apple includes six Fkeys with your System. Like DAs, these can be invoked at any time from any program. (Fkeys have nothing to do with function keys: F1, F2, F3, etc., that run horizontally across the top of extended keyboards). The Fkeys are:

- Control-Shift 1—Ejects internal floppy (bottom or right one).
- Control-Shift 2—Ejects external floppy (or top or left one).
- Control-Shift 0—Ejects 2nd external floppy (that Control-Shift 2 didn’t).
- Control-Shift 3—Captures Mac Paint screen image.
- Control-Shift 4—Prints screen image on Imagewriter printer only.
- Caps Lock-Control-Shift 4—Prints active window image on Imagewriter printer only.

Fkey Manager allows you to make your own keyboard numbering assignments and is almost a Font/DA mover look-alike in its window appearance.

Apple also provides MacroMaker (on the Utilities 2 diskette), a System software init that allows you to record characters, mouse clicks and menu commands as a series of steps (macros). Its player window is shown after installation (notice the little cassette icon its menu puts on the menu bar next to the Special Menu) in Fig. 6-35. MacroMaker greatly extends the power of Fkeys by allowing you to do anything you want with them and save the results as a command key sequence. While it has its limitations, free (you get it with Apple's System 6 software package) is a great price to pay. For more powerful macro capabilities, at a slight increase in cost, Tempo II and QuickKeys are the way to go.

![Apple MacroMaker window.](image)

Fkeys and Macros have really never made it into the mainstream. For the same reason most people prefer to pop a pre-made popcorn bag into their microwave, rather than measuring and popping either with air or oil poppers, cdev and init programs have overshadowed Fkey programs (because of increased functionality—not constrained to Command-Option-Number keys) and Macro programs (because there is nothing to program-shorter learning time investment). But, if a tool makes sense and saves time for you—use it (regardless of what others do!). Could you save time by automating everyday steps you do with your Macintosh to a keystroke sequence? Make a list to find out. Fkeys, MacroMaker and related third party products might be very worthwhile tools for you.

Customizing your desktop 175
More tools—let your fingers do the walking

Beyond the tools that Apple provides lies a whole world of more powerful and, occasionally, more dangerous tools. Not really inherently dangerous in themselves. A fast, powerful sports car is no more dangerous than a standard automobile—it is up to you to keep it under control while utilizing its higher performance capabilities. The two most significant tools in this class are finder alternatives and inits. In each case, the products save you steps (or time) when compared with the standard Apple System 6 offering. Let's look more closely.

Finder alternatives

Although the Finder and its graphical desktop interface put the Macintosh on the map, experienced or power users, with many files on their hard drives to manage, find it too slow in operation. Returning to the Finder to copy, move, delete or rename files can be time consuming. If you're not running Multifinder, closing one application to open another also consumes time. These perceived shortcomings led to the development of Finder alternatives. The most popular is probably DiskTop (use its latest incarnation), shown in Fig. 6-36. Notice it displays all your files/folders and has additional features available to you using the buttons at the upper left. Double-clicking on any file or folder opens it as before. When you select a file or folder for action, you undim the buttons.

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When you select one of the buttons, you bring up a dialog window that lets you operate directly on your selection: copy it to where, rename it to what, etc. It's a DA, so you can launch another application while inside another, already running, application—plus have access to all of DiskTop's other capabilities. Slick. XtremeMac is another excellent choice for hard drive owners because it gives you an actual on-screen directory so you can use it to organize your file/folders like you'd use applications such as More or Inspiration to organize your ideas.

But the downside is (if you're used to working with Finder and have formed the mental image of dragging your icon to the trash to delete it) the delete button—although equipped with a warning—can really delete your files or folders instead of moving them if you're not paying attention. While there are other tools you can use to recover your files/folders, some power users have opted to use a pre-trash folder when working in Finder alternative programs—you just move your files to the pre-trash folder and never ever use the Delete button. Later, when you are totally coherent (and sure of the pre-trash folder's contents) you can delete it.

Launching programs like On Cue (via pull-down menus) and Master Juggler (via pop-up menus) are also available that just supplant the Macintosh's application and document-launching capabilities or elevate the Macintosh to a new realm of efficiency and convenience.

**Inits**

There have been reams of articles written about Initialization Programs (inits) because they are at once the source of both agony and ecstasy. These are the Macintosh equivalent of the DOS PC Terminate and Stay Resident (TSR) programs. They execute automatically during startup if they are in the System folder. Many also display an icon along the bottom of your screen as they load during startup so you know that they are there. If there are multiple inits in the System the Macintosh loads them in alphabetical order. Unlike DAs that you invoke to use, inits are available in any program at any time once launched at startup. All the excitement is generated because you can use them as a tool to do pretty much anything you want and some program implementations are just really neat! Your System 6 diskette included three Apple-provided inits: MacroMaker, CloseView and Easy Access. Capture (the program used to make the screens shown in this book), shown in Fig. 6-37, is an example of an init program. After Dark, a screen saver program shown in Fig. 6-38, is another example of an init program. Amdek Power Page SE, Lapis Technologies’ video monitor driver, shown in Fig. 6-39, is yet another example of an init program. After Dark, Amdek Power Page SE, and Capture are all also cdevs and appear on the Control Panel.

Unfortunately, the growing number of inits available to Macintosh users has initiated a number of problems quite similar to those experienced by DOS PC users with TSRs—init conflicts with one another plus System, application and utility software. Result: your Macintosh won't boot up from your hard drive at all. There is no standard in place for Macintosh software developers to resolve conflicts—only to document them (such as Init Info Professional—a Hypercard stack from Baseline Publishing). Your choices are simple: remove all the inits and reinstall them one by one until the offender(s) are found, rename...
Capture™
Copyright 1990, Mainstay
Written by Y. Lempereur

After Dark

Select Key Combination:
Key: 3
☑ Shift ☐ Option
☐ Control ☐ Command

☐ Include Cursor
Send Capture to:
○ Clipboard ○ PICT File

Reduce to: 100%

Capture Control Panel screen.

After Dark

Starry Night
Can of Worms
Fish!
Flying Toasters
Hard Rain
Rainstorm
Rose
Spotlight
String Theory

Number O' Fish: 17
Speed: Speedy!

☑ Show Sea Floor

Options...

Fish! by Ed Fries & Tom Saxton.
©1990 Tom & Ed's Bogus Software.

After Dark Control Panel screen.
the inits to change their loading order, or purchase an init manager such as Init Picker, shown in Fig. 6-40. Init Picker gives you control over your inits and minimizes time spent in conflict resolution. It even produces an init listing log shown in Table 6-1 to aid you in your debugging.

While it is doubtful you can exist in today's Macintosh environment without inits, you can peacefully coexist with them by carefully selecting the ones you use, using an init manager, and minimizing the number loaded at any one time. While many Macintosh users have experienced pain and grief with inits—a perfect example of how too much of something good can be bad for you—their experience needn't be yours if you keep your head and manage your inits wisely.

Still more tools—a world of utilities awaits you

Beyond these tools are still others—the whole world of utilities. While the most popular fall into the formatting, backup, file recovery, and virus categories, there are countless others. Chapters 8, 9 and 10 will take a closer look at them because there are certain types of tools that have a great value to you.

Stylistic customizing

There are two kinds of stylistic customizing (through software) you can do to your Macintosh: Control Panel and ResEdit (and its cousins). I am not terribly fond of either. If you
Table 6-1 INIT Picker listing

<table>
<thead>
<tr>
<th>Startup document</th>
<th>BufPtr memory</th>
<th>System heap memory</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy Access</td>
<td>0</td>
<td>1184</td>
<td>1184</td>
</tr>
<tr>
<td>AfterDark</td>
<td>56664</td>
<td>31878</td>
<td>88542</td>
</tr>
<tr>
<td>AmdekPowerPage™SE</td>
<td>17084</td>
<td>162</td>
<td>17246</td>
</tr>
<tr>
<td>Capture</td>
<td>0</td>
<td>1828</td>
<td>1828</td>
</tr>
<tr>
<td>Total</td>
<td>73748</td>
<td>35052</td>
<td>108800</td>
</tr>
</tbody>
</table>


happen to engrave your nickname on the transmission of your car and later have to replace it, the transmission specialist cannot afford the time (and you cannot afford to pay for his/her time) to replace your custom engraving. Same principle in operation here—only multiplied.

The Control Panel's cosmetic changes are rarely fatal—only inconvenient. ResEdit and programs like it, on the other hand, not only allow you to do neat customizing tricks but also to change essential System code that your Macintosh needs in order to operate. It's a big gotcha! Plus a consultant is usually called in in a networking environment. Play-
ing with ResEdit on a floppy program on your own personal Macintosh is one thing. Using it in a networked environment is something else entirely. Your “Gee, I just changed the bundle bit and the creator and now the Server won’t boot” excuse can get you fired from your job.

Like the transmission specialist, the computer consultant called in to fix your problem will first replace your lovingly created and designed custom System with a pure version of a known-to-work System. In a flash, all your neat stuff is gone but your Macintosh or Macintosh network now works again. Hey, that’s life.

The ability to customize your Macintosh to your heart’s delight is one of the reasons behind your affection for it. Most DOS PCs are just a PC—a machine. But it’s, “hey, don’t touch my Macintosh.” Changing startup screens, desktop patterns, etc. is part of the fun. Customizing window displays, menus, icons, and dialog boxes with ResEdit is even more fun because it’s almost like custom-programming your Macintosh. There have been reams written about doing both, including some excellent new ResEdit books. I personally enjoy playing with ResEdit myself! But understand my counsel here. There is a time and a place for everything. Make sure your special customizing doesn’t interfere with your working livelihood, that of your work group neighbor’s, or your company’s. End of sermon.

Migration to System 7

It’s a dirty job but someone’s got to do it best describes my feelings for this section. Whatever I say here gets me in trouble with someone. But it has to be said. Let me use a few analogies. When you just got married and lived in an apartment, it was easy to move. After you’ve been married for 20 years, live in a house, and have teen-aged kids, moving becomes quite involved. The newly-married apartment dweller is equivalent to the new Macintosh buyer who gets System 7 automatically. No problems because that buyer has no involvement with anything yet. Just purchase other new System 7 “clean” software and go. The long-married house owner is equivalent to the current Macintosh user with System 6. The analogy is particularly accurate for larger company “networked” environments. You have new hardware and software investment issues and very real training issues as well. Let’s get into some of the details.

To be or not to be—a System 7 user

If you’ve just bought an Apple Macintosh for the first time and received System 7 with it—skip this section and go to chapter 7. You will develop everything new, won’t have any of the problems mentioned in this section, and your life is a lot more fun. Now for System 6 owners.

System 7 is the astounding product that Apple has promised us for the last several years—I ran out and got my $99 copy on its May 15, 1991 announcement day so I could answer my clients’ questions—but it is not something that everyone needs at this time. To make another analogy: suppose you own a 4-cylinder car you’ve been happy with for years and you put a V-8 into it. A V-8 would give you improved performance, a lot more acceleration, and some emotional/aesthetic benefits as well. The downside would be that
you’d be paying more for the V-8 initially, you might have to beef up other parts of the car to accommodate the new engine, and you’d also pay more for it in terms of gas mileage, maintenance, and oil changes as time went along. This analogy is similar to what System 7 does to you. Once you go to System 7, there is no turning back. Frankly, there are so many neat things that it does, you don’t want to go back.

System 7 affects your hardware In the year prior to the announcement, Apple told everyone you’d need a minimum of 2Mb of memory to run System 7. This is true, but it is just the minimum you need. The real truth is, double the memory you’ve been working with: use 4Mb (the minimum I recommend) if you’ve been used to working in 2Mb or 8Mb if you’ve been used to working in 4Mb. The amount of memory you have is still needed to run your applications—the additional memory is the overhead required for System 7 to run these applications in its environment. The other real truth is, you need a new, fast 40Mb or larger hard drive.

System 7 affects your software The System 7 upgrade is inexpensive at $99, but if you look at the documentation which accompanies this Apple distribution, virtually every software product requires a System 7 compliant upgrade version. This is why it’s a nontrivial upgrade, and why you can’t go back. You might be able to get away with an owner upgrade from some vendors for $50 or $100, but in most instances you’re going to have to go out and buy a whole new application package. If you’ve been running three or five applications you’re talking about $100 and up to upgrade each application. After your System 7 upgrade, you might have to spend an additional $1,000 on new software application upgrades. If you have many Macs and/or a network installation, your new required investment multiplies accordingly. Plus, you can expect that not everything is going to run on System 7.00 as it did before on System 6.04 or higher. Plus, once you have upgraded your applications to new revision levels, chances are some of your new data documents will not run in your System 6 environment unless the new application program also runs there.

System 7 affects your people The primary reason to buy System 7 is it makes you more productive—particularly in a networked environment. It primarily helps groups of Macintosh users rather than a single Macintosh user. But in order for this to happen, these people have to know how to use it. You must invest the time and effort to train your users—and plan for this cost in your migration budget—or forget about migration until you can afford to do it correctly. You are wasting money if your users can’t utilize the benefits of System 7 as well as they did those of System 6.

System 7 affects your business It was sad to see virtually all the Macintosh-related publications gloss over the real world impact of System 7 on Macintosh business users while devoting reams of copy to its benefits and features. In reality, System 7 is neither a Machiavellian scheme to make Apple and third-party software and hardware developers more money, nor is it a panacea or cure-all to make all your Macintosh problems go away. It is merely an extremely nontrivial upgrade—not at all like going from System 6.04 to System 6.05. In simplest terms, if you are using your Macintosh to earn your living and it is working great—leave it alone! I get paid for giving clients advice which lets both them and me sleep nights, and discretion (or caution) is the better part of valor with System 7. If you don’t need it, don’t get it. Let somebody else tell you about it and wait till System
7.01 or 7.02 comes out (when more bugs are worked out of it and all the software applications that run under it). Let your neighbor down the block do the pioneering after he tells you about all the problems he’s had with migrating all his applications. Don’t you be a pioneer here unless you absolutely have to. Continue using your System 6 Macintosh to make money for you and laugh all the way to the bank.

**System 7 versus System 6 migration issues** If you need speed, solitude, or to save money, stay away from System 7 today. Let me explain. If you’ve written special software to tweak the last possible MHz out of your specialized I/O hardware, you are not a candidate for System 7. Get the payback and speed from your present setup (System 7 is slower—it’s got more overhead) and migrate in the future. If you work only with the Finder, do mostly word processing or another dedicated application, or work alone in an environment where you don’t or can’t call someone for help, you are not a candidate for System 7. System 7 does very little for solitary user, dedicated-use Macintoshes, and typically generates “new software” questions—which is why Apple provides a phone number for you to call in the System 7 box along with your diskettes and documentation. If you don’t want to spend money on new hardware, software, and training, you are not a candidate for System 7. If you have an older Macintosh and use software that works fine for what you do, and you also have a limited budget (a writer, for example), you have no immediate need (or ability) to migrate to anything else. On the other hand, if you are a solitary user regularly using Multifinder, or if you’re in a small stand-alone workgroup constantly sharing documents, and can afford to make the time, money, and training commitment to migrate to System 7, by all means do so.

**Painless migration to System 7** If you must have System 7, go out and buy an additional hard drive (40 Meg minimum or 80Mb or 105Mb)—your own dedicated System 7 hard drive. It has System 7 and all your applications you need or want or run under System 7. You can do whatever you want to do with to your heart’s delight on this hard drive. Ideally, if your budget permits, also have a separate Macintosh dedicated to System 7 so you don’t have to keep swapping hard drives. This machine is stand-alone, it’s not connected to anything else. System 7 Macintoshes create “ownership” or “turf” problems on a mixed network with System 6 Macintoshes. While LaserWriter printing problems are easy to fix—install Apple’s version 6.02 Laserwriter drivers in all Macintoshes on the network—other network problems are more subtle. Every problem can be solved—it just takes time. So become familiar with System 7 in a stand-alone mode, initially keep it away from your System 6 machine(s) and gradually network into it until you know exactly how all your programs run. Bottom line: *work out all bugs before introducing it into your operating environment.*

**System 7 is the future** Realize one thing—in not buying System 7 now, you are only postponing the inevitable. Sure there are still Mac 128 users out there running MacWrite 1.0 on their 400K floppy-based systems. But the world has passed them by—they have severely limited their capabilities and excluded themselves from a world of more powerful applications by their choice of hardware. Don’t feel too bad. So have the people who spent $100,000 for a DEC 11/70 minicomputer in the 1970s or $1,000,000 for a fully equipped IBM 360 mainframe in the 1960s. Someday, the much greater quantity of System 7 software compared to System 6 software will mean that the application that interests you will
no longer be upgraded under System 6 and you will have to make the switch to take advantage of the new features. Until then, relax and let the other people do the pioneering so that your migration will be as painless as possible.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

Apple System 6 software

Your friendly, local authorized Apple dealer or Apple Macintosh specialist. Macintosh user groups. For a group in your area, contact:

Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Apple's System 7 software is the slickest thing to happen in the Macintosh world since the Macintosh itself was developed. While you can have it on your own Macintosh and do neat things, you really don't get the full benefit of it until you hook up or network your Macintosh to another Macintosh. You can immediately begin sharing files and data, and updating changes to derivative documents as they occur to the originals—no extra software required. The promise of work group computing—first introduced with the LaserWriter and Mac Plus back in 1986—is finally delivered with gusto using System 7 software in 1991. Work groups now truly have a piece of software that enables them to work together.

Behind this is a fundamentally different Macintosh product that is still in seed form—was was the Mac 128 and its System software when originally introduced in 1984. The true benefits and capabilities of the Macintosh architecture did not become available until application software programs (that took advantage of its features) were made available several years after its introduction.

The same is true with System 7. Until application software programs that take full advantage of its many features are developed, its true power and capabilities won't be available either. But what you are seeing is the first generation of a System software family that will sow the seeds or lay the foundation for much more powerful Macintosh products to come. If you jump on the bandwagon now, you are just that much further ahead.

One thing is certain: once you try System 7 you will never go back (yes, this is the same person writing who wrote chapter 6!). In many ways, both obvious and subtle, it breaks the limitations of System 6 and allows you even greater freedom and flexibility in working with your Macintosh.

This chapter will cover using System 7 from your hard drive's point of view. You will learn about installing, organizing and customizing your System 7 software. My objective here is to introduce System 7 to new users, provide a comparison for current users of System 6, and leave you with other sources that cover its details and intricacies.
It takes money to make money

System 7 does a lot more than System 6 but it takes a lot more to do it—in terms of your initial investment in hardware, your investment in software, and your learning and organization investment. System 7 also demands more from your Macintosh, because of its radically improved design. While power System 6 users might complain it is slightly slower—at least in its current 7.00 version—than System 6, this is more a perceived than an actual reality, one that is highly dependent on both the task being done and the Macintosh model it is being done on. But System 7 definitely has more overhead—so it is more important than ever to pay attention to organization if you want to coax the maximum speed out of your hard drive. Let’s meet System 7, debunk all the myths, and set your expectations straight.

Meet System 7

Compared to System 6, System 7 has either improved or introduced new features in hundreds of areas. Some you will encounter immediately, others never unless you use that particular feature. But the Macintosh interface has not changed, and all System 7’s improvements make the Macintosh faster to learn and even easier to use. The following paragraphs give you a “snapshot” of System 7’s highlights.

True multitasking With true multitasking, everyone can run Multifinder all the time (without the Multifinder problems of System 6!), and can enjoy the ability to do several things at once.

Finder 7 System 7 includes a greatly improved Finder and interface, which makes it even easier to access and manipulate your information.

File sharing Every Macintosh System 7 incorporates the features of Sitka (formerly TOPS) networking software, which means that every owner/user can share files with other Macintosh System 7 owner/users over a network without a dedicated server—it takes just a few clicks of your Mouse after networking or connecting the Macintosh hardware together.

True type fonts The quality of System 7’s fonts has been improved both on-screen and in print.

32-bit addressing 68030 CPU Macintoshes are able to address directly $2^{32}$ bits (four gigabytes) of memory—this is the software that supports it.

Virtual memory With System 7, you set aside a portion of your hard drive as an extension of your Macintosh’s memory, giving you the ability to run more or larger applications at the same time (for Macintoshes that support this feature) because program parts are swapped in and out of memory from the hard drive as you need them.

Interapplication communication (IAC) Imagine that the clipboard sharing data between applications was a dynamic one instead of a static cut, copy, and paste. Apple calls this dynamic data-sharing “publish and subscribe”—any user can “publish” information and “subscribers” receive a new version of the data each time the original is updated.
These are some—but not all—of the goodies you get. You also get additional utility applications, 32-bit QuickDraw, communications toolbox, sound-system improvements, and the list goes on—all as part of System 7. While many of its components and features are available in other products today, Apple's System 7 ties it all together in a neat, integrated package that works. Having all these capabilities on your Macintosh puts an enormous amount of computer power on the top of your desk.

**System 7 requires more hardware**

Salespeople often tell you that System 7 runs on all Macintosh computers from the Mac Plus to the Mac IIfx; requires 2Mb of memory to run one or two applications; and requires a hard drive.

The people who tell you this aren't exactly lying—they’re just shading the truth a bit. While you can run System 7 on a Mac Plus (you can climb Mount Everest, too!), you should run System 7 on a 68030 and up Macintosh—or at least a 68020-powered Mac LC or Mac II—to get the most out of your System 7 investment. While you can run System 7 with 2Mb of RAM, you should run it with 4Mb or more to enjoy its full benefits. The “do you need a hard drive to run System 7” was never an issue—you cannot run it without a hard drive—and while you can run System 7 on your vintage Apple HD 20, you should choose to run it on one of the new, faster (Quantum LPS 52-style) 40Mb-and-up hard drives.

**System 7 requires more software**

In the software department, expect to invest in newer versions of the software products you own to get the most out of System 7. Some older software products run just fine in the System 7 environment—they just don’t take full advantage of its capabilities. If you are not going to need these new System 7 capabilities either, then you don’t have to upgrade your software. On the other hand, other software products run in a reduced capacity mode (you can’t access all their existing System 6-compatible features), some don’t run at all, and some products either don’t permit your Macintosh to start up or cause it to crash when loaded.

Despite Apple’s best intentions in providing you with a great tool (the Compatibility Checker—to be discussed in a moment), you are not going to know your situation exactly until after you install System 7. You can make all the vendor “is it compatible” calls you like and also invest in third-party compatibility checkers, but it comes down to what works in your present Macintosh environment.

If you are in a mission-critical environment or using your Macintosh in business, invest in a second, external hard drive (or a second Macintosh) on which to do your System 7 software testing and debugging, before going online. You’ll see exactly how this is done later in the chapter. If your requirements are not so stringent, then load up Apple’s Compatibility Checker before installing System 7—see if you have any major problems—then install System 7 on your Macintosh and get down to the specifics.

If you’ve finally scraped together the money to buy your own Macintosh after using one at work for a number of years, your problems are over. Just install the version of System 7 that comes with your Macintosh and purchase only System 7 compatible software applications to go with it.
System 7 requires more of you

After you see System 7 working on your Macintosh, you'll have no doubts about it being easier to learn and easier to use. You can plunge right into it and use as you were using System 6, but you should invest in the time to learn it—and to organize your work slightly differently—if you want to take advantage of its more powerful new feature set. But everyone will have some new learning to do because there is just so much of it, so much to it. Even experienced System 6 users will have some relearning to do because System 7 does some things a little differently. Regardless of the level of your System 7 learning and organization investment, know that it pays rich dividends for you—it puts a whole new world of Macintosh at your fingertips.

System 7 basics

All the basics of working with System 6 still apply to System 7. You still want to maximize your investment by focusing on improving the performance of tasks that take minutes of your time, seconds of System 7's time, and milliseconds of your hard drive's time, in that priority order—exactly as mentioned in chapter 6. Tools, organization and incentive, the TOI concept introduced in chapter 6, is equally important when using System 7.

Tools While System 7 has eliminated the need for some tools entirely—because they are now included with the System software—the need for other tools remains, and some tools become even more important. It still makes good sense to complement your investment in System 7 with an investment in tools that help you get the most out of it.

Organization System 7 takes your Macintosh's organizational abilities to new heights, but you have to alter your System 6 way of working to get the most out of them. System 7 gives you far greater potential for saving time and labor, but you've got to learn how to use it to make it work for you.

Incentive Your incentive to back up, if anything, has to increase with System 7 because your investment is greater. Even the smallest of users is now into a hard drive environment and has a far greater amount of data at risk. Your incentive to back up should be directly weighted to the consequences of a possible loss and kept high in your priority queue of things to do at all times. System 7 and its data might be your most valuable asset—take care of it.

That about covers the System 7 preliminary thoughts. Let's now install Apple's System 7 software on the hard drive that was formatted and loaded with System 6 software in chapter 6. The exercise could very closely resemble your real world experience.

Installing Apple System 7 software

System 7's software distribution set can best be described as prodigious. With the single user $99.95 set, you get five manuals and twelve 800K floppy diskettes. The network $349.95 version gives you even more. Outstanding or excellent are the best words to describe the packaging, design and contents of either set. You get System 7 bundled with any new Macintosh you purchase (except for the 1Mb Classic, which still ships with Sys-
tem 6.07). As of this writing, no vendors distribute it already installed on their hard drives, although I'm sure this is but a short-term aberration, and most will offer the option as soon as System 7 comes into the mainstream.

Here are the single-user distribution (800K) diskettes:

1. Before You Install System 7
2. Install 1
3. Install 2
4. Install 3
5. Printing
6. Fonts
7. Tidbits
8. More Tidbits
9. Disk Tools
10. Macintosh Networking Basics
11. HyperCard 2.1 Program
12. HyperCard 2.1 Stacks

To support these twelve diskettes, here are the five manuals you receive:

1. What's New in System 7
2. How to Install System 7
3. Macintosh Reference
4. Macintosh Networking Reference
5. HyperCard Basics

The five manuals are all outstanding, but the Macintosh Reference manual is world-class! It quickly became a prized and dog-eared part of my collection.

There is little point in looking at the individual diskettes. You'll meet the contents of diskettes 2 through 8 after installation. The first diskette and the last three all contain instructive Hypercard stacks. The Disk Tools diskette contains roughly the same tools as the System 6.07 utilities diskette shown in Fig. 6-3 (minus Responder, and including a System 7 compatible HD SC Setup, as well as 6.07 versions of System and Finder).

First a word from your sponsor

Apple spends no inconsiderable amount of time admonishing you to view the Before You Install System 7 diskette first, so that is where I will also begin. When you click on this diskette's HyperCard icon, you are greeted with the screen of Fig. 7-1. This screen gives you two choices: "What's New" and "Compatibility Checker." If you click on the What's New icon, you get the screen of Fig. 7-2. I heartily recommend taking the tour offered by this screen (just click in any box of interest). Not only is it educational, it's entertaining as well. Bring the kids, open the popcorn and sit the whole family down to watch as your Macintosh automatically clicks through its paces on the automated Hypercard demo screens. Plus, its entertainment value drives home an educational point. How many kids know the names of the principal characters of the "Star Wars" movies? Good. Now, how many kids know the capitals of all 50 states? Hypercard's teaching method is interesting, you can go through the sequences at your own pace and you learn from it. Isn't that what
Before You Install System 7

The contents of this disk will help prepare you for upgrading to System 7. You can look through new features, and you can use a special utility program to check your system's compatibility with the new software.

To begin, click the title of your choice below.

What's New in System 7?
Here are brief demonstrations of new features. If you've never used the MultiFinder program, be sure to see the introduction to the new Finder.

Compatibility Checker
This utility program checks your current Macintosh system for items reported to be incompatible with System 7. You can get a printed report.

What's New in System 7?

System 7 offers many new features, but you only need to learn about the ones that interest you. You can see highlights of new features by clicking the topics below.

If you haven't used MultiFinder
- An Introduction to the New Finder

What you'll notice most
- Working With Applications
- Getting Help
- Using Control Panels and Labels
- Viewing and Organizing Files
- Adding and Removing Fonts
- Desktop Improvements

Interested in more power?
- Desk Accessories and the Apple _DD Menu
- Finding Files
- Sharing Files on a Network
- Expanding System Memory
- Creating an Alias for an Icon

Questions?
- Frequent Questions About System 7
education is all about? It's a neat way to capture the high points of System 7. Treat yourself to it.

Now on to your Macintosh

When you're through with the What's New tour, click on the Contents button and you're back at the screen shown in Fig. 7-1. If you click on its Compatibility Checker icon, this time the screen of Fig. 7-3 comes up briefly on your way to the window of Fig. 7-4. As you can see, the Compatibility Checker is not a panacea or cure all but it will bring you greater peace of mind, and at least place you in the ballpark. Figure 7-5 shows the abbreviated result—the real one runs to several pages for even the smallest Macintosh hard drives. Notice the categories. Products are compatible, mostly compatible, must upgrade, or not available. I put a few examples into Fig. 7-5. Apple does everything possible in this report to start you out on the right foot. Take appropriate action if your major application falls into the must upgrade or not available category; otherwise proceed.

System 7 installation

The actual System 7 installation I will show here is an upgrade installation—System 7 is to be installed on a Cirrus 20Mb hard drive whose desktop you last saw in Fig. 6-26. This is the smallest hard drive you would use today (it happens to be the drive Apple provided in numerous Macintosh SE/20 models), but many users still have and use them, and it provides a contrast to the System 6 installation of chapter 6.
Introduction

As of 4/25/91, System 7 has proven compatible with the most recent versions of the most widely used Macintosh software. The developers of these products have provided Apple with the information that will appear in your compatibility report.

We urge you to follow any recommendations listed in your compatibility report. Although Apple cannot guarantee that your report will identify all compatibility problems, we are confident that it will aid you in a smooth transition to System 7.

To continue, click Start Checking, below.

7-4 Compatibility Checker 1.0 opening dialog window.

YOUR SYSTEM 7 COMPATIBILITY REPORT

Macintosh System 7 has proven compatible with most recent versions of the most widely used Macintosh software...

We urge you to follow the recommendations in this report. Although Apple cannot guarantee that the report will identify all compatibility problems, we are confident that it will aid you in a smooth transition to System 7.

IMPORTANT It's always a good idea to back up your hard disk, and especially your System Folder, before installing new system software.

Disk(s) checked:
Cirrus 20

PLEASE NOTE The Compatibility Checker has examined the System Folder on your current startup disk, Cirrus 20. No other System Folders were checked. If you want to install System 7 on another startup disk, please start up with that disk and use the Compatibility Checker again before installing.

Following is a list of all items checked. An explanation of categories and notes appears at the end of the report.

<table>
<thead>
<tr>
<th>Item</th>
<th>Your Version</th>
<th>Status</th>
<th>Notes</th>
<th>Found on Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Excel</td>
<td>3.00</td>
<td>Compatible</td>
<td></td>
<td>Cirrus 20</td>
</tr>
<tr>
<td>Microsoft Word</td>
<td>4.0</td>
<td>Compatible</td>
<td></td>
<td>Cirrus 20</td>
</tr>
<tr>
<td>TeachText</td>
<td>1.2</td>
<td>Mostly comp. 7.0</td>
<td>RI</td>
<td>Cirrus 20</td>
</tr>
<tr>
<td>Font/DA Mover</td>
<td>3.8</td>
<td>Must upgrade 4.1</td>
<td>UN</td>
<td>Cirrus 20</td>
</tr>
<tr>
<td>Capture Converter</td>
<td>3.0</td>
<td>Not avail.</td>
<td></td>
<td>Cirrus 20</td>
</tr>
</tbody>
</table>

This report is based on compatibility information as of 4/25/91.

7-5 Abbreviated Compatibility Checker report.
7-5 Continued.

END OF COMPATIBILITY REPORT

Categories used in this report:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible</td>
<td>This version is recommended for use with System 7.</td>
</tr>
<tr>
<td>Mostly compatible</td>
<td>This item is compatible with System 7. If you like, you can obtain a more recent version.</td>
</tr>
<tr>
<td>Must upgrade</td>
<td>Apple has been told that this version is incompatible with System 7. You need to upgrade to a compatible version to use this item with System 7.</td>
</tr>
<tr>
<td>Not available</td>
<td>Apple does not have compatibility information for this item. Please contact the developer directly.</td>
</tr>
</tbody>
</table>

Notes used in this report:

| Version numbers   | A version number appearing in the Notes column represents the first version of the item that is fully compatible with System 7. |

RI When you upgrade to System 7, replace this item with the version on the System 7 installation disks (or on one of the other disks) included with your upgrade materials.

UN This item is not necessary with System 7.

Below is contact information for developers of products listed in your report. (If you are outside the United States, please contact your Apple dealer for upgrade information.)

To begin your install, first lock all seven diskettes you will be using (Install 1 through More Tidbits), then insert Install 1 into your floppy drive and double-click on the installer icon. The first screen to greet you is identical to the System 6 screen shown in Fig. 6-6. Click OK and the next screen to come up is the Easy Install window shown in Fig. 7-6. As with the System 6 installation, the System 7 default Easy Install makes the choices for you. If you have nonstandard needs, click on the customize button to see the available options. After making your decision, click on the Install button and the fun begins. While not quite as much fun as a HyperCard stack, the installation is quite entertaining and thoroughly painless—you are prompted for the next diskette after the previous one ejects. On a Macintosh SE with a slow 20Mb hard drive, the seven-diskette installation takes about 15 minutes. On a faster Macintosh and hard drive, it takes 10 minutes or less. In either event, the show is soon over. You are told whether your System 7 installation was successful or not, and asked to restart your Macintosh to proceed. After restarting, System 7 rebuilds the desktop of the Cirrus 20 (and any other mounted hard drive or volume) and displays a dialog box while this process is taking place. With the Cirrus 20, this step takes about five more minutes. Then you are presented with the results—your brand new System 7 desktop shown in Fig. 7-7.

If at first you don't succeed . . .

If you have difficulties booting your Macintosh after the System 7 install, start up from the Disk Tools diskette (diskette number 9). Alternately, you can use any other diskette with a
Click Install to update to Version 7.0 of
- Macintosh System Software
- Any Existing Printing Software
- File Sharing Software
on the hard disk named
- Cirrus 20

Eject Disk
Switch Disk
Customize
Help
Quit

7-6 System 7 Easy Install screen.

7-7 Cirrus 20 drive after System 7 installation.

System 6 Finder and System icons on it. (The reason you have to do this is that System 7 does not fit on a single diskette.) After rebooting your Macintosh, remove everything that could possibly offend from the hard drive System folder, and add needed icons back in one by one until you catch the offender(s). In the case of the Cirrus 20 hard drive, After Dark, Capture, and Init all had to be removed before it would mount as a System 7 volume (Amdek Power Page could not be eliminated—it was used by the only attached monitor—but it did have to be relocated from the default subfolder where the installer placed it!). It is usually a straightforward process—maybe one or two iterations are necessary—to get to
your Fig. 7-7 desktop using this procedure. By the way, I have not heard of any applications outside of the System folder creating a problem with a newly installed System 7 launch. So first concentrate your efforts on the items inside the System folder as the likely culprits.

Organizing your System 7 desktop

At first glance, Fig. 7-7 doesn’t appear that much different from System 6—all the familiar window, menu, and icon features are there. Only there are a few new ones . . . Hmmmm, what are they for? That is part of the fun of working with System 7—the discovery process. System 7 is at once familiar and new. The familiar part you receive immediately, the new part comes gradually—like peeling back the layers on an onion. Before you can organize with System 7, you need to be aware of its parts, both familiar and new. Let’s look under the hood, starting with the menus.

System 7 menus

There are now five Menus on the left side of the Menu bar—Label is the new addition. Both icons identifying menus on the right side of the Menu bar are new. Let’s start with the Apple Menu and move from left to right.

Apple menu Figure 7-8 shows the new Apple menu, one of System 7’s most powerful and convenient organizing features. Notice it has both icons and names on it. You’ll discover more details in a moment.

File menu The File menu is shown in Fig. 7-9. There are major differences. The Close and Print commands are now Close Window and Print Desktop. Four new commands have been added: Sharing, Make Alias, Find, and Find Again.
Edit menu  There are no changes from System 6 in the Edit menu.

View menu  Figure 7-10 shows the new View menu and its single addition: the "by Label" selection.

Label menu  The Label menu, shown in Fig. 7-11, is all new. It allows you additional flexibility in categorizing files and folders, and will be covered in more detail later.

Special menu  Figure 7-12 shows the Special menu. While Eject Disk is the only new command added to this menu, some of the other commands are used in a new way; for example, the Empty Trash command. Empty Trash, when selected as shown in Fig. 7-13, is now a two-step process. In System 7, you can put items in the trash, but they don't get removed or deleted until you overtly select the Empty Trash command. The warning dialog box is optional (you can turn it off or on from the Trash icon's Get Info window), and
the new empty trash feature works the same either way. The trash icon is also smart—you can locate it anywhere on the desktop and it remembers where you put it the next time you restart your Macintosh.

**Balloon Help menu**  This menu, shown in Fig. 7-14, is intended to be a real help to newcomers to Macintosh, and really gets that job done well. Plus you have the ability to turn Balloon Help off—which most experienced Macintosh users do after about five minutes. Finder Shortcuts is another helpful choice from this menu, since everybody occasionally forgets the keyboard shortcut for a particular menu choice.

**Finder menu**  Figure 7-15 shows the Finder menu, the new home for the Multifinder applications that used to reside on the Apple menu when opened. This menu also incorporates window control—the Finder and other application windows can be hidden to unclutter the appearance of your desktop.
The all new system folder—no more Font/DA mover

In direct contrast with the jumble of icons, folders, cdevs, inits, preferences, and chooser resources to be found in a typical System 6 System folder—the System folder of System 7 has a whole new look as shown in Fig. 7-16: a neat collection of other folders with names on them.

You can now drag any type of item to a closed System folder and it will automatically go into the appropriate folder—for its category—inside it. There is no longer a need for the Font/DA mover (that's why I unceremoniously put it into the Trash in Fig. 7-13) because
you install fonts and DAs by dragging them over to the System folder. The fonts go into the System file and the DAs go into the Desk Accessories folder. The improved System folder is one of the features that really makes working with System 7 easier. Let's look at its contents—starting with the System file.

System file icon  The System file icon for System 7 looks like a suitcase, and you can double-click on it to open it up. When you do so, you get to see the fonts, sounds, and keyboard resources stored inside it as shown in Fig. 7-17.

Startup items folder  Use this folder to specify the items you want to open at startup. Place their icons (or aliases) in it, and that application, desk accessory, or document will be opened automatically the next time you start up your Macintosh.
Apple Menu Items folder When opened, it looks like the window shown in Fig. 7-18. You looked at the System 7 Apple menu in Fig. 7-8; this is the folder that controls it. Put anything you want to appear on the Apple Menu into this folder. Unlike your System 6 Apple Menu with only DAs, you can customize your System 7 Apple menu with applications, cdevs, DAs, documents, folders, AppleShare volumes or their aliases! The Control Panels icon in Fig. 7-18 is an alias—notice its italicized name. To add any of these, drag them into the Apple Menu Items folder and they immediately become available on the Apple menu—no rebooting your Macintosh necessary.

Preferences folder This folder, shown opened in Fig. 7-19, holds the special settings for application programs.

Extensions folder This folder, shown opened in Fig. 7-20, holds extensions—an umbrella term for inits, printer drivers, network drivers and other files that modify the System software.

Control Panels folder The Control Panel function is used in System 7 as it was in System 6—to customize your Macintosh. But its implementation has taken a giant step for-
7-18 Inside the System 7 Apple Menu Items folder.

7-19 Inside the System 7 Preferences folder.

Organizing your System 7 desktop 201
ward. Rather than fitting everything into a Control Panel DA (à la System 6), System 7 uses a folder, shown opened in Fig. 7-21, to hold all the icons which can be opened for customizing by you. By putting an alias of the Control Panel on the Apple Menu Items folder, you can still open the Control Panels folder from the Apple menu as with System 6.

Some new faces also appear in the Control Panels folder to make your life easier. The new Labels icon, shown in Fig. 7-22, allows you to attach a different category or label—one that you define or from the Labels list—to any file or folder. This gives you another powerful sorting and viewing tool in addition to the existing view by icon, name, size, kind and date. The new Views icon, shown in Fig. 7-23, allows you to precisely control the appearance of your desktop through its many options.

Some old faces in the Control Panels folder have new capabilities. Figure 7-24 shows the Sound icon and the new sound you get with System 7. The default System 7 sound is the Indigo chord which replaces the Simple Beep default sound of System 6.

**A new view on life plus label power**

System 7 gives you more power in its Finder window views, too. The desktop shown in Fig. 7-25 is the same as the one shown in Fig. 7-7, except that it uses the "by Name" view. Notice the triangles to the left of the folder icons. By clicking on them, you make them point down and list the contents of the folders underneath—as has been done with the System folder in Fig. 7-25.
7-21 Inside the System 7 Control Panels folder.

7-22 Labels icon window.

Organizing your System 7 desktop  203
7-23 Views icon window.

7-24 Sound icon window.
Clicking on a folder within the System folder also causes its triangle to point down and divulge its contents—as shown with the Control Panels folder in Fig. 7-26. Double-clicking on the Control Panels icon in the System folder gives you its window as shown in Fig. 7-27. Notice the triangle again points right. You get two choices, but not both simultaneously, of how you want to view a folder’s contents.

The new Label options add to the power of System 7’s “by Name” and other non-icon views. Figure 7-28 shows how the Amdek Power Page icon is changed to the Essential...
7-27 Double-clicking on a folder's icon opens it to view its window.

7-28 Labels are easily assigned from the Label menu.

icon label just by selecting it and clicking on that choice in the Labels menu. Assigning your own labels to files and folders and viewing the results by Label is a way to gain control very quickly over the organization of your desktop.

A rose by any other name is still an alias

Forgive the poetic injustice but the wonderful world of System 7 aliases deserved something different. Because aliases are different. You can treat them like files, folders, appli-
ations, or system items but they are not. You can use them to show a single file by several different views at the same time—or do this with all your files. You can put an alias for a commonly used file on your Apple menu and also on the desktop for convenience—while the actual file lies safely nested away several layers down in the HFS hierarchy.

Creating an alias couldn't be simpler. Once it's created, you can double click on it instead of the original to open it—from anywhere on your desktop. It is a very handy feature. Figure 7-29 shows how. Here the Word folder (inside the Applications folder) has been opened, the Microsoft Word icon has been selected, and the Make Alias selection from the File menu has been invoked.

Figure 7-30 shows the results. The Microsoft Word alias icon appears on the desktop, and its Get Info window has been opened. Notice several things here. First, aliases occupy very small amounts of room. This makes them convenient when acting as pointers and openers for the real icon or folder. Your get all the benefits of the original file or folder icon and you don’t have to duplicate its original size. Notice you also have a Find Original button in the Get Info window for every alias. Very handy when you no longer need a file or folder and want to delete it or take another action (move, make another alias) with it. Finally, notice the Comments window box. Just like System 6, System 7 Get Info window comments disappear every time you rebuild the desktop—so don’t put something permanent and important there.

In Fig. 7-31, a copy of the Microsoft Word alias icon has been made and placed in the Apple desktop items folder within the System folder—so it now appears on the Apple menu. Even though the Microsoft Word icon is buried several folders deep and neatly organized into its own folder within the Applications folder, you now have two convenient locations to invoke it from if you use it regularly—either the desktop or the Apple menu. Figure 7-32 shows the result. Microsoft Word is now up and running as a result of your
7-30 Word icon alias also appears on desktop now—info window says it only takes 1K on disk.

7-31 A copy of the Word alias may also be placed in the Apple Menu Items folder.

selecting its alias from the Apple menu in Fig. 7-31. You can do this with files, folders—anything you use regularly and want to get at quickly. Are you beginning to appreciate System 7's organizational power?

Just an aside here, when you invoke any application, System 7 keeps tabs on your memory allotment via a new sizable and movable window—the "About This Macintosh" option under the Apple menu. In Fig. 7-33, it shows memory status with Microsoft word
Word application may then be launched from the Apple menu.

About This Macintosh window on Apple menu keeps tabs on memory allotment.

By the way, while you can name aliases anything you want—it just appears in italics—I prefer to leave mine with the word alias in them because it reminds me I have to do something with them at some point. Even after you throw the original file away, its alias(es) remain—so you must develop some organizational methodology to deal with them. For some, just assigning them the label alias might work. The problem with this simplistic approach is that most people use aliases for other jobs, organized by other categories.
7-34 About This Macintosh window is dynamic—it shows new status after Word application quit.

**Find a better way**

The Find and Find Again are also powerful organizational tools. Once you label files and folders, you can quickly take your labeled set or subset and rearrange it to suit a new organizing need. The Find command is also powerful in itself. To use Find, just type your selection into the window displayed (as shown in Fig. 7-35) when you click on Find in the

7-35 System 7 Find command is asked to locate icon on desktop.
File menu. In Fig. 7-36, since what you were looking for was already on the desktop, System 7's polite dialog box (it could have appended "you dummy!" to the message)

![Image](image_url)

7-36 Find command has a sense of humor—it tells you politely icon was found on desktop.

appears, advising you of the fact. Figure 7-37 shows a more normal use—you’ve asked to find a deeply buried file. Figure 7-38 shows the result. System 7’s new Find command not only tells you where it is (a la System 6’s Find), but it goes to it and opens the window. This is why you really wanted to know its location in the first place—because you wanted to do something with the file or folder after you found it. Wait, it gets better. You don’t

![Image](image_url)

7-37 Find command now asked to locate Excel.
even have to type all the characters of your filename, just the first few. Figure 7-39 shows
the request, "bonnie." Figure 7-40 brings up the result: the ideas folder with the "Bonnie's Birthday" document in it. And it gets still better. If the basic Find command doesn't
do it for you, you can invoke the "More Choices" button, bringing up the window shown
in Fig. 7-41—giving you still more power and control over your choices.

7-38 Find command opens window with Excel in it.

7-39 Find command asked to locate Bonnie.
7-40 Find command opens Ideas folder with Bonnie's Birthday file in it.

7-41 Find command also has more choices options.

Good organizations never die, they just . . .

Now that you’ve been briefly introduced to System 7, you can see that you have a lot of help in organizing your desktop with it. Figure 7-42 tells the story. Icons, Views, Aliases, Labels, Find File, and Folders are all available to help you get the job done. But some variation on the system, applications, and data organizing approach is still the best framework to use when constructing your desktop.
Installing, organizing and customizing System 7 diagram.
Icons are back—because of the power of aliases. You might want or need to keep several alias icons on your desktop or on the Apple menu just for convenience in accessing frequently used files. Aliases make icons useful—even for users with hundreds of folders and thousands of files—for the same reason.

Views are both a powerful alternative and a useful complement to icons when organizing your desktop.

Aliases, whether used from the desktop or located on the Apple Menu, can really leverage your time-saving ability and greatly multiply your organizing choices because they enable you to do so many things well. Consider using aliases for any of the following reasons.

**Frequent access/startup** Assign an alias to any folder, file, application or cdev that needs to be accessed or opened frequently.

**Network access/startup** Make aliases for any network volume or device that you need to access frequently, or any network user that needs to access information on your hard drive.

**Archive access** Store only the alias on your hard drive for a file now on a dismounted volume to allow you to quickly retrieve both volume and file.

**Concurrent multiple views** Create multiple aliases for each file or folder, every alias differing only in its label, and assign these aliases to different window views.

Labels add an extra degree of flexibility to your views, because now you can assign your own categories without any limits. The ability to do this in color—for those Macintoshes that support this feature—is an even greater advantage.

Find File, in the More Choices mode, adds another extra dimension to your organizing capabilities. You might quickly find all the files of a given type and place them in a different view window or change their labels before placing them in a different view.

After all the dust has settled from opening shipping cartons and playing with new toys (and you have become comfortable with using System 7), you are still in the best position to decide what works best for your Macintosh. All the new features and newly empowered old features of System 7 cannot change the fact that partitioning makes your hard drive faster. Plus system, applications, and data organization of partitions is still the best way to take advantage of partitioning speed and space-saving abilities combined with erase of backup—a mandatory option for System 7 users.

On the other hand, aliases make a tremendous difference in convenience. Your mission in using System 7 is to be balanced and systematic with the use of aliases, and have some definite “Sunset Law” in operation that retires unused or unconnected aliases after their originating file or folder has been removed to the trash.

So my answer is, take the best from all worlds, until you find what works best for you. And never hesitate to change or exchange it for something better. But have a plan.

**Customizing your desktop**

Your primary mission should be to organize your Macintosh System 7 desktop. Then you can turn to customizing it to better fit your needs. Unlike System 6, with System 7 Apple
has already gone pretty far along the road towards providing you with a lot of customizing tools already. Some tools needed for System 6 are already incorporated in System 7. Many System 7 tools have been announced, but other developers are still working on converting many of their usable tools to accommodate System 7's more powerful capabilities. Remember too, that System 7 is still in its infancy and "you ain't seen nothing yet" as far as eventual System 7 tools are concerned.

The main point of System 6's customizing discussion is still valid with System 7. Functional customizing is great, and don't overdo it on stylistic customizing (because no one can easily help you debug/decipher your problem).

There are three classes of tools:

- Tools—Apple/3rd party provided in System folder
- More tools—3rd party provided: Finder alternatives, inits
- Still more tools—3rd party provided utilities for formatting, backup, recovery, virus, and more

**Tools—Apple's System 7 is a great beginning**

Figure 7-42 is our starting point. The System folder contents shown in Fig. 7-16 about covers it all for starters. Not that you won't add more as time goes on. The basic tools—already covered in chapter 6—are back, they're better, and there are more of them. If you have additional cdev, rdev, DA favorites that you want to add from System 6 (that still work for System 7) by all means go ahead. But the new System 7 user is going to be in very good shape just with the set Apple has provided already.

Font tools are one of the most powerful advantages of System 7. Since you merely drag and drop them into the System folder, you can have a good time customizing with them. On the other hand, I see fonts as the new mini-battleground of the future. With Adobe's Type 1 fonts and ATM rumored for inclusion in System 7.1 or System 7.2, don't get too set in your ways with Apple's TrueType.

Since fonts will multiply to fill the space available, Suitcase and/or Master Juggler are still excellent tool additions to your collection for managing them. Both also manage FKeys—which are still an extremely useful but unsung part of System 7. Master Juggler also manages sounds.

**More tools—let your fingers do the walking**

Beyond the basic Apple-provided tools for System 7, I have recommendations in but two areas: Finder alternatives and inits.

Multimaster (a versatile file and application launching program) and Super Boomerang (Macintosh file manager) or related Finder, launcher, and organizing programs are about the only area that Apple has left uncovered in System 7. They make navigating through dialog boxes and menus to open needed folders or applications still more efficient. These two from Now Utilities are covered in chapter 10.

MODE32 from Connectix Corporation is a system extension that you will find on the diskette enclosed with this book. It is discussed in chapter 11, but basically it patches SE 30, Mac II, Mac IIx, Mac IIcx ROM to make it 32-bit clean, and allows owners of those models to run more than 8Mb of real or virtual application memory. It is a valuable and
worthwhile init—even more so now that the price is right (you already bought the book so the init is “free”).

Init Manager is also still a valuable tool—even more so with System 7 as you get bolder and bolder and incorporate more and more inits.

Still more tools—System 7 needs its supporting utilities even more

The power tools or utilities for formatting, backup, file recovery, and virus categories are even more important to System 7 users because you are always dealing with a hard drive and a minimum of 20Mb to 40Mb of data. There is a good supply of System 7-compatible major utilities available now, and more are being announced weekly. You will take a closer look at them in chapters 8, 9 and 10. Don’t just look—use them!

Stylistic customizing

System 7 still offers you two kinds of stylistic software customizing via Control Panels and ResEdit (and its cousins). You can read my long form litany on the subject in chapter 6. In short form, knock yourself out with Control Panels and be extra careful (if that’s possible) with ResEdit.

Control Panel stuff that makes cosmetic changes to your Macintosh’s behavior, alters its desktop appearance, makes it talk, etc. is rarely fatal—have fun. ResEdit (and programs like it) on the other hand, allow you to do neat customizing tricks to keyboard equivalents, dialog boxes and icons, but also allow you to change essential System code that your Macintosh needs in order to operate. While this was inconvenient in System 6, you could always call someone to help you out of trouble. If you do it to yourself with System 7, who are you going to call (“Ghostbusters” is not an acceptable answer here!). No one is that familiar with System 7 yet except its Apple developers and a few others—and they don’t make house calls. So, p-l-e-a-s-e be careful. Do your ResEdit stuff on a 1.4Mb floppy with squished System 7 System and Finder icons. Bring it over only after you’ve tested it three times and had a knowledgeable Macintosh friend also test it. I believe you get the message.

System 7 is the future

Once you install System 7, there is no turning back. You will endure the barbs from your System 6 Macintosh friends saying their Macintoshes are faster. You will endure the cold glances from your wife (or husband or business associates or kids) because you haven’t talked to them in days (or weeks) while pondering the installation/conversion of all your System 6 files/folders/applications to System 7. You will even endure slings and arrows from your boss (or joint tenancy in common co-owner) saying that all that money invested for new hardware and software hasn’t improved your productivity at all. All this and more will pass away.

System 7 is the future. Once you master it, you’ll be the envy of your friends (tell them you’ll help them convert from System 6—for a fee!), have more time to spend with your wife and kids (“by the way dear, there is just one little tiny thing I’d like to add... an optical drive—you know, for backup”) and be able to impress the heck out of your boss
by finding a file in two seconds on your Macintosh that he finally gave up looking for after a half hour's search on his System 6 Macintosh ("gee boss, could I get a raise now?").

Every day, you are that much further ahead of a System 6 Macintosh community that is only postponing the inevitable. Sure there will be glitches, you remember them well from System 6, but overall you can relax and enjoy the fact that you have the most modern, efficient, and powerful software available for any microcomputer running on your Macintosh today. And it will only get better as the improvements to it and the applications software for it arrive on the scene in the future.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

Apple System 7 software

Your friendly, local authorized Apple dealer or Apple Macintosh specialist
Macintosh user groups
For a group in your area, contact:

Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Before you've experienced death, you don't know what you're talking about. After you've experienced death, it's hard to find anyone who will listen (the movie "Ghost" comes to mind here)! If you've never lost part or all of the data on your hard drive, nothing I say here really means anything to you. On the other hand . . . you get the message.

Sprinkled liberally throughout the preceding seven chapters of this book was a not-too-subtle encouragement from me to back up your hard drive. This chapter shows you how it's done.

My primary objective in this chapter is to give you the tools—utilities and media—to help you meet your hard drive backup needs. It will feature two world-class backup utility products, look at backing up to floppy, hard, removable, or tape drive media, and leave you with information on where you can find additional products.

You need to back up

"To go forward, you must back up," is how Dantz Development Corp (developers of Retrospect archiving/backup software) wrote the lead line in some of their ads. It is quite appropriate to the backup area. For just pennies a day, you can avoid disaster.

Whether self-inflicted, done by a well-meaning friend, or by Mother Nature, you can never be sure that an accident will not happen to you. Your insurance policy—backup copies in any form—protects you. Even the simplest backup—copying via the Finder onto a floppy disk—is better than nothing. Backup software is available from numerous sources. The backup utility of your choice and 800K floppy diskettes are great for simplicity and low cost. Beyond that, your media choices are hard drive, removable, Optical MO, WORM, cartridge tape, even reel-to-reel tape. How many and what kind of backups (i.e., full or partial) you need are determined by how important your data is. Let's take a look at the basics before we get into the actual process.
Why you should back up your hard drive

While some users treat the "why should I back up" question as an oxymoron, to others it is a perfectly sensible and logical question to ask. There are five primary reasons:

- Finite hard drive lifetime
- Power failure
- Operator error
- Acts of nature and people
- Murphy’s law

Finite hard drive lifetime    When you take your brand new hard drive out of its box, you don’t think of its finite lifetime. Regardless of the statistically-derived MTBF hours on its spec sheet (10,000 to 150,000 hours or more), your hard drive operating in the real world will probably expire sometime in the next two to five years. “Probably” means better than 50-50 to start and “living on borrowed time” as you approach five years. Beyond five years, you are likely to retire it anyway for a newer model. So think of your hard drive as an object with a definite life span. The best thing you can do to guarantee a long and healthy life for your hard drive—other than treating it right while you own it—is to buy the best product you can from the most reliable vendor to begin with. After it dies, by the way, you might still be able to get your data back—but it is a time-consuming process.

Power failure    After your hard drive’s finite lifetime, this is the number one killer of hard drives and the data on them. Without the protection of a surge protector, the power hit that makes your refrigerator hiccup and your lights flicker can sizzle your hard drive. Fried, gone, kaput in an instant. Without the protection of an uninterruptible power source (UPS), the same power hit takes your data along with your drive—although modern hard drives have circuitry that tells them to stop writing as soon as the power drops. Here too, you might get your valuable data back, but it is still a time-consuming process.

Operator error    People make errors. Whether you accidentally trashed, reinitialized, or reformatted your hard drive (or just some of the files on it), or shut the power off at the wrong time, certain human errors create problems for hard drives and their data. Again, probably recoverable, but time consuming.

Acts of nature and people    These could be accidental or deliberate. Lightning strikes, a water main breaks, or someone permanently borrows your computer and hard drive. In this case your computer and hard drive are probably replaceable (via insurance) but your valuable data is gone.

Murphy’s law    Murphy’s law also rears its head when it comes to hard drives. Statistics tell you this, but don’t tell you when your drive is likely to fail. Murphy tells you when—whether you like it or not. For Murphy’s sake and for all the other reasons, you should back up your hard drive.

The backup process

When all Macintoshes used only floppy drives the backup world was a simpler place—of course doing your work was much more difficult and slower. Now, it’s come a full circle.
Current, more powerful, software products make doing any task on a Macintosh easier, while current hard drives make it faster and allow ever-increasing amounts of data to be stored online. The backup world has become complex because there are so many choices. Let's sort them out. Your hard drive's size (under or over 40Mb), how you're connected (stand-alone or network), and the time you have available to back up mainly determine your choices. Of course, your budget is always in the picture. Whatever your style, just do it!

**Hard drive size**  If your hard drive is under 40Mb or you just want to back up a few files, floppy diskettes are the vehicle of choice. Backing up a few files via the Finder—unless they are the specific ones you are just working on—is most easily done by placing your file windows in the View By Date mode and grabbing the files you need. If you want to make life easier, using a backup utility for even this minor step can save you time. Beyond a few files, if you want to back up your entire 40Mb hard drive, you use a backup utility and a stack of floppy diskettes—between 30 and 60 800K diskettes do the job, depending on the backup utility you use and whether it has compression or not. For hard drives greater than 40Mb in size, you need to look at other media. This is for speed (time to do backups), reliability (one bad floppy can spoil your whole day) and sanity (repeating the floppy load-eject cycle beyond 60 times at one sitting is not my idea of a good time!).

My personal backup experiences have biased me somewhat against using 1.4Mb floppy diskettes. They are fine for Finder backups and everyday storage. They are just a bit more unreliable when used in backup format mode in conjunction with different vendor's backup utilities. You are better served by other media when you would think of using 1.4 Mb floppy diskettes and a utility program for backup.

**How you're connected**  If you are backing up your own Macintosh's hard drive, you have many backup options. When you have to back up many Macintosches or a Macintosh network server, the field is narrowed down considerably. With many Macintoshes to back up, you need something quick and reliable (SyQuest, optical, tape) if you have to physically do the backups yourself, or something large and reliable (optical MO or DAT tape) that you can schedule to run unattended at night or in off-peak times.

**Time to do backups**  If you have little time for backing up even your 40Mb or under hard drive, this too calls for a different approach. Floppy diskettes are out. You need a second hard drive, a removable drive, or an optical MO drive. A direct finder copy to any of these is probably the easiest solution. If you use a backup utility, you can save even more time, and DAT drives in the streaming (back up everything on the drive) backup mode become competitive in speed at the larger drive capacities.

**Second set and second location—or a second chance**

Once you've thought out your size, environment, and time/speed needs, you can devote yourself to thinking about a backup strategy. Yes, backing everything up to floppy diskettes and putting them in your desk drawer is a strategy, but not necessarily the best one. Think about why you are doing backups in the first place, how important your data is to you, how easy it is to replace, how long it would take to do it, and include one worst case scenario.

*The backup process*  221
The simplest technique is just have two backup sets (diskettes, drives, tapes) and alternate them. A better technique is to keep your second set at a second location because this gives you a second chance in the event of acts of nature and people at the first. A still better technique (and the one I recommend) is to have three sets with the third set rotating to your offsite location on a periodic basis alternating with the other two sets at your site. Table 8-1 shows the plan. The primary area (near your computer) is where your most recent backup resides—should you need it. The following week, set number 1 moves to your backup area (vault, file cabinet, basement storage room) away from your computer and set number 2 takes its place. The third week, set number 1 moves offsite (safe deposit box, another building, etc.), set number 2 goes to backup area and set number 3 takes its place. Then the pattern repeats. The same plan is useful daily, weekly, or monthly, but change or modify it to suit yourself.

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<tr>
<th>Time</th>
<th>Backup set #1</th>
<th>Backup set #2</th>
<th>Backup set #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Primary area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>Backup area</td>
<td>Primary area</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>Offsite</td>
<td>Backup area</td>
<td>Primary area</td>
</tr>
<tr>
<td>Week 4</td>
<td>Primary area</td>
<td>Offsite</td>
<td>Backup area</td>
</tr>
<tr>
<td>Week 5</td>
<td>Backup area</td>
<td>Primary area</td>
<td>Offsite</td>
</tr>
</tbody>
</table>

1Could also apply to daily or monthly

Your task is simplified if you use the organization suggested in chapter 6: system, applications, data. It is even further simplified if you partition your hard drive to support this organization as was further suggested. This way you have your original system distribution diskettes, and you only have to back up that partition once, and only infrequently after the first time. You also have the original application distribution diskettes, so this partition need only be backed up once, and then infrequently as changes occur. That leaves only your data to deal with on a recurring basis—making your backup task far simpler and also quicker.

No rule says you have to back up all your data every time. This is called a full backup—but you can also do partial backups. Fastback II actually supports two kinds of partial backups: incremental (only the files you have changed or created since the last backup) and differential (all the files you have changed or created since the last full backup). In incremental backup mode, every small change you make since the full backup is recorded. Each backup is only the increments that changed, and you only use a few floppy diskettes each time. But you wind up with a lot of floppy diskettes after awhile. In differential mode, you record only the differences between what you have today and what you had on the last full backup date. Each backup takes more diskettes than incremental, but each new differential set replaces the old differential set, and you wind up with fewer diskettes over time than with the incremental method. To restore incremental backups, you need the original full backup plus each successive incremental backup. To restore differential, you need the original full backup plus the last differential.
Either way you save backup time—you just need to pick the right method for you. If you use the same files every day, the differential method is quicker and easier. If you use many different files from one day to the next, the incremental one is better, and gives you an audit trail of your work as well.

Backup hardware

Floppy diskettes require no additional hardware to start. Use the floppy drive on your Macintosh. If you are doing daily floppy backups using 60 diskette backup sets, you might consider purchasing a second floppy drive dedicated just to backup purposes.

Hard drives are a viable alternative for backups. Copying to the backup drive is just like copying to a very fast, large floppy if you use the Finder. Utility programs speed up the process even more. A removable drive can also be of great use to you here—particularly if you need to replicate your operation at another site.

If you have SyQuest drives, the pattern changes slightly because you have to tell your Macintosh to look for your SyQuest cartridge when you want to back up to it—especially when it wasn’t mounted at startup time. Figure 8-1 shows the APS SyQuest drive, cartridge case, and cartridge package. After verifying it is not write-protected (my finger in

Fig. 8-2 points to the window), identify its loading orientation as shown in Fig. 8-3 (also, the ribbed area on the cartridge is toward you when loading) and insert it into the drive. After whirring up to speed, the SyQuest drive’s icon should appear on the screen momentarily as shown in Fig. 8-4. If no icon appears, it is because it has not been mounted. You
8-2 SyQuest 45Mb removable cartridge—pen points to direction of insertion arrow.

8-3 Insert SyQuest cartridge into drive after verifying orientation.
8-4 Alliance SyQuest drive icon appears on desktop after drive is mounted.

8-5 You can mount SyQuest drive with Silverlining.

have a number of aids to assist you at this point. Silverlining's Silver Init, shown in Fig. 5-12, can be used to mount removable cartridge drives at startup, or Silverlining itself can be used as shown in Fig. 8-5, first selecting the removable drive via the Select Drive window, then mounting it using the Volume Manager window. SCSI Director also offers this
capability as shown in Fig. 8-6, as does StorWare as shown in Fig. 8-7, as does the APS Power Tools product you were introduced to in chapter 5. A noncommercial cdev product, SCSI Probe, shown in Fig. 8-8, is also very handy in performing this function.

8-6 You can mount SyQuest drive with SCSI Director.

8-7 You can mount SyQuest drive with StorWare.

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You can mount SyQuest drive with SCSI Probe.

The pattern for optical MO drives is similar to that of SyQuest removables. Figure 8-9 shows a Sony 5 1/4-inch SMO-S501 external drive package with third-party formatting software and MO cartridge. The MO cartridge (which looks like an oversized floppy diskette!) is again inserted into the MO drive (as shown in Fig. 8-10) after write protection is disabled and its correct orientation is verified. In Fig. 8-11, Silverlining software has been used...
Insert MO cartridge into drive.

MO cartridge after formatting by Silverlining.

Backing up your hard drive
used to format one side of the cartridge and its icon appears on the desktop after mounting, as shown in Fig. 8-12.

The pattern changes for tape drives. Even though they mount, they don’t appear as a volume on the desktop, and special tape backup software must be used. Figure 8-13 shows

![Desktop showing mounted Sony MO drive.](image)

![APS TEAC tape drive package with cassette media and case.](image)
the APS Teac tape drive package with cassette case and tape cassette. The tape cassette (which superficially looks like an audio cassette—but don’t be fooled by outer appearances!) is inserted into the tape drive as shown in Fig. 8-14. The tape goes toward the left—away from the lever. In Fig. 8-15, SCSI Probe software shows that the Teac tape drive at SCSI ID number 3 has been mounted, yet it does not appear on the desktop behind the SCSI Probe window.

**Backing up with Fastback II**

Now let’s spend a little more time with one product, Fastback II, that will enable you to do almost anything that you’d want to do—in terms of backing up—regardless of the hard drive you own. The exception is backup to nonmounting tape drives, for which I recommend the backup utility of the next section—Retrospect.

**One product fits all**

Fastback II’s developers, Fifth Generation Systems, are not shy. They just say it’s the world’s fastest, safest, most powerful, easiest-to-use backup system for the Macintosh. While other vendors might disagree, I’d have to say Fastback II comes mighty close. I’ve
lumped the benefits Fastback II delivers into five areas: speed, safety, power, ease-of-use, and flexibility. Its greatest benefit is that one product works with many drive types, speeds, and sizes from many manufacturers, and it does just about everything you’d ever want to do. The following sections summarize Fastback II’s benefits.

**Increases speed** Fastback II restores files and folders to their original desktop positions, and can work in the background while you run another application.

**Increases safety** Fastback II warns you before it overwrites a drive with data already on it.

**Increases power** Fastback II provides you with statistics about the progress of the backup that is underway. It uses modeless dialogs which let you work in one place and simultaneously see the effect of your work in another. It lets you control whether to overwrite existing files during the restore operation. It offers optional data compression, and lets you password-protect the backup set. Fastback II includes a versatile built-in macro facility with an autolaunch init you can use to automate your backups, and offers a macro-scheduling facility for unattended backups.
Increases ease-of-use  Fastback II provides short menus for beginning use, and full menus for custom control over backup and restore operations. In addition it offers context-sensitive help.

Increases flexibility  Fastback II permits backup to a wide range of device types, including any hierarchical file system (HFS) device, many tape drives, removable cartridge drives, and all floppy drives. It provides four backup types, including full, incremental, and differential backup. It lets you select files by creation date, modification date, creator, type, color, file-size, or by a combination of these. It maintains AppleShare attributes. It is Multifinder-compatible (and its newest versions are System 7-compatible). It can print labels for backup disks on your Imagewriter or Laserwriter.

Overall, Fastback II contains a range of powerful but easy-to-use features that let you control every phase of planning, automating, and executing backups (and restores if you need them!).

**Fastback II at work**

The Express menu of Fastback II is simplicity itself. Figure 8-16 shows it. Click in the windows until they show what you want. What media do you want to back up to? What files? What drive do you want to take your backup from? Answer the questions, click on OK, and Fastback does the rest.

![Fastback II Express menu](image-url)
Frequently your backup needs are a little more involved, so you can’t go the “express route.” Then you use Fastback’s Select Menu, shown in Fig. 8-17. Notice the top two choices answer two of the three questions of the Express menu—only in more depth. The

```
Backup From/Restore To
Backup To/Restore From...

Menu Type

Date Range...
Creators/Types...
File Size Range...
Password...
Appleshare Attributes...

Audible Prompts
Background Speed
```

![8-17 Fastback II Select menu.](Image)

"Backup From/Restore To" selection brings up the box shown in Fig. 8-18. In this case, you want to back up files from the Cirrus 20 drive. Figure 8-19 shows the window behind

```
Backup From/Restore To
Back up To/Restore From...

Menu Type

Date Range...
Creators/Types...
File Size Range...
Password...
Appleshare Attributes...

Audible Prompts
Background Speed
```

![8-18 Backup From/Restore To brings up your drive icon.](Image)
Backup To/Restore From brings up your backup media—floppy drive here.

The Select menu controls whether you are in the Express, Short, or Full menus mode (as shown in Fig. 8-20), allowing you to tailor your menus to your needs. Directly below

Select menu permits Express, Short or Full menu choices.
the menu area are the selections that allow you to tailor your backups precisely by dates, creators, types, sizes, etc.—all the control you could possibly want.

The Backup menu, shown in Fig. 8-21, controls everything about the process: which file(s) to back up, how you want it done, and the actual execution.

8-21 Backup menu.

The Choose Backup Files Selection answers the last question of the Express menu in exquisite detail by bringing up the window shown in Fig. 8-22. This menu is the heart of Fastback. The buttons across the top control the action. The window on the left is a snapshot of the files and folders on your hard drive. The window on the right expands your selection in the window on the left. Here the Word folder, chosen in the window on the

8-22 Choose Backup Files window.
If you wanted to back up just the Word folder and its contents, you would click the Include Selection button at this point.

The Options selection on the Backup menu brings up the window shown in Fig. 8-23. Here I've changed the default setting to turn Data Compression on, and the Help window to the right tells me the consequences of my action.

The Backup option on the Backup menu starts the backup process by bringing up the Backup Progress screen shown in Fig. 8-24. The figures to the lower left give you Fastback's estimate of how long the backup process you have specified will take. Here Fastback says a full backup of the present contents of the Cirrus 20 drive—6,440K—with data compression on will take about 8:49 minutes and fit on six 800K floppy diskettes. In other words, it only takes about 1.5 minutes per megabyte! The actual figures fill in next to the estimates as you do the backup. The segment window above shows the various files as they are actually being backed up. All the action starts with your click of the Start Backup button.

I've just done a fast scan of Fastback II for you. It is very straightforward. Obviously, mastery of its more advanced features (Macros) requires a learning curve on your part, but it is something that you can step into at an entry level and grow with as you become more proficient and your needs expand. Plus it is a rock-solid, bulletproof program that's been through several generations—exactly what you want in a backup program.

**Backing up with Retrospect**

Retrospect has all the benefits of Fastback and then some. It is particularly well suited for tape backups of any flavor—a capability Fastback only has in partial form. Retrospect also
supports true archives—a superset of the backup function—that allows you to offload data from your hard drive to your backup media. Erase your archived files from the hard drive to free up space, restore them at any time, and protect your files from virus infection while in archive form. Slick. Let’s get right to its goodies.

**Retrospect at work**

The main Retrospect screen that greets you in Fig. 8-25 couldn’t be easier. Do you want to backup/archive or restore/retrieve? Retrospect’s Action and Config menus, shown in Fig. 8-26 and Fig. 8-27, respectively, contain roughly the same basic capabilities as their counterpart Fastback menus but with some added features.

After you invoke the backup function, Retrospect asks you for the Source, as shown in Fig. 8-28. Here you are instructing it that the Cirrus 105-Q hard drive is the source from which you will back up to a SyQuest drive.

The next step is to select an Archive: first you choose the media, then you create the catalog file. A window nearly identical to the Sources window appears, and you make your selection. If you are creating a new archive, you click on New in the window while holding down the Option key, and Retrospect shows you all the media types it supports.

If you were doing a tape backup using a Teac tape drive, you would turn the tape drive on, load the tape, and lock it into place first. Even though it isn’t visible on the desktop—recall the configuration shown in Fig. 8-15—the first step with Retrospect is to ask it to
ARChive

Store infrequently accessed files for a later Retrieve.

Recreate original hard disk from Backup.

Get one or more files from Archive or Backup.

8-25  Retrospect opening window.

8-26  Retrospect Action menu.

8-27  Retrospect Configuration window.

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In Backup window Retrospect first asks for Source. Name the cassette, as shown in Fig. 8-29. The cassette then comes up in the Available Devices window with a Ready handle, as shown in Fig. 8-30. Since this is a new cassette you are using for the first time, you ask Retrospect to "Retension" it. After retensioning, you ask to Erase it. Retrospect prompts you with the dialog box shown in Fig. 8-31—"Really erase the cassette?" When you click OK, the erasing takes place, and you are presented with the screen of Fig. 8-32. After selecting the file(s) to back up and clicking the Next button on the Backup screen, the window shown in Fig. 8-33 appears. Here a single 682K file has been selected to back up. Click on the Proceed button and listen to the tape drive whir as Retrospect goes to work. Believe me, I've used many tape backup programs and nothing even remotely comes close to Retrospect when it comes to working with tape drives. It's fast, trouble-free, and efficient.

Back to the Select option in the Backup window (the third button in the row at the upper left!) shown in Fig. 8-34. Here's how the Cirrus 20 hard drive looks in the Retrospect window—compare this with the Fastback window of Fig. 8-22. On the surface they look similar but then pull down the Browser window and View by Technical as shown in Fig. 8-35. A whole new world opens to you in terms of looking at what you are dealing with.

It's really difficult to appreciate the true capability and ease of working with Retrospect in just a brief tour. You have to try it. It is very straightforward. Like Fastback, mastery of its advanced features also requires a learning curve on your part, but it is also something that you can step into at an entry level and grow with as you become more proficient and your needs expand. It is, like Fastback, also a rock-solid, bulletproof program.
If new, you have to name the device—here a TEAC tape.

Ask Retrospect to Retention the new tape.
8-31 Then ask Retrospect to Erase the tape.

8-32 Retrospect then tells you the device is ready.
Choose a new cassette...
This will be cassette #1
(682 K to archive)

And asks you what file(s) you want to back up.

Cirrus 20 hard drive desktop in Retrospect Backup window.
that's been through several generations. It's hard to position Fastback versus Retrospect because you can use either one at an elementary level, and yet get very sophisticated. Along with the fact that Retrospect supports any mainstream tape drive you might want to use with your Macintosh, I give it the edge in sophistication, and would recommend it for high-end use (large volumes, servers, tapes) over Fastback for that reason. At the low end, Fastback gets the nod because it whips through backing up floppies and makes the process simple.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

Backup software

Dantz Development
1400 Shattuck Ave., Suite 1
Berkeley, CA 94709
(415) 849-0293
(Retrospect)

Fifth Generation Systems Inc.
10049 N. Rieger Rd.
Baton Rouge, LA 70809
(504) 291-7221
(Fastback II)
Surf City Software
8144 E. Woodwind Ave.
Orange, CA 92669
(714) 289-8543
(SurfGuard)

TerraNetics
1538 N. Martel Ave., Suite 413
Los Angeles, CA 90046
(818) 446-7692
(AutoBack)
Hard drive maintenance and troubleshooting

The old adage, "an ounce of prevention is worth a pound of cure" is still as worthwhile as ever today—applied to your hard drive!

Before your hard drive dies of old age, as all inhabitants of this planet are destined to do, there are certain steps you can take to prolong its life. There is no eternal Fountain of Youth for hard drives or living beings. What you are really seeking is to preserve the life of your all-important data—the contents of your hard drive. This can be done in perpetuity if you so desire. Along the way, if you’ve accidentally erased the data from your hard drive, or the drive suddenly ceases to run, or fails to turn on one morning, there are steps you can take to recover your data.

Through chapter 8 of this book, I have encouraged you to back up your hard drive whenever I had the opportunity to mention it. This chapter will reinforce this need by showing you that even the finest recovery techniques and software are far more time-consuming and unreliable than backing up; they do not guarantee you can actually get all your data back.

My primary objective in this chapter is to give you the tools and techniques to meet your hard drive maintenance and troubleshooting needs. It will feature two world-class troubleshooting/restoration utility products, look at periodic hard drive maintenance you can do, give you hard drive troubleshooting techniques for when things go wrong, and leave you with information on where you can find additional products.

Maintaining your hard drive

Your hard drive is encased in a protective metal housing, breathes only the purest of air especially filtered through the finest of screens, and requires no mechanical periodic maintenance on your part—there is no lube, oil change and filter analogy between your car and your hard drive! On the other hand, there are periodic things—easy ones—you can do to prolong your hard drive’s operating life, and prolong the likelihood of easy access to your all-important data. While nothing you can do guarantees your hard drive will live longer, you will have peace of mind knowing that you’ve done all you can do to help it.
Periodic preventive maintenance helps you drive safely

Periodic hard drive maintenance extends the life of your hard drive because a well-maintained drive doesn't have to work as hard. It is easy to do, and you should include it as part of your routine backup regimen (not necessarily every time if you back up frequently, but perform it on a regular, routine basis). It involves five steps:

1. Rebuilding your desktop.
2. Defragmenting your hard drive.
3. Optimizing your hard drive.
4. Partitioning your hard drive.
5. Formatting your hard drive.

Rebuilding your desktop  Rebuilding your desktop is perhaps the easiest and most beneficial step you can take for a hard drive running either System 6 or System 7. Hold down the Option and Command keys when restarting your Macintosh until you see the dialog box asking whether you want to rebuild the desktop, as shown in Fig. 9-1 (for System 7). After clicking OK, the process takes just a few minutes, more or less, depending on the speed and size of your hard drive and the amount of information present on the desktop. You should notice an immediate improvement (e.g., in opening Finder desktop items, etc.) afterwards.

This saves wear and tear on your hard drive because it doesn't have to do so much thrashing about to establish an icon's or folder's location on the desktop. The analogy is redoing a full backup rather than doing incremental backups to the original full backup. Rebuilding the desktop establishes the new baseline.

By the way, although the rebuilding process is identical, the System 6 and System 7 desktops are radically different creatures. System 7 creates its own desktop for all mounted System 7 and System 6 volumes. That is why if you later view your System 7 initialized Cirrus 20 drive from a System 6 drive (the HDisk 105 in this case), you see the System 7-created Trash and Data files on it, as shown in Fig. 9-2. It is also why System 7 takes some time (while displaying a rebuilding desktop dialog box) whenever you launch a System 6 volume—it is creating its own desktop file.
Defragmenting your hard drive  You recognize the term defragmenting from earlier chapters. Fragmenting occurs where the consecutive blocks are already occupied when the hard drive goes back to rewrite a file, and it winds up putting parts of that file in whatever open blocks will accommodate it on your hard drive. Figure 9-3 shows the picture in graphic form. The dark areas show all the files written—the used space—on the Cirrus 20

9-3  The picture of how your files actually are written on your hard drive.
drive, the white areas show the space available. The boxes on the right show the details. Notice 5 files are fragmented, representing percent of all the files. When you ask your utility software tool to defragment a file (I cover this later in the chapter), it finds all the file's parts and puts them back together again into one contiguous string, storing it on an unused part of the drive.

Like rebuilding your desktop, defragmenting also saves wear and tear on your hard drive, depending on its extent. If you are using only 5Mb of a 100Mb hard drive you are not going to notice fragmentation. If you've been heavily using 19.5Mb of a 20Mb hard drive's available space for 6 months, defragmenting (plus removing say 5Mb of files) will make an immediate and recognizable difference to you in speed, and your hard drive will be absolutely ecstatic over your kindness!

**Optimizing your hard drive** Once you defragment your files, the light and dark areas of Fig. 9-3 are still scattered. You can optimize your hard drive by rewriting all of the files continuously, one after the other, back onto the hard drive (I also cover the tools to do this later in this chapter). Then you have one solid black area followed by one solid white area. Optimizing complements the defragmentation process and always follows it in sequence.

Optimizing is extremely valuable—especially on larger hard drives where you’ve just erased a large number of files following the completion of a project (you have saved or backed them up to somewhere else, of course). In this case, you would have large gaps (where your old data was written on the drive) that would slow down your access times and introduce further fragmentation when you write into these gaps with new data.

**Partitioning your hard drive** Partitioning was covered in detail in chapter 5 when formatting was discussed. You can also view this as a periodic maintenance step performed infrequently—you do this once or perhaps a few times a year. By partitioning, you save yourself a lot of time and save your hard drive a lot of work. Backups take less time too. Plus you reduce fragmentation, and shorten the time it takes to optimize your volumes. Should you ever have a problem with a part of your hard drive losing its memory, you can also confine it to that partition and again save time in recovering your data.

**Formatting your hard drive** Some hard drives age gracefully, while others do not—they develop defective media areas and display other intermittent problems. Formatting (or reformatting) is the ultimate periodic maintenance step to help aging hard drives. You make a full backup (better yet—make two full backup sets for safety), reformat the entire drive, repartition it, then restore your system, applications, and data to the partitions in order. It is a major step, but sometimes the only one that prevents recurring (yet intermittent) data loss problems on older hard drives. Silverlining’s Test Sectors command is an interim alternative to this process. It maps out bad sectors, and recovers all the data it can, and places it in a known, “good” media area on the drive. Reformatting, followed by repartitioning, reinitializing, and restoring writes all your files contiguously back onto your hard drive and gives you peak performance again.

**Troubleshooting your hard drive**

Hard drive troubleshooting follows two different paths: one for those just installed, and one for those that have operated for some time. Initially, a lot of things can go wrong.
After you’ve been running for awhile, only a few things can go wrong, and you will notice instantly because you are so familiar with every sound the drive makes when booting up or running.

With any troubleshooting process, it pays to be organized, methodical, and calm. If the drive was working, your first question has to be, “What has changed since it was last working?” If the drive was just installed, your first questions have to be, “Did I hook it up right? Are the SCSI and power cables attached? Is it terminated correctly?” Sometimes a simple reboot will cure all problems on a new or operating installation, so try it first and see if the problem repeats itself.

When your hard drive doesn’t work, the problem might be software- or hardware-related, and either temporary or permanent in nature. Your solution might be simple or complex, and might involve a single step or several steps over time. First you need the tools to help you.

Safe driving tools

While Apple and other full-time third party maintenance organizations have a complete set of diagnostic and maintenance tools at their disposal, your needs are not that exotic, just as your home garage is not as thoroughly equipped as that of your local auto dealer’s shop. If you really need the tools you know where to go.

But there are some tools you should have. Let me tell you about Dr. Bob’s handy-dandy travelling hard drive medicine bag. It’s my first line of defense for client outages. It’s a soft-sided diskette carrier with about a dozen floppy diskettes in it. You only need three (hey, I’m a professional, I need to carry more!). Place minimum size Apple System 6 (versions 6.04 and higher work fine) System and Finder files on two of the diskettes. These are your primary and backup startup diskettes. Install your formatting tools on one and your diagnostic tools on the other. The third floppy diskette stores everything else you might need in a pinch. The basic tools you need on your startup diskettes are formatting, initializing, install drivers, partitioning, SCSI ID, SCSI mounting software (i.e., Silverlining), and either of the restoring tools (MacTools or Norton Utilities). Now you are set for just about any emergency.

While more serious problems require the services of a travelling Macintosh and hard drive (my laboratory or operating room), over 95 percent of what I encounter is covered by my floppy diskette medicine bag. Your experience should be the same—only you should be covered by your three-floppy-diskette setup. If you have special needs, as I do, you need to add additional floppy diskettes to your medicine bag. These could include performance, network, monitor, printer, diagnostic, ResEdit, and other tools. Now, let’s look at the troubleshooting details.

Hard drive troubleshooting after installing

Figure 9-4 tells the story. Your initial problems can span the known universe so your approach at this point is to narrow down the field to isolate the problem.

First question: “Is your hard drive running or not?” If it is not running and it is not a simple power problem, you have a defective hard drive (internal) or a defective power supply or hard drive (external). If you bought the external drive as a complete unit and it
Troubleshooting plan after installing hard drive.

9-4 Troubleshooting plan after installing hard drive.
doesn’t work, stop—don’t do any more. Don’t open the enclosure. Return the entire unit to the vendor in exchange for a new one. Ditto for a nonworking internal drive. Replace or return all nonworking hard drives immediately. You do both yourself a favor (a defective new hard drive is not going to come back to life—replace it ASAP for a working unit because it’s your money!) and the vendor a favor (your problem could just be part of a larger batch of reported failures—early reporting can nip the problem in the bud).

If your hard drive is running, your second question is, “Is my hard drive booting?” If not, your problem is either hardware or software. Boot from a backup floppy to find out which. If your hard drive is visible on the SCSI chain and it is mounted, you have a software problem. If not, check SCSI cable connections, unique SCSI ID, and termination first. To check your software, look at the likely culprits in sequence:

1. Inits—remove all inits from the system folder to another.
2. Finder—replace with a fresh copy.
3. Additional systems—remove all extras.
4. Startup—check that your hard drive is being selected as a visible volume that mounts at startup, and that Apple System software has selected the correct device in the Set Startup menu (System 6) or folder (System 7).

If your hard drive boots up to the blinking question mark, you can still have either hardware or software problems. The most likely hardware culprit is that your SCSI cable is not connected somewhere. Software-caused blinking question marks on installations are usually related to driver software not being installed or recognized, and/or System software.

**Hard drive troubleshooting after operating**

All hard drives fail; the wear and tear of normal use eventually causes malfunctions. But before you get all excited or dejected about this fact remember that the same thing can be said about any mechanical device.

In the case of a drive that has been operating for some time with your data on it, your immediate first step is to take no action before you decide how you are going to recover your data. Your options are to send it out for recovery (if it is not running) or recover it yourself (if it is running). But in either case you want to sit down, calmly and logically review your backup situation, and make a command decision—while you’re in a position to do something about it (all your data is probably still there—you just can’t get to it). Once you write on your drive, all bets are off. Once you initialize or format your drive, it’s goodbye Charlie—your data is gone permanently. If you’ve just made a backup the day before your hard drive malfunctioned, you are obviously in a better position than someone who made one last month—who is still in a far better position than one who has never backed up at all. If you have a backup, you can skip the time- and money-consuming recovery step, reinitialize your hard drive and restore from your backup. If not, it helps to be an ex-Marine—“improvise, adapt, overcome” is the order of the day while you restore your data.

In this case, Fig. 9-5 tells the story. Again the first question is, “Is your hard drive running or not?” If it has been running fine and it is not running now, chances are you have a defective hard drive. If it is an early-in-its-life hard drive failure, your more important mission is to determine that something hasn’t caused it that will make the same thing happen to the next drive you install. Check each of the following.
Cables Have the power or SCSI cables connecting to your hard drive become damaged from usage, accidentally disconnected, or have connector contacts jarred loose or become oxidized with age?

Power If dc power supply providing power to your hard drive has failed, is it because of a single surge or repeated ac line voltage fluctuations and/or transients?

Environment Has your hard drive been subjected to excessive heat, cold, vibration, shock, static electricity, dust, or cigarette smoke?

You (at least in theory) have all these factors under your control. Check to see that they are not the cause of your problem before introducing another hard drive to the same environment.

Hard drive internal failure modes fall into two categories and are basically inherited by you with the purchase of your drive. Failures can be classified as permanent or intermittent/aging (the same problem occurs with increasing frequency). Permanent failure modes are due to:
Media Most hard drive problems are media-related. Despite the conscientious efforts of all vendors to maintain purity and uniformity, it is extremely difficult to maintain quality control of the plating material and process over the entire surface of each disk platter due to the extremely small tolerances (we are talking about microns here). Some portions of every hard drive’s platters are unusable when the drive is brand new. These are detected by the quick test almost all manufacturers run on each drive before shipment to detect and set aside any bad spots on the platters.

Mechanical The mechanical problem most often encountered is the straight-ahead wear-out problem. Motors, bearings, heads, and other mechanical components wear out with use, and the drive does not work “right” or fails altogether. “Stiction,” a problem in some manufacturer’s drives in which the head sticks to the drive platter, preventing its rotation upon power up, can be another source of drive failure.

Electrical The principal electrical culprit is failure of the embedded SCSI controller, usually caused by electrically overstressing the board (static electricity in handling the drive or electrical transients in operation), and occasionally caused by a marginal component.

In addition to the outright permanent failure modes just mentioned, you can also encounter intermittent/aging related failures:

Intermittent Portions of every hard drive’s platter surfaces degrade in use. This process introduces errors that are classified as hard or soft errors. If you look at a disk platter’s surface, you can observe pits or grooves in it. Since a dust speck is like a giant boulder to your hard drive’s read/write heads, an encounter with a dust particle or a head crash will each permanently damage a part of the magnetic coating on a platter and make it unusable. Hard errors are produced by permanently unusable media areas. Soft errors can indicate marginal media that cannot reliably store data, or can be random errors unrelated to media quality. Soft errors caused by marginal areas are usually detected and corrected by the disk controller’s error-correction circuitry. Sometimes they manifest as a gradual degradation of performance with use because a large number of errors increases the amount of time needed to read a disk. They can only be corrected by reformattting the drive and adding the new bad tracks to the bad track map. Random soft errors, typically created by disk/controller interaction, are usually responsible for the most “interesting” situations when they occur. All manufacturers can do is to limit their frequency to some tolerable level.

Aging Gradual misalignment of the head and platter surface with age is another type of problem that can occur. When a drive is first formatted, the head is usually positioned over the precise center of each track. Over time, the head position can shift slightly off center. As a result, the drive thinks it is reading from a certain track and cylinder position when, in fact, the head is positioned far enough from the center of the track that it can no longer reliably read or write data stored on it.

If your favorite hard drive is still running (turning), but all of a sudden you can’t communicate with it, chances are you have a software-related problem. If it leaves you only with a blinking question mark on rebooting, while it can be just a loose cable, chances are something has caused it to “lose track” (I couldn’t resist!) of where it was. You need to
take your backup floppy diskette out and methodically go through the steps to see what the
problem is:

1. Mount volume—Check to see that this feature hasn’t been accidentally turned off.
2. System software—You might have to reinstall your System and Finder.
3. Driver software—Chances are good the directory track has been scrambled, so
   you must reinstall your software driver.
4. Initialize—if everything else fails, you might have to reinitialize your volume
   (aren’t you glad you partitioned your hard drive?) and reinstall your backed up
   software set onto it (aren’t you glad you backed up your hard drive?). In absolute
   worst-case situations, you might even have to reformat your drive.

If you don’t even get the blinking question mark on rebooting, but the “Do you want
to initialize?” message instead, you don’t have a hardware problem, but can jump directly
into the software stage at the “fix the driver software” level.

**Hard drive repairs**

If your hard drive is not running and if you want your data back, you send your hard drive
to a hard drive repair and recovery shop. Notice I emphasized data recovery—not getting
back a repaired hard drive! No, I have nothing against hard drive repair shops. I have used
them, and found several to be outstanding.

The problem is cleanliness. If you ever visited Quantum’s or Conner’s Class 100 and/
or Class 10 clean rooms (you can literally eat off the floors) you know what I mean. But
these facilities cost big bucks. Positive air outflow systems, scrubbers, air baths, shoe
cleaners, special surgical smocks and headgear are hard to duplicate on small repair shop
 budgets. So ask what kind of facility they have before you send your hard drive to get it
repaired. Then figure your repaired hard drive has one or at most two years of useful life
left before you have to invest in another drive. It is not like buying a new hard drive from
the factory!

Let me give you an example. Look at the economics:

Quantum 40Mb (Model 240, 28ms) repair $150 + data recovery $100 = $250
Estimated useful life = 1 year
Quantum 52Mb (Model LPS 52, < 12 ms) new street price = $250
Estimated useful life = 5 years

Which would you rather have? Uh huh, me too. For the same outlay you get a faster, new
drive with a much longer useful life.

The magic of drive repair and recovery shops, of course, is the data recovery aspect.
If you’re running a business, have all your data on your hard drive, and your hard drive
just headed south (the equivalent of putting all your written files into a file cabinet and
then locking it)—it is worth every penny just to get your data back. After which I can guar­
antee you will become religious about backups (you probably wonder why I know this).
Hard drive repair and recovery shops perform the absolutely invaluable job of recovering
your data from your nonoperating hard drive when no other source can. But remember—
it’s your data, not the hard drive, that is valuable. I would use a repaired hard drive only
for unimportant applications, and then only as a last resort.
Hard drive recovery

If your hard drive is running, you can recover your data yourself using either of the world-class tools available: MacTools Deluxe or Norton Utilities For The Macintosh. The next two sections introduce you to these tools, and to the straightforward hard drive recovery process. Obviously you benefit more by buying and using them!!! Besides, each one is today System 7-compatible, comes bundled with other useful tools and utilities, and has a great manual.

Recovering your hard drive using MacTools Deluxe

The System 7-compatible (version 1.2) of MacTools Deluxe is the latest incarnation (as of this writing) of the MacTools family that has been a favorite of Macintosh owners since the very earliest Macintosh models were introduced (and with good reason). MacTools Deluxe provides you with an extremely powerful set of tools in one package, at a very attractive price. Plus its reference manual—a book all by itself at 350 pages—is easily the best manual by any of the tools product vendors. Let’s take a closer look.

Great tools for your Macintosh toolbox

MacTools comes packaged with its own installer on four 800K diskettes. As before, lock these before you use them and put them away in a safe place after you make a backup copy of the originals or copy them to your hard drive (be sure to get the titles exact—including the ® in the name!). Figure 9-6 shows the first diskette with the Installer on it. The other items you’ll see in a moment, but notice the Mirror icon. Mirror is an init/cdev that safeguards your data by maintaining a master directory of your volume’s contents, and provides a fast and convenient way to undelete files (because it keeps track of what you throw into the trash!). It lets you perform this function at any time from your Control Panel—very handy.
Clicking on the Installer icon brings up the screen of Fig. 9-7. Choose your options or elect to go with the default set—you can tailor it any way you like. By the way, the MacTools Installer also has the handy option of deinstalling everything automatically too. Of course, you can still install everything manually by copying what you need from the diskettes onto your hard drive. Click on the installer icon and the show begins.

![MacTools Installer screen.](image)

The result is the tidy folder installed on the Cirrus 20 hard drive with the icons shown in Fig. 9-8 in it. Let’s visit with these briefly (starting from the top left):

![MacTools installed in folder on Cirrus 20 desktop.](image)
Backup  A full-fledged backup utility, MacTools Backup has AppleShare and Tops support, can be run from a floppy, and can do full or incremental backups and restores with a specific folder as the backup destination. While not quite in the same league as the dedicated backup Fastback II and Retrospect software (that is all they do), MacTools Backup does a very respectable job, is easy to learn and use, and is only one of the tools you get with MacTools Deluxe.

FastCopy  Quickly copy or initialize multiple floppies rather than using the Finder—especially important with System 7. Plus FastCopy lets you use MacTools Track Editor to repair damaged sectors on floppy disks.

FileEdit  The traditional tool you got with the earliest MacTools versions is even better today—it features a useful tree view in addition to its many other capabilities. You’ll see more of it in a moment.

Launcher  An optional desktop from which you can launch all your MacTools utilities and other applications. Launch it once, keep it handy in the background, and your utilities are available quickly whenever you need them. Figure 9-9 shows it ready for action—notice the Launcher icon active next to the Balloon Help menu at the far right of the Menu bar.

Optimizer (and Optimizer Help)  A disk maintenance utility for doing the important defragmentation and optimizing steps talked about earlier in this chapter. You’ll also see more of it in a moment.

Rescue  The powerful data recovery utility that you’ll see in operation in a moment.

Secure  Both a utility and a DA, Secure can be accessed from any application. It password-protects and encrypts your sensitive data. It’s so powerful it’s not sold outside the USA (because we use it).

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Not shown (see the options in Fig. 9-7) are:

**Locate**  A unique and clever file finding utility—available at any time by virtue of its being a DA—Locate supplements the features found in Apple’s System 7 Find File, and adds this absent capability to System 6.

**Partition**  This DA and init complements Optimizer and allows you to partition your hard drive.

**CPS TagFix**  An init that makes it easier for MacTools to recover files from 800K floppy diskettes.

Figure 9-10 shows you MacTools diskette four (Rescue bundled on a diskette with a System folder—it’s version of the backup startup diskette mentioned earlier in the Safe Driving Tools section of this chapter). Everything you need to get your files back—wherever they are now! Make a backup copy of it and add it to your own travelling diskette collection. Speaking of Rescue, let’s get into it.

![Figure 9-10 MacTools diskette number 4—the backup startup diskette.](image)

Figure 9-11 shows you the first screen you get after you launch MacTools Rescue. What do you want to do next: undelete files, fix volumes, or repair files? If you select Fix Volumes, you bring up the screen of Fig. 9-12, which shows that you’ve either accidentally erased a volume or it’s something else. Clicking on Unknown Problem brings up the Volume Select screen of Fig. 9-13. By the way, if your volume doesn’t appear in this window at this point, you know you have SCSI cabling, SCSI ID, or termination problems to cure before you can fix your volume—or maybe that will be the only fix required. MacTools Rescue proves its intelligence in Fig. 9-14—after I’ve clicked Continue in Fig. 9-13.

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It is smart enough to know that if it recovers my data to the volume it is trying to repair, it risks overwriting some of my good data. So I must run the process that rescues one volume from another volume or floppy diskette. I'm just doing a demo here so I'll click OK in Fig. 9-14 to continue.

9-11 MacTools Rescue screen.

9-12 MacTools Fix Volumes screen.

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Figure 9-15 gets into the heart of the subject—the Volume Analysis screen. Here you see that MacTools Rescue is set up to check Volume Info, Extent File, Catalog File, Volume Bitmap, Boot Blocks, and Bad Blocks—everything that you need. The Help window at the bottom of the screen shows you the consequences of your next selection alternatives. Click Continue to begin the analysis. Figure 9-16 shows the results. Everything checked OK up to bad blocks, and Rescue asks if you want to spend 23 minutes checking for them (I didn’t).
You got a whirlwind tour, but I'm sure you can appreciate the power that a tool like Rescue puts at your fingertips. Undelete or Repair Files are equally powerful. The Rescue tool gives you everything you need to recover your damaged hard drive and you don't need to be a rocket scientist to use it!

Speaking of powerful tools, the MacTools Optimizer is one of the best. Figure 9-17 shows the screen that comes up when you select it. The operations to check for bad blocks, unfragment, consolidate free space, and erase (overwrite) free space can all be done from this screen. Start it all by first clicking Analyze. Figure 9-18 shows the result.
MacTools® Optimizer

Volume:  Cirrus 20

- [ ] Check For Bad Blocks
- [ ] Unfragment Files
- [ ] Consolidate Free Space
- [ ] Prioritize Applications
- [ ] Erase Free Space
- [ ] Erase Entire Disk

Analyzer

Fri, Oct 11, 1991 12:09:52 PM

Drive Statistics:
Drive Size: 20392K
Free Space: 9851K

Map of Cirrus 20

- [ ] Free Space
- [ ] Fragmented Documents
- [ ] Fragmented Applications
- [ ] Contiguous Documents
- [ ] Contiguous Applications

Help

Hold down the Option key and point to an item on the screen. A brief message appears explaining the purpose of that item.

9-17 MacTools Optimizer.

9-18 MacTools Optimizer window showing graphic status of all files on hard drive.

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The Map of Cirrus 20 (this window initially appears below the Optimizer screen—I clicked its Grow box in the upper right hand corner to make it its present size) is presented in copious detail with all its different files. Contrast this picture with that of the product shown in Fig 9-3.

Figure 9-19 shows you the MacTools FileEdit window for the Cirrus 20 drive (the HDisk 105 window is just behind it). Long-time MacTools users are very familiar with the power of this tool—it lets you look at the contents of any file or any block on a disk and make changes to it. Notice, in using FileEdit, even the invisible desktop files are not free from your scrutiny and alteration (arrgh!—my ResEdit comments of chapters 6 and 7 apply equally strongly here). Plus this version of MacTools has a Tree Display option that you can select from the Disk menu as shown in Fig. 9-20. This option brings up the tree

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9-19 MacTools FileEdit window—notice invisible desktop files.

9-20 Tree Display command being invoked from Disk menu.
display window shown, in Fig. 9-21, which is very handy for organizing your desktop or files on any volume because you can also use the tree display to move folders.

MacTools Deluxe is a most valuable addition to your Macintosh tool set—one that you can use over and over again. I've only scratched the surface here. The company behind the product is very easy to deal with and their outstanding treatment of current product owners when new versions are announced (you must send in your registration card!) is legendary. If you have only a limited budget, buying MacTools is your basic software Swiss Army knife—one product does a lot of useful work.

Recovering your hard drive using Norton Utilities

The System 7-compatible—version 1.1—of Norton Utilities for the Macintosh is the latest (as of this writing) in this family. Norton tools, long a powerhouse in the DOS PC world, has applied that expertise to the Macintosh world and come up with a neat product. Like MacTools, Norton Utilities also provides you with a powerful set of tools at an attractive price. While its reference manual is only half the size of the MacTools manual, it is well-written and gets the job done. Let's take a closer look. I'll provide comparisons to MacTools wherever possible for handy cross reference.

Another great Macintosh toolbox candidate

Norton Utilities also comes packaged on four diskettes—three 800K diskettes and one 1.4Mb diskette. Figure 9-22 shows the first installation diskette. FileSaver is like Mirror in MacTools. DiskLight is a neat utility that puts your hard drive's utility light on the Mac-
intosh screen. Click on Installer and you bring up the installation screen shown in Fig. 9-23. You can customize or go the default route. For this demo I chose the default set, and just clicked on Install to go the automatic route of putting Norton Utilities on the Cirrus 20 hard drive. Figure 9-24 shows the result. Only two applications are currently in the folder:

**Norton Utilities** This collection includes the Disk Doctor, UnErase, and Format Recover tools (which provide the functionality of Rescue in MacTools) plus Norton Disk Editor (FileEdit in MacTools).

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**9-23 Norton Utilities Installation screen.**

**9-22** Norton Utilities number 1 installation diskette.

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9-24 Norton Utilities installed in folder on Cirrus 20 desktop.

**Speed Disk**  This application provides the same function as Optimize in MacTools.

Not shown here is the third application, Layout Plus, which is an adaptation of the popular Layout share program that no longer works in System 7 because it is organized differently. (The version 1.0 manual you receive in the version 1.1 box doesn't tell you this—but the System 7.0 Teach Text notes on the first installation diskette gives you a polite one-sentence notification of it!) Also not shown are the DAs: KeyFinder (complements Apple's Keycaps) and Fast Find (replaces Apple System 6 Find File—not as powerful as Apple's System 7 version) and Directory Assistance (enhances Apple's standard Open, Save, etc. dialog boxes).

Figure 9-25 shows you Norton's HD Emergency diskette—a 1.4Mb floppy with Norton Utilities and Speed Disk on it—another candidate for your own travelling diskette collection. Speaking of Norton Utilities, let's get into them.

9-25 Norton Utilities diskette number 4—a 1.4Mb backup startup diskette.
When you double-click on the Norton Utilities icon, the screen of Fig. 9-26 appears. The four functions shown are available from the screen. In addition, Norton Disk Editor (and Layout Plus for System 6 users) is also available from the Utilities menu above.

![Norton Utilities main screen.](image)

Disk Doctor is probably the best known (and most useful) utility—after clicking on its icon, the screen of Fig. 9-27 appears. Disk Doctor goes through the six steps shown in a

![Norton Utilities Disk Doctor window.](image)
very amusing way, and gives you a dialog as it goes along directed at fixing whatever problem ails your diskette or hard drive. In the case of Fig. 9-28, the Volume Info check produced the dialog box shown—similar dialog boxes are provided for all six steps. It's a neat product to watch in action.

**Fig. 9-28** Norton Utilities Volume Info dialog box.

The UnErase utility was invoked for the screen of Fig. 9-29. Here, the recoverability of files is poor because FileSave protection was not invoked.

**Fig. 9-29** Norton Utilities UnErase dialog box.
The Format Recover utility was invoked for the screen of Fig. 9-30. Here too, total recoverability of files is poor because FileSave protection was not invoked.

Figure 9-31 shows Speed Disk, the Norton Utilities optimizer. Contrast this screen with Fig. 9-3 and Fig. 9-18.

Norton Utilities has a definite place in your Macintosh tool set. While I use both MacTools and Norton Utilities you are probably best served by choosing one or the other and becoming thoroughly familiar with it. Disk Doctor is slightly faster. Rescue is more thor-
ough, and typically recovers many files that Disk Doctor does not. I’d probably give the nod to MacTools if I had to choose one product, but you might pick differently. Because Symantec is the larger company, it is typically more difficult to deal with—the Macintosh division is only a small part of their business.

Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

Hard drive software tools

Central Point Software Inc.  
15220 NW. Greenbrier Pkwy., Suite 200  
Beaverton, OR 97006  
(503) 690-8090  
(MacTools Deluxe)

Symantec Corp.  
10201 Torre Ave.  
Cupertino, CA 95014  
(408) 253-9600  
(Norton Utilities for Macintosh)
Utilities can be a blessing or a curse. Used wisely, they can elevate your Macintosh to new heights of efficiency and bring you a sense of ecstasy. Used indiscriminately, they can cause ruin and bring utter frustration. In reality, software utilities are neither good nor bad in and of themselves—they are just utilities!

If you pick up just one good utility package idea as a result of reading the chapter, this book will have done its job. For in utilities, as in many other areas of life, quality (and, well, "utility") is more important than quantity. Think about it. Although you have a pegboard full of tools in your home shop, the 80/20 rule still holds—you use a few of them a lot more than all the others. In this chapter, I've given you my best shot for a utility product tool set to get you started—obviously these are not the only tools you can use and you will add to them over time.

My primary objective in this chapter is to give you a look at some of the utility tools available to meet your various needs. It features a closer look at one world-class packaged utility tools product and a brief overview of the utility products category, and leaves you with information about where you can find additional products.

Managing your Macintosh using Now Utilities

I'll pick up where I left off in the previous chapter—a brief product tour—but just one product package this time. My fondness for this package will be obvious from the start, so let me just be blunt and say that if you can afford only one utility package for your Macintosh—this should be it. Whether you're running System 6 or System 7, Now Utilities offers a set of extremely useful enhancements that help you manage your Macintosh even better. The net result is productivity gains for you.

The one and only Now Utilities

As the TV slogan says, "it doesn't get any better than this." Only I am talking about a set of twelve world-class utility tools packaged together under the name of Now Utilities (from Now Software, of course)—at a very attractive price. The version 3.0.1 edition
you'll be looking at here is fully System 7-compatible. The Now Utilities reference manual is almost on a par with the excellent MacTools Deluxe manual. Let's just say you will not be unhappy with it. Now (ho, ho, ho)—to take a closer look.

Now Utilities comes packaged with its own installer on two 800K diskettes. Lock these originals before using them and put them away in safe place (after you make a backup copy and copy them to your hard drive). If you are working with the backup diskettes, be sure to get the titles exact—spaces, dashes, even the TM on the name. Figure 10-1 shows the first diskette with the Installer on it. Figure 10-2 shows the second diskette. When you click on the Installer icon, the dialog box of Fig. 10-3 comes up. Elect to install the full set or a partial set of utilities. After making your decision, click on Install (I chose

![Image of Now Utilities number 1 diskette with Installer.](image1)

10-1 Now Utilities number 1 diskette with Installer.

![Image of Now Utilities number 2 diskette.](image2)

10-2 Now Utilities number 2 diskette.

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the full set). The next window you see is the one shown in Fig. 10-4. The desktop is as before with a Now Software folder added. It only has two data icons in it—the utilities themselves are within the menus and System folder and must be loaded first.

By the way, notice the amount of space available on the Cirrus 20 hard drive—only 7.1Mb. If you’ve been keeping track, other than System 7, Word, Excel, a few software
tools and a tiny amount of data—there is nothing else on this drive! If this fact does not drive home the need for a 40Mb hard drive—minimum—I really don't know what else to tell you.

Next, you are instructed to reboot your Macintosh for its tools to be loaded. I encountered a problem and the window shown in Fig. 10-5 shows why. Here you are looking at the Extensions window inside the System 7 System folder. The Now people—clever beings that they are—decided to put two spaces before their StartUp Manager name thus ensuring that it would load before anything else. And that it did. It loaded ahead of everything—including the Amdek Power Page SE init required to put an image on my monitor screen. But I added two spaces ahead of the Amdek title and practiced one-upsmanship—because Amdek comes before Startup when they both have two leading spaces. After rebooting, everything worked fine. The Cirrus 20 hard drive huffed and puffed to put a full row of startup icons across the bottom of the screen and start on a second row before bringing up the desktop. Because utilities themselves work behind the scenes, I'll review all you get with your Now Utilities package before pushing on. Now Utilities 3.0.1 includes the following:

![Image of Cirrus 20 desktop with Now Utilities folder]

**AlarmsClock**  How about a configurable alarm clock on the right side of your menu bar that displays the time and/or date (or has a stopwatch mode) and flashes "mini-messages" to remind you of important appointments? AlarmsClock has it all, including options for configuring multiple alarms. It supports hot key selection of its dialogs as well as a pull-down menu from the clock. And it does it in color—you can change the color of the clock and stopwatch in the menu bar if you like.

**DeskPicture**  Allows you to replace the standard desktop patterns with color or black and white pictures. You can select your favorite picture (or multiple layers of pictures on the same monitor!), clip art or scanned image to provide a personalized touch to your Macintosh. Plus, selecting and configuring pictures is very straightforward.
**MultiMaster** Why search through endless folders when you can launch applications or files instantly through pull-down menus or pop-up windows? MultiMaster is either mouse- or keyboard-driven, and easy to set up and configure.

**NowMenus** This utility’s submenus for Desk Accessories, the Control Panel, and Chooser—any folders installed in the Apple menu under System 7—make it far easier to use your Apple menu. You can create several layers of submenus and pop up your menu bar anywhere you click your mouse.

**NowSave** How about a comprehensive auto-saving utility that works with any application and saves your work after a specified length of time, number of keystrokes, or number of mouse clicks? This is it. If you’ve ever forgotten to save a document—lost all your hours of work—when your computer crashes, NowSave might even save your . . . (job, life, sanity, fill in the blank here).

**Profiler** How about a utility that analyzes your System and its configurations to help simplify tracking down software conflicts and other problems with your Macintosh? Profiler reports information about your System and loaded applications, Extensions, Control Panel extensions, printer drivers, and Chooser extensions in either Basic or Detailed mode. Plus, it scans for duplicate files, reports which fonts are installed, and records the load order of extensions. All these features of Profiler make it very handy when migrating from System 6 to System 7.

**Screen Locker** This utility not only provides easy and convenient password protection for your Macintosh, but also allows you to generate custom text or graphics screens for display while your Macintosh is secured. Screen Locker keeps a record of everything that happened to your Macintosh while you were gone—you can see at a glance if anyone has tried to use it. And Screen Locker not only makes it easy for you to set and change passwords, but also gives you both front- and back-door user-definable password keys.

**StartUp Manager** How about a System management utility that lets you optimize the performance of your Macintosh by giving you control over which Extensions load (and in what order) when you start up your Macintosh? StartUp Manager delivers that capability and also supports hot keys for changing groups at startup, reports pertinent information about Extensions, and supports linking groups of Extensions to run together (provided they are not known to be incompatible!).

**Super Boomerang** This file management utility, combined with MultiMaster and NowMenus, delivers a fabulous 1-2-3 punch for managing your Macintosh. The Super Boomerang folder under the Apple menu displays your recently used folders and files for quick opening, and does the same within the standard Open and Save dialog boxes. Super Boomerang even features a submenu to the Open command that displays and gives you direct access to your recently opened files!

**WYSIWYG Menus** Wouldn’t it be nice if you could group font families together in alphabetical order and display them in their own font typeface on the menu within each application? You can with the WYSIWYG Menus utility. WYSIWYG Menus not only unites font families and displays them in submenus, but also allows you to re-order fonts in the Font menu (so frequently used fonts can be placed at the top), display the style and size
menus in the selected font, and access a Control Panel at any time so you can easily reconfigure your selections.

Now that’s a utilities package. Frankly, I’ve probably gone a little overboard in my praise, but nothing I say here can compare with the enjoyment (or fun!) you will derive out of actually using the products—not to mention their productivity benefits to you. Let’s continue with the brief tour now that you know about the component parts.

Figure 10-7 shows you the Super Boomerang menu from the Apple menu with a couple of defaults loaded. In this case the Cirrus 20 menu option quickly shows you its con-

10-6 System 7 Extensions folder with Startup Manager after Amdek PowerPage.
tents and you can go directly to whatever folder you need. If you had opted to open the Word folder first (the menus are smart—they remember what you do), you would get the situation of Fig. 10-8. Here the Word folder displays its contents on the third-level menu but you can open the Word application directly from the second-level menu beneath the Word 4.0 folder listing if you choose to. Open a few more folders and files and you're up to the picture of Fig. 10-9.

10-8 Super Boomerang menu off Apple menu shows Word folder contents.

10-9 Super Boomerang menu changes with your activities.

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The how of your application and file launching is controlled by MenuMaster, as shown in Fig. 10-10. Word was placed on the menu in anticipation of its frequent use. The MenuMaster icons are available from either end of the menu bar—a handy convenience. MenuMaster also lets you view RAM, adjust your memory allocation on the fly, and vary sound level and color depth on an application-by-application basis.

10-10 MenuMaster controls application and file launching.

NowMenus is responsible for submenu creation and menu option control, as shown in its window box of Fig. 10-11. You can use it to assign submenu control to your Chooser and Control Panel windows, as shown in Fig. 10-12 and Fig. 10-13, respectively. Only the Capture folder takes advantage of NowMenu's further nesting capabilities in Fig. 10-13.

10-11 NowMenus is responsible for submenus creation.
10-12 Chooser contents are visible and invokable from Apple menu.

10-13 Control Panel contents are also visible and invokable from Apple menu.

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Super Boomerang enables you to navigate quickly through your maze of folders. First, it allows you control over their sheer numbers, as shown in Fig. 10-14. When you click on the Preferences button, the window of Fig. 10-15 opens. Here you can set up

![Super Boomerang main window.](image)

![Super Boomerang Preferences screen.](image)
whole groups or families to open together, list them alphabetically, and on and on. Super Boomerang also gives you the capabilities shown in Fig. 10-16—a menu within every Open Save As dialog box along with numerous options that capability provides. Here it is shown being used from an opened Word document. You’ve probably thought how neat it would be to combine System 7’s aliases with Now’s utilities—how right you are. If you made an alias for one of the Data folder items—Fig. 10-17 shows the Ideas folder being used—it can very easily be opened from the Apple menu. If you make an alias of the entire Data folder, the power of Now’s menus begins to come into play, as shown in Fig. 10-18 (and you still have another level to go—only four are shown). You’ve got a tremendously flexible and powerful set of tools here with Super Boomerang, MultiMaster, and Now-Menus. My examples only scratch the surface.

Up at the right hand side of the menu bar is the AlarmsClock as shown in Fig. 10-19. Opening its New Alarm selection gives you the window of Fig. 10-20. The clock toggles between time and date as you wish. The alarms do whatever you want, as you can see. Plus there is a stopwatch feature (not shown).

Also in the very handy (and very desirable!) category is the NowSave utility, invoked from inside a Word application in Fig. 10-21. You tell it exactly how you want to structure your autosave feature and it does the rest. I believe you can see the benefits of this without any further fanfare.

Another possibility for your favorite tool category is Screen Locker—shown in Fig. 10-22. You can custom tailor your messages and graphics (or just present a totally blank screen—that really confuses casual passers by). Click on the Message button and it brings
10-17  Super Boomerang menus and Ideas folder alias saves time.

10-18  Super Boomerang menus and Data folder alias saves lots of time.
you to the screen shown in Fig. 10-23. Here you can type in your own message and customize it. When you invoke Screen Locker, your message drifts casually across a darkened screen as shown in Fig. 10-24. When you strike any key, Screen Locker asks you for your password—which you must know! But, one of its handy features is a backdoor password option, shown in Fig. 10-25, in case you forget. Screen Locker also has a log of who attempted to get into your Macintosh. You can see it has intriguing possibilities.
Profiler, shown in Fig. 10-26, comes under the category of very valuable tools, particularly if you are managing many Macintosh resources, migrating to System 7, or contemplating hardware or software upgrades. As shown in Fig. 10-27, Profiler shows you exactly what you have, depending on how you set its preferences on the screen shown in Fig. 10-26.

In the fun/aesthetic or practical category is DeskPicture, shown in Fig. 10-28. This utility allows you to replace your "patterned" desktop with interesting, humorous, or
attractive Macintosh graphics. You can use one or many (e.g., four—one in each quadrant—makes a nice combo). DeskPicture allows you to size and configure the graphics, and also offers a random selection where multiple pictures alternate locations on successive startups—if boredom is your problem . . . On the other hand, configure your desktop with maps, price lists, frequently called phone numbers, and so on, if you are of a more practical bent.
Figure 10-29 shows WYSIWYG Menus in a Word application. This is a poor example because only a few font families are loaded, but you can see the possibilities. You can separately configure WYSIWYG Menus for each application. This is a great utility for desktop publishing and graphics work.
10-27 Now Utilities System Profile.

10-28 DeskPicture main screen.
10-29  WYSIWYG menus installed in Word application.

Figure 10-30 shows you the StartUp Manager window. You will find it an invaluable power tool for managing your ever-increasing amount of init resources.

What else can I say? Now Utilities is probably the most useful collection of tools in your Macintosh tool set—one that you'll wind up using daily. I've only given you a taste here. The company behind the product is filled with real people whose common denominator seems to be that they treat their customers like they would like to be treated. You can do worse, but you'll find it hard to do better than Now from Now.
Other utilities for your Macintosh

While Now Utilities are great, they are not the only utilities you can use with your Macintosh. Not by any stretch of your imagination! Utilities come in all sizes, shapes, flavors, and prices.

Actually, the first thing you have to do is decide how you're going to manage your utilities after you get them (before that you had to manage how you were even going to find the utilities you were searching for—that's why a single package with about everything you need a la Now Utilities is a painless way to go about it). I just established some arbitrary categories—twelve in all—to help you take a close look. Each of the twelve categories is summarized in table form. Again, my intent is to point you in the right direction—not to provide all-inclusive lists. Here are my utility software categories:

- Backup
- Formatting
- Management
- Finder augmenting
- File enhancement
- Font
- CPU enhancement
- Security
- Cataloging
- Printer
- Repair
- Tools

You can see that not everything you might be interested in (sounds, FKeys, Graphics, etc.) is broken out separately—that's why I called it "arbitrary" categories. When you conduct your own search, you get to make up your own categories! Let's get started.

Backup utilities

You visited with this category already in chapter 8. Table 10-1 gives you another picture of the offerings. You have many quality products to choose from. Notice that the prices group mostly in the $100 to $250 range. Notice too, that there is software to automate your UPS monitoring—very handy for networks.

Table 10-1 Backup utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>APB Express</td>
<td>Baseline Publishing</td>
<td>Tape</td>
<td>$ 99.95</td>
</tr>
<tr>
<td>AutoBack</td>
<td>TerraNetics</td>
<td>Automated</td>
<td>$ 99.00</td>
</tr>
<tr>
<td>Backmatic</td>
<td>Magic Software</td>
<td>Automated on changes</td>
<td>$ 99.95</td>
</tr>
<tr>
<td>Brutility Pro</td>
<td>Millennium Computer</td>
<td>Full service</td>
<td>$ 95.00</td>
</tr>
<tr>
<td>Cat•Back</td>
<td>Master Manufacturing</td>
<td>Archival/mirror image</td>
<td>$ 39.95</td>
</tr>
</tbody>
</table>
Table 10-1 Continued.

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiskFit</td>
<td>SuperMac Technology</td>
<td>Finder-readable format</td>
<td>$99.95</td>
</tr>
<tr>
<td>DiskTwin</td>
<td>Golden Triangle Computer</td>
<td>Duplexing full service</td>
<td></td>
</tr>
<tr>
<td>Fastback II</td>
<td>Fifth Generation Systems</td>
<td>High speed, full service</td>
<td>$189.00</td>
</tr>
<tr>
<td>FastTape</td>
<td>Nuvo Labs</td>
<td>Tape</td>
<td>$129.00</td>
</tr>
<tr>
<td>HFS Backup</td>
<td>Personal Computer Peripherals</td>
<td>Archive/restore</td>
<td>$99.00</td>
</tr>
<tr>
<td>MacBack</td>
<td>Advanced Digital Information</td>
<td>Automated Network</td>
<td>$99.00</td>
</tr>
<tr>
<td>NetStream</td>
<td>Personal Computer Peripherals</td>
<td>Network</td>
<td>$129.00</td>
</tr>
<tr>
<td>Nightshift</td>
<td>Transitional Technology</td>
<td>Automated</td>
<td></td>
</tr>
<tr>
<td>OptiManager</td>
<td>Conversion Dynamics</td>
<td>WORM archival</td>
<td></td>
</tr>
<tr>
<td>Retrospect</td>
<td>Dantz Development</td>
<td>Full service and fast tape</td>
<td>$249.00</td>
</tr>
<tr>
<td>Retrospect Remote</td>
<td>Dantz Development</td>
<td>Network automated</td>
<td>$249.00</td>
</tr>
<tr>
<td>TurboBack</td>
<td>Peripheral Land</td>
<td>Full service</td>
<td>$69.00</td>
</tr>
<tr>
<td>PowerChute</td>
<td>American Power Conversion (APC)</td>
<td>UPS monitoring</td>
<td>$99.00</td>
</tr>
</tbody>
</table>

1 Unlisted prices are either bundled with hardware or available for OEM use.

Formatting utilities
You visited the formatting category already in chapter 5. Table 10-2 gives you another view. Silverlining’s even on the list! As with backup utilities, you have many quality products to choose from and the prices also group mostly in the $100 to $250 range. Notice that there are products that do everything, as well as products that do tasks only for floppies, as well as products that are geared to a specific product such as the Sony MO driver.

Table 10-2 Formatting utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CharisMac SCSI Cmdr</td>
<td>Micro-Voice Communication</td>
<td>HD and MO drives</td>
<td>$99.00</td>
</tr>
<tr>
<td>DiskBox Software Mgr</td>
<td>Hologlyph</td>
<td>Disk manager</td>
<td>$29.95</td>
</tr>
<tr>
<td>DiskExpressII</td>
<td>Alsoft</td>
<td>Disk optimizer</td>
<td>$89.95</td>
</tr>
<tr>
<td>DiskTree</td>
<td>Hologlyph</td>
<td>Volume mapper</td>
<td>$20.00</td>
</tr>
<tr>
<td>Hard Disk Partition V3</td>
<td>FWB</td>
<td>Partition &amp; password</td>
<td>$89.95</td>
</tr>
<tr>
<td>Hard Disk ToolKit</td>
<td>FWB</td>
<td>Hard disk formatter</td>
<td>$249.95</td>
</tr>
<tr>
<td>Hard Disk Util V3</td>
<td>FWB</td>
<td>Uploads protected S/W</td>
<td>$149.95</td>
</tr>
<tr>
<td>Maxima 2.0</td>
<td>Connectix</td>
<td>24-bit mode memory exten.</td>
<td>$129.00</td>
</tr>
<tr>
<td>Microcom 911 Utilities</td>
<td>Microcom</td>
<td>Disk/file recovery tools</td>
<td>$149.95</td>
</tr>
<tr>
<td>MultiDisk</td>
<td>Alsoft</td>
<td>Hard disk partitioning</td>
<td>$89.95</td>
</tr>
<tr>
<td>OffLine</td>
<td>SNA</td>
<td>Disk management</td>
<td>$99.95</td>
</tr>
<tr>
<td>Optix Sony MO Driver</td>
<td>Blueridge Technologies</td>
<td>Sony SMO-SS01 driver</td>
<td>$100.00</td>
</tr>
<tr>
<td>ReTreever</td>
<td>DataTree</td>
<td>Removable disk drive mgmt</td>
<td>$78.95</td>
</tr>
<tr>
<td>Silverlining</td>
<td>La Cie</td>
<td>Hard drive everything tool</td>
<td>$149.95</td>
</tr>
<tr>
<td>SpeedyCD</td>
<td>ShirtPocket Software</td>
<td>Speeds up CD-ROM access</td>
<td>$60.00</td>
</tr>
</tbody>
</table>
Table 10-2  Continued.

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot On</td>
<td>MacPeak Research</td>
<td>Drive formatting/caching</td>
<td>$69.95</td>
</tr>
<tr>
<td>SuperDisk!</td>
<td>Alysis Software</td>
<td>Performance enhancement</td>
<td>$89.00</td>
</tr>
<tr>
<td>Trackmate TM573</td>
<td>Trackmate</td>
<td>Floppy drive diagnostics</td>
<td>$34.95</td>
</tr>
<tr>
<td>TurboOptimizer</td>
<td>Peripheral Land</td>
<td>Disk optimizer</td>
<td>$69.00</td>
</tr>
<tr>
<td>Videodisk Accessory</td>
<td>The Voyager Co.</td>
<td>DA for laser disc players</td>
<td>$49.95</td>
</tr>
</tbody>
</table>

Management utilities

These utilities are summarized in Table 10-3. I called these products “management utilities” because most of them are a collection of tools that manage and/or organize your entire desktop as opposed to just a single tool. You’ll find Now Utilities on this list. You’ll also find MacTools and Norton Utilities. Now Utilities is an enhancement package, MacTools and Norton Utilities are both maintenance packages, but both types of packages “manage” the entire task in that area for you. Pricing in this category is narrow—take anything you want—it costs about $129.

Table 10-3  Management utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Your Service</td>
<td>Bright Star Technology</td>
<td>Six-in-one utilities</td>
<td>$59.95</td>
</tr>
<tr>
<td>File Director</td>
<td>Fifth Generation Systems</td>
<td>Desktop management</td>
<td>$129.00</td>
</tr>
<tr>
<td>MacTools Deluxe V1.2</td>
<td>Central Point Software</td>
<td>Hard disk utilities</td>
<td>$129.00</td>
</tr>
<tr>
<td>MockPackage Plus Utilities 4.4</td>
<td>CE Software</td>
<td>10 DAs/utilities</td>
<td>$49.95</td>
</tr>
<tr>
<td>Norton Utilities V1.1</td>
<td>Symantec</td>
<td>Hard disk utilities</td>
<td>$129.00</td>
</tr>
<tr>
<td>Now Utilities 3.0</td>
<td>Now Software</td>
<td>System enhancement utilities</td>
<td>$129.00</td>
</tr>
<tr>
<td>Symantec Utilities (SUMII) V.20</td>
<td>Symantec</td>
<td>Hard disk utilities</td>
<td>$149.95</td>
</tr>
<tr>
<td>The DaWarehouse</td>
<td>Sheworker Graphic Arts</td>
<td>Desk accessories</td>
<td>$39.95</td>
</tr>
</tbody>
</table>

Finder augmenting utilities

These utilities are summarized in Table 10-4. In this category, I put tools that help your System’s Finder do its job better that are not offered in a bundled package—like the previous management category. Some might argue with placing On Cue, Master Finder, and DiskTop in this category rather than in the previous one. Here the pricing is typically lower than that of the management products because you are looking at the “a la carte” items that would make up a full management package.

Table 10-4  Finder augmenting utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Dark 2.0</td>
<td>Berkeley Systems</td>
<td>Screen saver</td>
<td>$49.95</td>
</tr>
<tr>
<td>AutoSave DA</td>
<td>Magic Software</td>
<td>Automatically saves to logged disk</td>
<td>$49.95</td>
</tr>
<tr>
<td>Product</td>
<td>Vendor</td>
<td>Description</td>
<td>Price</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>AutoSave II V2.0</td>
<td>Magic Software</td>
<td>Saves work at preset time interval</td>
<td>$49.95</td>
</tr>
<tr>
<td>Balloons</td>
<td>Olduvai Corp.</td>
<td>System 6 balloon help</td>
<td>$99.00</td>
</tr>
<tr>
<td>Capture 4.0</td>
<td>Mainstay</td>
<td>Selective screen capture</td>
<td>$129.95</td>
</tr>
<tr>
<td>ClickChange</td>
<td>Dubl-Click Software</td>
<td>Personalize look/feel of Macintosh</td>
<td>$89.95</td>
</tr>
<tr>
<td>ClickPaste 2.0</td>
<td>Mainstay</td>
<td>Pop-up, hierarchical scrapbook</td>
<td>$99.95</td>
</tr>
<tr>
<td>Comment 2.1</td>
<td>Deneba Software</td>
<td>Post-it note desk accessory</td>
<td>$99.95</td>
</tr>
<tr>
<td>DeskToppers</td>
<td>Harvard Associates</td>
<td>DA collection</td>
<td>$19.95</td>
</tr>
<tr>
<td>Disk Top 4.0.1</td>
<td>CE Software</td>
<td>Finder alternative plus DAs</td>
<td>$99.95</td>
</tr>
<tr>
<td>DiskFinder</td>
<td>Williams &amp; Macias</td>
<td>DA, disk librarian, file finder</td>
<td>$50.00</td>
</tr>
<tr>
<td>FolderJump 1.5</td>
<td>Cra Z Software</td>
<td>Open/save dialog box extender</td>
<td>$49.00</td>
</tr>
<tr>
<td>Font/DA Juggler Plus</td>
<td>Alsof</td>
<td>Access fonts, DAs, Fkeys, sounds</td>
<td>$59.95</td>
</tr>
<tr>
<td>HandOff II</td>
<td>Connectix</td>
<td>File launcher</td>
<td>$99.00</td>
</tr>
<tr>
<td>Icon-It! 2.1</td>
<td>Tactic Software</td>
<td>Icon bar menus, DAs, fonts</td>
<td>$89.00</td>
</tr>
<tr>
<td>INIT Manager</td>
<td>Baseline Publishing</td>
<td>Takes control of startup documents</td>
<td>$59.95</td>
</tr>
<tr>
<td>INIThound</td>
<td>Cambridge Information</td>
<td>INIT tracking software</td>
<td>$129.00</td>
</tr>
<tr>
<td>KiwiFinder</td>
<td>Kiwi Software</td>
<td>Enhanced file management</td>
<td>$99.95</td>
</tr>
<tr>
<td>MacPS-Power Scripts</td>
<td>Neff Systems Group</td>
<td>Automates Macintosh Finder</td>
<td>$27.00</td>
</tr>
<tr>
<td>MacQwerty 3.04</td>
<td>Paragon Concepts</td>
<td>Dvorak/custom keyboard reconfig</td>
<td>$45.00</td>
</tr>
<tr>
<td>MasterFinder</td>
<td>Tactic Software</td>
<td>Disk management</td>
<td>$99.00</td>
</tr>
<tr>
<td>MasterJuggler</td>
<td>Alsof</td>
<td>Juggles applications &amp; windows</td>
<td>$89.95</td>
</tr>
<tr>
<td>Mr. File</td>
<td>Softways</td>
<td>Finder alternative DA</td>
<td>$99.00</td>
</tr>
<tr>
<td>MultiClip 2.0</td>
<td>Olduvai Corp.</td>
<td>Multiple clipboards &amp; scrapbooks</td>
<td>$129.00</td>
</tr>
<tr>
<td>MultiSet 3.0</td>
<td>Neff Systems Group</td>
<td>MultiFinder or Finder work sets</td>
<td>$35.00</td>
</tr>
<tr>
<td>NameViewer</td>
<td>AStar Technologies</td>
<td>Displays full 31-character name</td>
<td>$15.00</td>
</tr>
<tr>
<td>On Cue II</td>
<td>Icom Simulations</td>
<td>File launching</td>
<td>$99.95</td>
</tr>
<tr>
<td>Personality!</td>
<td>Baseline Publishing</td>
<td>Interface utilities</td>
<td>$49.95</td>
</tr>
<tr>
<td>PictureBook V3.2</td>
<td>Loop Software</td>
<td>Multiple scrapbooks DA</td>
<td>$69.95</td>
</tr>
<tr>
<td>PowerIcons</td>
<td>Magic Software</td>
<td>Icon clone finder enhancement</td>
<td>$49.95</td>
</tr>
<tr>
<td>Protector Shark</td>
<td>Ibis Software</td>
<td>Screen saver</td>
<td>$49.95</td>
</tr>
<tr>
<td>Pyro! 4.0.1</td>
<td>Fifth Generation Systems</td>
<td>Screen saver</td>
<td>$39.95</td>
</tr>
<tr>
<td>SnapJot</td>
<td>Wildflower Software</td>
<td>Screen-capture/screen management</td>
<td>$59.95</td>
</tr>
<tr>
<td>Suitcase II</td>
<td>Fifth Generation Systems</td>
<td>Font and desk accessory liberation</td>
<td>$79.00</td>
</tr>
<tr>
<td>Tiles 1.0</td>
<td>CE Software</td>
<td>Intelligent desktop</td>
<td>$99.95</td>
</tr>
<tr>
<td>Type/Creator Changer</td>
<td>Berkeley Scientific Associates</td>
<td>File management</td>
<td>$29.00</td>
</tr>
</tbody>
</table>

**File enhancement utilities**

These tools, summarized in Table 10-5, help you perform some aspect of working with your files better. Arguably, some could also be in the previous table, while the capabilities of others are found in the management utility packages. Pricing here is also like that for the other “a la carte” items in Table 10-4.
Table 10-5  File enhancement utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CanOpener</td>
<td>Abbott Systems</td>
<td>Information search/retrieval</td>
<td>$125.00</td>
</tr>
<tr>
<td>Complete Undelete</td>
<td>Microcom</td>
<td>File recovery</td>
<td>$ 79.95</td>
</tr>
<tr>
<td>DataQuilt</td>
<td>Tri-Millenium Corp.</td>
<td>Text file data manipulation</td>
<td>$ 59.00</td>
</tr>
<tr>
<td>DiskDoubler</td>
<td>Salient Software</td>
<td>File compression</td>
<td>$ 79.00</td>
</tr>
<tr>
<td>Eureka!</td>
<td>Personal Computer Peripherals</td>
<td>File finding desk accessory</td>
<td>$ 24.95</td>
</tr>
<tr>
<td>FetchIt 2.2</td>
<td>Cra Z Software</td>
<td>File management system</td>
<td>$ 25.00</td>
</tr>
<tr>
<td>Findswell Version 2.0</td>
<td>Working Software</td>
<td>Locator, opener, path saver</td>
<td>$ 59.95</td>
</tr>
<tr>
<td>Last Resort 1.0</td>
<td>Working Software</td>
<td>Retrieving lost text</td>
<td>$ 49.95</td>
</tr>
<tr>
<td>Multi-File Creator</td>
<td>Berkeley Scientific Associates</td>
<td>File management</td>
<td>$ 39.00</td>
</tr>
<tr>
<td>On Location V2.0</td>
<td>On Technology</td>
<td>Reduces find/view time</td>
<td>$129.95</td>
</tr>
<tr>
<td>Shortcut 1.5</td>
<td>Aladdin Systems</td>
<td>Open/save box enhancer</td>
<td>$ 79.95</td>
</tr>
<tr>
<td>StuffIt Deluxe 2.0</td>
<td>Aladdin Systems</td>
<td>Compression and archiving</td>
<td>$ 99.95</td>
</tr>
<tr>
<td>Word for Word/Macintosh</td>
<td>Mastersoft</td>
<td>File conversion utility</td>
<td>$149.00</td>
</tr>
<tr>
<td>XPsort</td>
<td>Stackhouse Software</td>
<td>Sorts Macintosh data files</td>
<td>$ 35.00</td>
</tr>
</tbody>
</table>

Font utilities

These tools, summarized in Table 10-6, help you when working with fonts. Whether loading, printing, creating, altering, storing, or dealing with font menus, you’ve got a huge variety of tools today to help you do your work with fonts better. Only a very few of the offerings are listed, just to give you the flavor.

Table 10-6  Font utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe Type Reunion</td>
<td>Adobe Systems</td>
<td>PostScript font utility</td>
<td>$ 65.00</td>
</tr>
<tr>
<td>Fontina</td>
<td>Eastgate Systems</td>
<td>Improve font menus</td>
<td>$ 69.95</td>
</tr>
<tr>
<td>FontShare 2.2</td>
<td>Tactic Software</td>
<td>Downloadable PS fonts</td>
<td>$249.00</td>
</tr>
<tr>
<td>MenuFonts4</td>
<td>Dubl-Click Software</td>
<td>Font names in own fonts</td>
<td>$ 89.95</td>
</tr>
</tbody>
</table>

CPU enhancement utilities

These utilities are summarized in Table 10-7. Use these to tweak your Macintosh up for a performance boost. Again only a few of the possibilities are listed. Mode 32 is now given away as a result of Apple’s decision to help earlier model 68030 Macintosh owners.
Table 10-7  CPU enhancement utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode32</td>
<td>Connectix</td>
<td>Runs Macs in 32-bit mode</td>
<td>$169.00</td>
</tr>
<tr>
<td>RamSnap</td>
<td>Dove Computer</td>
<td>RAM disk/disk cache</td>
<td>$30.00</td>
</tr>
<tr>
<td>S.P.A.M.M.</td>
<td>Bravo Technologies</td>
<td>Math speedup utility</td>
<td>$79.00</td>
</tr>
<tr>
<td>SmartCache V1.3</td>
<td>Novy Systems</td>
<td>Hard disk accelerator</td>
<td>$99.00</td>
</tr>
<tr>
<td>SpeedDisk</td>
<td>MindCraft Publishing</td>
<td>Simulated RAM disk</td>
<td>$29.95</td>
</tr>
<tr>
<td>TurboCache</td>
<td>Peripheral Land</td>
<td>Improves performance</td>
<td>$99.00</td>
</tr>
</tbody>
</table>

Security utilities

Table 10-8 gives you a good idea of the offerings among security utilities. Here you are looking at anything from the simplest of products to the most sophisticated, and prices vary accordingly. You are definitely going to be able to find what you are looking for in this category. And judging from the sheer volume of products, a lot of Macintosh users are looking for security.

Table 10-8  Security utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Security</td>
<td>Advanced Gravis</td>
<td>Security software</td>
<td>$69.95</td>
</tr>
<tr>
<td>FileGuard V2.7</td>
<td>ASD Software</td>
<td>HD desktop protection</td>
<td>$249.00</td>
</tr>
<tr>
<td>PrintGuard V1.0</td>
<td>ASD Software</td>
<td>Printing control system</td>
<td>$199.00</td>
</tr>
<tr>
<td>AME 1.1.3</td>
<td>Casady &amp; Greene</td>
<td>Security &amp; virus program</td>
<td>$279.00</td>
</tr>
<tr>
<td>SuperLock</td>
<td>Datapath Technologies</td>
<td>HD copy protection</td>
<td>$575.00</td>
</tr>
<tr>
<td>SecureInit</td>
<td>Direct Software</td>
<td>Security</td>
<td>$99.95</td>
</tr>
<tr>
<td>DiskLock</td>
<td>Fifth Generation Systems</td>
<td>Password protection</td>
<td>$189.00</td>
</tr>
<tr>
<td>Hard Disk DeadBolt</td>
<td>FWB</td>
<td>Multilevel file encryption</td>
<td>$89.95</td>
</tr>
<tr>
<td>Destructor</td>
<td>Hedra</td>
<td>Security software</td>
<td>$99.00</td>
</tr>
<tr>
<td>Entropy</td>
<td>Hologlyph</td>
<td>Compression/encryption</td>
<td>$95.00</td>
</tr>
<tr>
<td>Public Key Registry</td>
<td>Illumind</td>
<td>Electronic registration srvs</td>
<td>$30.00</td>
</tr>
<tr>
<td>MacSpyProof</td>
<td>Information Security Corp</td>
<td>Security/encryption</td>
<td>$99.00</td>
</tr>
<tr>
<td>The NightWatch</td>
<td>Kent Marsh Ltd.</td>
<td>HD security software</td>
<td>$149.95</td>
</tr>
<tr>
<td>MacSafe II</td>
<td>Kent Marsh Ltd.</td>
<td>Password/encryption</td>
<td>$189.95</td>
</tr>
<tr>
<td>QuickLock</td>
<td>Kent Marsh Ltd.</td>
<td>Screen/network password</td>
<td>$59.95</td>
</tr>
<tr>
<td>Empower 4.0</td>
<td>Magna</td>
<td>Security program</td>
<td>$169.00</td>
</tr>
<tr>
<td>Empower ScreenLock 4.0</td>
<td>Magna</td>
<td>Password protection</td>
<td>$69.00</td>
</tr>
<tr>
<td>AntiToxin</td>
<td>Mainstay</td>
<td>Virus protection</td>
<td>$99.95</td>
</tr>
<tr>
<td>MasterKey</td>
<td>New Visions Limited Partnerships</td>
<td>Password recovery</td>
<td>$165.00</td>
</tr>
<tr>
<td>Passport 2.1</td>
<td>Praxitel</td>
<td>Disk security</td>
<td>$24.95</td>
</tr>
<tr>
<td>Tipem</td>
<td>RSA Data Security</td>
<td>E-mail Internet privacy</td>
<td>$900.00</td>
</tr>
<tr>
<td>Folder Locker</td>
<td>Software Brewing Co.</td>
<td>Password protect folders</td>
<td>$30.00</td>
</tr>
<tr>
<td>Bullet Proof</td>
<td>Spectra Micro Development</td>
<td>File &amp; virus protection</td>
<td>$99.00</td>
</tr>
<tr>
<td>Sentinel</td>
<td>SuperMac Technology</td>
<td>File security</td>
<td>$149.95</td>
</tr>
</tbody>
</table>
Cataloging utilities

These utilities, summarized in Table 10-9, are typically what you’d use to put labels on your diskettes and keep track of their contents. Not a big deal, but it helps to have the right tool for the job because everyone does it in their own way. This list should get you started.

Table 10-9  Cataloging utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ColorDex</td>
<td>DataTree</td>
<td>Diskette indexing</td>
<td>$ 49.90</td>
</tr>
<tr>
<td>Disk Accessory Plus</td>
<td>Vertical Solutions</td>
<td>Disk labeler</td>
<td>$ 10.00</td>
</tr>
<tr>
<td>Disk Ranger V4.7</td>
<td>Graham Software</td>
<td>Hard disk/floppy utilities</td>
<td>$ 59.95</td>
</tr>
<tr>
<td>DiskQuick</td>
<td>Ideaform</td>
<td>Catalogs drives &amp; floppies</td>
<td>$ 49.95</td>
</tr>
<tr>
<td>FastLabel 2.0</td>
<td>Vertical Solutions</td>
<td>Labeling software</td>
<td>$ 79.95</td>
</tr>
<tr>
<td>MacDiskManager</td>
<td>Weber &amp; Sons</td>
<td>Prints directory labels</td>
<td>$ 19.95</td>
</tr>
<tr>
<td>MacLabeler Plus</td>
<td>Ideaform</td>
<td>Disk-labeling system</td>
<td>$ 79.95</td>
</tr>
<tr>
<td>MyAdvancedLabelMaker</td>
<td>MySoftware</td>
<td>Label making utility</td>
<td>$ 49.95</td>
</tr>
<tr>
<td>MyDiskLabeler III</td>
<td>Williams &amp; Macias</td>
<td>Design/print disk labels</td>
<td>$ 80.00</td>
</tr>
<tr>
<td>Silicon Press</td>
<td>Silicon Beach Software</td>
<td>Label/envelope printer utility</td>
<td>$ 79.95</td>
</tr>
<tr>
<td>StickyBusiness</td>
<td>Williams &amp; Macias</td>
<td>General labeling/printing</td>
<td>$180.00</td>
</tr>
</tbody>
</table>

Printing utilities

Summarized in Table 10-10, these utilities include software drivers and cable sets to tie non-Apple printers into your Macintosh, DOS PCs into your Apple LaserWriter, and everything in between. If you need it, chances are it’s been done before. This list only gives you an inkling (oops!).

Table 10-10  Printer utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AppleShare Print Server</td>
<td>Apple Computer</td>
<td>LaserWriter print spooler</td>
<td>$299.00</td>
</tr>
<tr>
<td>Color Convert</td>
<td>BugByte</td>
<td>Low-end color printing</td>
<td>$ 55.00</td>
</tr>
<tr>
<td>DynoPage 1.0</td>
<td>Portfolio Systems</td>
<td>Double-sided printer driver</td>
<td>$125.00</td>
</tr>
<tr>
<td>Freedom Of Press</td>
<td>Custom Applications</td>
<td>Color PS on mono printers</td>
<td>$495.00</td>
</tr>
<tr>
<td>Freedom Of Press Light</td>
<td>Custom Applications</td>
<td>Graphics on non-PS printer</td>
<td>$ 98.00</td>
</tr>
<tr>
<td>Grappler Spooler</td>
<td>Orange Micro</td>
<td>Print spooler</td>
<td>$ 79.00</td>
</tr>
<tr>
<td>JetLink Express V2.1</td>
<td>GDT Softworks</td>
<td>Printer driver/serial cable</td>
<td>$159.00</td>
</tr>
</tbody>
</table>
Table 10-10  Continued.

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>JetLink Express V2.1</td>
<td>GDT Softworks</td>
<td>Printer driver/parallel cable</td>
<td>$249.00</td>
</tr>
<tr>
<td>LaserPlot</td>
<td>MacVonk USA</td>
<td>Convert HPGL to PostScript</td>
<td>$795.00</td>
</tr>
<tr>
<td>Mac Daisy Link 1.1.5</td>
<td>GDT Softworks</td>
<td>Printer program</td>
<td>$82.00</td>
</tr>
<tr>
<td>MacMatrix</td>
<td>Toshiba America</td>
<td>Toshiba P321/P341 driver</td>
<td>$49.00</td>
</tr>
<tr>
<td>MacPalette II</td>
<td>Microspot</td>
<td>Color ImageWriter II driver</td>
<td>$69.00</td>
</tr>
<tr>
<td>MacPlot DMA CT</td>
<td>Microspot</td>
<td>Color thermal printer driver</td>
<td>$1295.00</td>
</tr>
<tr>
<td>MacPrint</td>
<td>Insight Development</td>
<td>HP LaserJet/DeskJet driver</td>
<td>$149.00</td>
</tr>
<tr>
<td>NetCounter 2.03</td>
<td>Prism Enterprises</td>
<td>Networked laser printers</td>
<td>$75.00</td>
</tr>
<tr>
<td>Preview 1.5</td>
<td>Computer Applications</td>
<td>Replacement printer driver</td>
<td>$15.00</td>
</tr>
<tr>
<td>PrintLink Collection V4.0</td>
<td>GDT Softworks</td>
<td>Printer driver/serial cable</td>
<td>$99.00</td>
</tr>
<tr>
<td>Prof Output Manager-PICT</td>
<td>Visual Business Systems</td>
<td>Color print PICT interpreter</td>
<td>$795.00</td>
</tr>
<tr>
<td>ShadowWriter</td>
<td>Gizmo Technologies</td>
<td>Share printers on AppleTalk</td>
<td>$179.00</td>
</tr>
<tr>
<td>Sitka NetPrint</td>
<td>Sitka</td>
<td>PC printing on AppleTalk</td>
<td>$189.00</td>
</tr>
<tr>
<td>SpotPrint</td>
<td>MacPeak Research</td>
<td>SCSI laser printer software</td>
<td>$149.95</td>
</tr>
<tr>
<td>SuperLaserSpool</td>
<td>Fifth Generation Systems</td>
<td>LaserWriter print spooler</td>
<td>$149.95</td>
</tr>
<tr>
<td>SuperSpool</td>
<td>Fifth Generation Systems</td>
<td>ImageWriter print spooler</td>
<td>$99.95</td>
</tr>
<tr>
<td>TurboSpool</td>
<td>Peripheral Land</td>
<td>Laser spooler</td>
<td>$69.00</td>
</tr>
</tbody>
</table>

Repair utilities

These utilities, summarized in Table 10-11, feature some pretty slick products designed to make your Macintosh troubleshooting task a lot easier. There are many more products out there.

Table 10-11  Repair utility software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help!</td>
<td>Teknosys</td>
<td>Problem-solving utility</td>
<td>$149.00</td>
</tr>
<tr>
<td>MacEKG</td>
<td>MicroMat Computer Systems</td>
<td>Diagnostic software</td>
<td>$99.00</td>
</tr>
<tr>
<td>MicroRX</td>
<td>MicroMat Computer Systems</td>
<td>Repair reference software</td>
<td>$99.00</td>
</tr>
<tr>
<td>Mug Shot Lite 1.30</td>
<td>Mi Concepts</td>
<td>Diagnostic utility</td>
<td>$30.00</td>
</tr>
</tbody>
</table>

Utility tools

Table 10-12 lists those utilities I thought you might find useful—but didn’t want to break out into any additional categories (twelve is enough!). Everything from soup to nuts is on this list but there are hundreds more items that could go on it.
### Table 10-12 Utility tools software

<table>
<thead>
<tr>
<th>Product</th>
<th>Vendor</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calc+</td>
<td>Abbott Systems</td>
<td>DTP calculator</td>
<td>$79.00</td>
</tr>
<tr>
<td>Colorizer 1.14</td>
<td>Palomar Software</td>
<td>Color screen utilities</td>
<td>$49.95</td>
</tr>
<tr>
<td>DBMS/Copy Mac</td>
<td>Conceptual Software</td>
<td>Mac/PC spreadsheet converter</td>
<td>$95.00</td>
</tr>
<tr>
<td>Escape!</td>
<td>Beagle Bros.</td>
<td>Keyboard remapping</td>
<td>$19.95</td>
</tr>
<tr>
<td>Gizmo 1.01</td>
<td>Mi Concepts</td>
<td>GIF picture viewer</td>
<td>$30.00</td>
</tr>
<tr>
<td>Hacker Pack II</td>
<td>Cloudpine Computer Ltd.</td>
<td>Resource tutorials</td>
<td>$99.00</td>
</tr>
<tr>
<td>HyperDA II</td>
<td>Symmetry Software</td>
<td>HyperCard desk accessory</td>
<td>$129.00</td>
</tr>
<tr>
<td>HyperPix</td>
<td>Mi Concepts</td>
<td>Pictures/clip art catalog</td>
<td>$30.00</td>
</tr>
<tr>
<td>HyperRacks</td>
<td>HyperRacks</td>
<td>HyperCardRack metaphors</td>
<td>$99.95</td>
</tr>
<tr>
<td>II In A Mac</td>
<td>Computer:Applications</td>
<td>Apple II S/W emulator</td>
<td>$149.95</td>
</tr>
<tr>
<td>Image Grabber 3.0</td>
<td>Sebastian Software</td>
<td>Grabs screen images</td>
<td>$49.00</td>
</tr>
<tr>
<td>InLarge</td>
<td>Berkeley Systems</td>
<td>Image-enlarging software</td>
<td>$95.00</td>
</tr>
<tr>
<td>Isis Halftone Dot Installer</td>
<td>Isis Imaging Corp.</td>
<td>Prints halftone images</td>
<td>$125.00</td>
</tr>
<tr>
<td>MacImage</td>
<td>Xerox/Datacopy</td>
<td>JetReader scanner software</td>
<td>$695.00</td>
</tr>
<tr>
<td>MacInUse 3.0</td>
<td>Softview</td>
<td>Records usage of Macintosh</td>
<td>$99.00</td>
</tr>
<tr>
<td>MacKeymeleon II V1.0</td>
<td>Avenue Software</td>
<td>Custom keyboard utility</td>
<td>$119.95</td>
</tr>
<tr>
<td>MacNest</td>
<td>Fortnum Software</td>
<td>Electronic storage tray</td>
<td>$49.00</td>
</tr>
<tr>
<td>MacScan 1.65</td>
<td>Prism Enterprises</td>
<td>Image scanner software</td>
<td>$199.00</td>
</tr>
<tr>
<td>Magic Typist</td>
<td>Tactic Software</td>
<td>Mac repetitive typing</td>
<td>$99.00</td>
</tr>
<tr>
<td>PatchMaker V1.0</td>
<td>Advantage Software</td>
<td>Patch any Mac application</td>
<td>$79.00</td>
</tr>
<tr>
<td>PathFinder</td>
<td>Silk City Software</td>
<td>Automated stack mapper</td>
<td>$59.95</td>
</tr>
<tr>
<td>PICTure This</td>
<td>FGM</td>
<td>Graphics file conversion</td>
<td>$99.00</td>
</tr>
<tr>
<td>Port Authority II</td>
<td>Heizer Software</td>
<td>HyperCard import/export</td>
<td>$25.00</td>
</tr>
<tr>
<td>Reports 2.0</td>
<td>Nine to Five Software Co.</td>
<td>HyperCard printer/viewer</td>
<td>$149.95</td>
</tr>
<tr>
<td>SmartScrapp &amp; Clipper II</td>
<td>Solutions</td>
<td>DAs for clip art users</td>
<td>$89.95</td>
</tr>
<tr>
<td>SoundPlay 1.02</td>
<td>Hologlyph</td>
<td>Play sound resources</td>
<td>$20.00</td>
</tr>
<tr>
<td>Stepping Out II</td>
<td>Berkeley Systems</td>
<td>Big screen S/W alternative</td>
<td>$95.00</td>
</tr>
<tr>
<td>SuperGlue II</td>
<td>Solutions</td>
<td>DTP print-to-disk utility</td>
<td>$119.95</td>
</tr>
<tr>
<td>SuperRuler</td>
<td>Computer:Applications</td>
<td>Ruler desk accessory</td>
<td>$15.00</td>
</tr>
<tr>
<td>SAM V3.0</td>
<td>Symantec</td>
<td>Virus protection/elimination</td>
<td>$99.00</td>
</tr>
<tr>
<td>The Evaluation System</td>
<td>General Information Services</td>
<td>Software evaluator</td>
<td>$995.00</td>
</tr>
<tr>
<td>Turbo View 1.06</td>
<td>Mi Concepts</td>
<td>Graphic utility</td>
<td>$30.00</td>
</tr>
<tr>
<td>Twelve-C</td>
<td>Florida Marketing Intern</td>
<td>HP-12C calculator emulator</td>
<td>$49.95</td>
</tr>
<tr>
<td>Virex</td>
<td>Microcom</td>
<td>Anti-virus/treatment</td>
<td>$99.95</td>
</tr>
<tr>
<td>Virus FirstAid Volume 2</td>
<td>Showker Graphic Arts &amp; Design</td>
<td>Public domain virus S/W</td>
<td>$9.95</td>
</tr>
</tbody>
</table>

### You’re on your own

I hope lumping these two hundred or so utilities in different categories has given you some ideas on how you might organize your own utility software search. Some great products are listed, but hundreds more are not listed and new ones are announced regularly. Use the media sources listed in chapter 12 to keep you up to date. Enjoy your quest.

*Other utilities for your Macintosh*  
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Sources

Here are vendor names, addresses, and phone numbers for the products mentioned in the chapter to assist you in your quest for the best product and/or solution to meet your needs. As mentioned earlier, some of these will be out of date before the ink is dry on the printed pages, and others will become dated later, but they should still provide a good starting point bolstered by your own use of the more frequently published media mentioned in chapter 12.

<table>
<thead>
<tr>
<th>Utility software</th>
<th>Utility software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alsoft Inc.</td>
<td>Icom Simulations Inc.</td>
</tr>
<tr>
<td>P.O. Box 927</td>
<td>648 S. Wheeling Rd.</td>
</tr>
<tr>
<td>Spring, TX 77383</td>
<td>Wheeling, IL 60090</td>
</tr>
<tr>
<td>(713) 353-4090</td>
<td>(708) 520-4440</td>
</tr>
<tr>
<td>(Master Juggler)</td>
<td>(On Cue)</td>
</tr>
<tr>
<td>Baseline Publishing Inc.</td>
<td>Kiwi Software Inc.</td>
</tr>
<tr>
<td>1770 Moriah Woods Blvd., Suite 14</td>
<td>6546 Pardall Rd.</td>
</tr>
<tr>
<td>Memphis, TN 38117</td>
<td>Santa Barbara, CA 93117</td>
</tr>
<tr>
<td>(901) 682-9676</td>
<td>(805) 685-4031</td>
</tr>
<tr>
<td>(INIT Manager)</td>
<td>(KiwiFinder Extender)</td>
</tr>
<tr>
<td>CE Software Inc.</td>
<td>Microseeds Publishing Inc.</td>
</tr>
<tr>
<td>P.O. Box 65580</td>
<td>5801 Benjamin Center Dr., Suite 103</td>
</tr>
<tr>
<td>West Des Moines, IA 50265</td>
<td>Tampa, FL 33634</td>
</tr>
<tr>
<td>(515) 224-1995</td>
<td>(813) 882-8635</td>
</tr>
<tr>
<td>(DiskTop)</td>
<td>(HAM)</td>
</tr>
<tr>
<td>Connectix Corp.</td>
<td>Now Software Inc.</td>
</tr>
<tr>
<td>2655 Campus Dr.</td>
<td>520 SW Harrison, Suite 435</td>
</tr>
<tr>
<td>San Mateo, CA 94403</td>
<td>Portland, OR 97201</td>
</tr>
<tr>
<td>(800) 950-5880</td>
<td>(800) 237-3611</td>
</tr>
<tr>
<td>(Hand-Off II)</td>
<td>(Now Utilities)</td>
</tr>
<tr>
<td>CRA Z Software</td>
<td>Tactic Software Corp.</td>
</tr>
<tr>
<td>P.O. Box 6379</td>
<td>11925 SW 128th St.</td>
</tr>
<tr>
<td>Haverhill, MA 01831</td>
<td>Miami, FL 33186</td>
</tr>
<tr>
<td>(508) 521-5262</td>
<td>(305) 378-4110</td>
</tr>
<tr>
<td>(Folder Jump)</td>
<td>(MasterFinder)</td>
</tr>
<tr>
<td>Fifth Generation Systems Inc.</td>
<td></td>
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<tr>
<td>10049 N. Rieger Rd.</td>
<td></td>
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<tr>
<td>Baton Rouge, LA 70809</td>
<td></td>
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<tr>
<td>(504) 291-7221</td>
<td></td>
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<tr>
<td>(File Director Suitcase II)</td>
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Enclosed floppy diskette

The previous chapter introduced you to the world of commercial utility software. You saw there were many alternatives. The public domain, freeware, or shareware software utility offerings multiply your alternatives by yet another order of magnitude (or more)!

Where do you go? What do you look for? Which ones are the best? These are some of the questions that cross your mind . . . While I cannot provide answers for you sight unseen, I’ll point you in the right direction. To help you get started, this book has an enclosed floppy diskette with public domain software on it, including a few of my favorite utility programs. You might enjoy some of them too.

If you are just looking and nothing suits your fancy or meets your needs, please feel free to reformat the enclosed floppy diskette and put it to a higher and better use. You need feel no guilt whatsoever. On the other hand, if you are going to use a shareware author’s product, please be conscientious and considerate (like Abe Lincoln was) and pay the author his or her requested fee.

Mama mia that’s a lotta programs

Those of you who already subscribe to the monthly (or weekly) Macintosh magazines are probably already aware of the large amount of Macintosh public domain software offerings. Commercial vendors with 600Mb CD-ROM disks still can’t fit them all on, and the list keeps growing.

Believe it or not, your best source is probably closer than you know—your friendly, local Macintosh user group. Wherever you live, a Macintosh user group is usually not too far away (yes, I know there are exceptions). In virtually every Macintosh user group there is a disk librarian person whose sole purpose is to stay updated on such matters. This person is usually glad to illuminate you further about a subject that is close to his or her heart. Not only that, he or she is usually glad to talk with anyone human—after spending so much time with a near-human Macintosh cataloging the expanding public domain software universe. Some user groups offer a disk-of-the-month or even a BBS to help you in your pursuits in this area.
Beyond that, another universe of software is available at your fingertips via your telephone lines and the information providers: Compuserve, et al. You can quickly browse through their large collections and pick the item you want for downloading over your modem. This, of course, is an overly simplistic characterization. It costs you money to browse, so you should be reasonably prepared beforehand about what you are looking for, and quickly move to download just what you need at the moment.

If your desire is to own the largest public domain software collection on the block, then your needs are best met by purchasing a CD-ROM player and buying software in bulk form stored on a CD-ROM diskette via one of the many public domain repackaging providers. You save downloading charges and any extra steps and time to visit your Macintosh user group library, plus the contents of just one CD-ROM disk can keep even the most hyperactive of us occupied for weeks—just delving through its contents.

A baker's dozen

Out of the universe of possible offerings, I've chosen an even dozen plus one—a baker’s dozen. The dozen programs are each reasonably well-behaved under System 7, and will work under System 6 as well (one program has a version for each included). The thirteenth program only runs under System 6 and you already get some (but not all—unfortunately!) of its functionality when you purchase System 7.

Figure 11-1 shows you a picture of the enclosed diskette’s contents (your icon arrangement might vary slightly depending on how the diskette is packaged). In terms of functionality, I’ve tried to add to your Macintosh tool kit in four ways: a collection of SCSI/ADB tools, memory analysis and control tools, System 7 migration tools, and a performance monitoring tool. Finally, I included a tool that gives you the very desirable capability of customizing your System 6 desktop’s appearance.

11-1 Software programs on enclosed floppy diskette.
SCSI/ADB tools  You get ADB Probe plus three different varieties of SCSI tools. SCSI Probe (3.0 is the System 7 version, 2.0.7 is the System 6 version) gives you a quick and dirty view of what's attached to your Macintosh SCSI port and mounts or dismounts your attached SCSI devices also. SCSI-Identifier is a slightly more powerful tool that not only tells you where a device is attached but also provides you with a little more information about the device. SCSI Info is the top of the line. Run it and you learn everything about what's attached and what it's about. I especially liked the listing of the "when did you last back up" item in the lower left corner of the window. With this in your toolkit it is checkmate—nonpower users can't lie to you about when they last backed up (power users can do anything!).

Memory analysis and control tools  Connectix Mode 32 puts 32-bit clean capability in the hands of Mac II, IIx, IIcx and SE 30 users. When installed, you can toggle back and forth between 24-bit and 32-bit modes. To get the most out of it you also want Connectix Optima and Maxima software. RAM Check tells you about the overall health of your memory. MemINIT, when installed, dynamically tells you how much of your current application memory (heap, MultiFinder) is being used by placing a little pie chart over the Apple on the menu and a single scan line at the top of the screen with tick marks at intervals.

System 7 migration tools  These tools don't have to be used in this mode; they just come in handy when you are doing a System 7 migration. Version gives you the version number of every application on your volume—very handy for compatibility checking. DisKeeper does it at an advanced user-definable level and much more—plus I got a kick out of the bird's moving eyeball! Try it, you'll see what I mean. System Picker lets you toggle back and forth between System 7 and System 6 volumes. Notice I said volumes. I really don't recommend your using it to go between System 7 and System 6 System folders on the same volume—although you can. Hey, it's your data and your choice. Don't say I didn't warn you . . .

Performance monitoring tool—Speedometer  You really have to run this tool to appreciate it. It's fun, neat to watch in action, and gives very useful results. It compares your Macintosh system: CPU (clock), FPU, hard drive, and overall versus standard Apple configuration systems, and gives you your exact timings on the benchmark suite of tests. It's another checkmate tool for your toolkit, especially when you find that installing one vendor's performance "enhancement" actually decreases your hard drive's performance, or two vendors' identically sized hard drives give drastically different results on your Macintosh . . .

Layout  The only non-System 7-compatible item in the collection, Layout allows System 6 users to modify their desktop arrangements, including icon spacing, fonts, and so forth. It is a very useful tool, but Apple no longer uses the LAYO resource that this application modifies in its System 7 desktop manager. System 7's view option sort of gets the job done—but it's not the same. Try it, you'll like it.

All of the tools either have Read Me documentation explaining their use (a la Mode 32), come with online help as part of the application (a la Speedometer), or are straightforward without any assistance (a la ADA Probe). Enjoy.

A baker's dozen  301
You made it—all the way through the book. That’s the good news. The bad news is Macintosh Hard Disk Management was outdated before it was even printed. The techniques you learned for dealing with the different hard drive ownership aspects—purchasing, installation, setup, and use—are invaluable and timeless. But, technological change has or will have made obsolete all the specific product and pricing information in the book—even though its writer made every effort to tell you about the latest and the greatest at the time it was being written. I called this chapter, “the end of the beginning” because staying up to date with your Macintosh is a never ending process, and as Darwin Gross said in several of his books, “there’s always another step to take.”

This chapter will tidy up three areas: the future, housekeeping, and ongoing information sources. The future is change, but you can’t let it bother you—a few words here will tell you why. While no one can criticize your personal work habits, those that affect your Macintosh do make a difference, so I’ll spend a little bit of time and revisit these. Finally, I’ll direct you to sources that can help you continue to grow and to expand your Macintosh hard drive knowledge base.

A few words about change

No this is not a treatise from Mr. Toeffler or Mr. Naisbit. As I’ve mentioned before, don’t be too upset by the enormous amount of change taking place in your Macintosh universe. Apple is quietly working on next year’s Macintosh models that will continue to push the price/performance envelope, and third-party vendors are developing new and innovative options that will enable your Macintosh to perform even better. But why be concerned?

You need only to concern yourself with now—this moment. If you need a hard drive today, get the best you can afford with the money you have to spend. Ditto for the software. Overview the options and take your best shot. Period. End of story. You cannot wait for prices to drift lower. Of course they will. And whatever you buy today will be a used model and worth only a fraction of its purchase price tomorrow. But so what? Meanwhile you will have taken advantage of the increased speed and capacity the hard drive you just
purchased has given you over the model you previously had. Plus the organization introduced by your new software formatting, partitioning, and management tools will also be an improvement. You will have done the very best you can under the circumstances of the moment.

About two to three years down the road the process will repeat itself. Ain't life grand? Meanwhile, the options you have today are not too shabby at all—so enjoy them. Let Quantum—their Go•Drive 80 is shown in Fig. 12-1—and other vendors put your future hard drive in the palm of your hand . . .

A few words about your Macintosh work habits

Everyone has their own personal work habits. That's as it should be, we are all individuals. But how you set up and operate your Macintosh and its hard drive definitely affects their lifetime, their performance, their reliability—and your wallet or purse. You cannot afford to be sloppy in the care and feeding of your Macintosh and hard drive. If you are, it can cost you dearly.

Don't be a slob—with your Macintosh

Let's talk about involvement versus commitment for a moment. The old joke goes, "the difference between involved and committed is like eggs and ham. The chicken is involved. The pig is committed." Apple is committed to bringing you the most technologically involved and trouble-free Macintosh models. The hard drive manufacturers are committed to bringing you ever faster (yet smaller) and higher capacity hard drives while increasing their reliability. The software utility vendors are committed to bringing you products that
offer more and more functionality while being more bug-free than their predecessors. You cannot just be involved with your Macintosh—especially in a business environment. If you don’t become committed, you waste the efforts of all the people who are—the people who have taken the time and made the effort to place these wonderful products at your disposal. Most of all, if you’re not committed, you can waste your own time and money (or that of your company).

Commitment begins at the heart level—some say at the gut level. You bring your Macintosh and hard drive into your office or work environment and guarantee its integrity in three ways: setup, working, and backup. Let’s look at setup first.

This is no setup for a Macintosh like you

Rough handling accounts for more hard drive failures than all other factors combined, so don’t drop or shock your hard drive (or your Macintosh for that matter). Save the padded containers your Macintosh and hard drive came in. If you must ship them, do so only in their original padded container. Set up your Macintosh and hard drive where casual walking traffic does not bump it while it’s operating. Also, look at the overall environment—a freight loading dock would not be my first choice of an ideal location for a standard Macintosh and hard drive, although Macintoshes in special environment-protected housings could thrive there.

Static is the next killer. If you have a high static environment you know it without anyone telling you. Make sure your Macintosh and hard drive are protected from the same shocking experiences you are going through. Use antistatic mats on the floor of your work area, on your desktop, and make sure your Macintosh is well-grounded (third wire on power plug).

Excessive heat or cold, moisture (water or liquids), and dust are the next killers. All can prematurely age your Macintosh and hard drive and any of them—under the proper circumstances—can do them in instantly. A cup of coffee can kill your Macintosh, its keyboard, or your hard drive. Water can too. Even dust can, especially in the form of tiny airborne cigarette smoke particles that precipitate out of the air and settle on your Macintosh logic board or hard drive. Trust me here. I open up Macintoshes to repair them—the ones used in smoke-filled offices are incredibly dirty inside. Precipitated smoke and dust buildup on your Macintosh’s logic board act like a blanket, and the Macintosh slowly “cooks itself to death” because it can no longer dissipate its heat effectively. Precipitated smoke and dust buildup also clog your hard drive’s air filter—yup, just like the one in your furnace only smaller—and it dies a horrible and painful death from lack of air circulation. Notice I didn’t say slow death, either.

Connect your Macintosh to a stable, clean voltage source and use a UPS—not just a surge protector. More about this in a moment.

Don’t be the first on your block—to buy serial number 0001

In your Macintosh and hard drive working environment, if you make haste slowly, don’t fix it if it ain’t broke, and don’t be an early innovator or early adopter (especially not on Macintoshes being used in a production environment)—good Macintosh and hard drive karma will most likely be your reward.
As with other areas of life, we bring most problems upon ourselves. You have a perfectly good, stable, working Macintosh hardware and software setup. Then you introduce a new piece of hardware. This hardware says it requires new software to run. You add the software and, all of a sudden, your problems begin. Some of your applications that ran perfectly before now crash for no apparent reason. You get random system bombs when doing nothing at all—on and on. You make phone calls. You find the problems and make the fixes. After days, weeks, or months, all your problems are cleared up and you’re back to where you were before. Then you introduce another new piece of hardware and the process starts anew. Sound familiar?

The problem—assuming you’re using defect-free hardware and software—is caused by incompatibility across older and newer generations of hardware and software products. It’s like when you grow up and go back to your old neighborhood, the vacant lot that you used to walk across on your way to the store now has a building on it. The shortcuts taken by earlier hardware/software designers were invalidated by the rules Apple ever more stringently followed, both in designing new System software and in putting massive amounts of its software code into ROM to make things run swifter. The example that most easily comes to mind is Apple’s introduction of its 512K ROMs on the Mac IIfci and later Macintoshes. Many respectable and well established third-party vendors’ products crashed. The analogy of what happened from a third-party vendor’s viewpoint is “it’s as if the automobile seat belt laws were suddenly strictly enforced in your home state one day without warning.”

The punchline is, keep the XIVth corollary of Murphy’s Law in mind, which (loosely translated) states, “Never buy serial number 0001 of anything—wait for others to test the new, improved model to verify that it is improved and continues to work after it is new.”

Do be the first on your block—to buy UPS backup

On the other hand, in your Macintosh and hard drive backup environment, you want to be the first with everything you can possibly use that gives you the edge in preserving your all-important data.

Several chapters have been devoted to the backup and maintenance products and process that can help you enjoy your Macintosh and hard drive longer and secure your data. You already know about the importance of regular and frequent backups, about the need to rebuild your desktop frequently, about defragmenting and optimizing your hard drive periodically, and reformatting and restoring occasionally.

This section is all about Uninterruptible Power Supplies—UPS for short. Just like a hard drive is no longer a nicety—it’s a necessity on all modern Macintoshes—the same goes for UPS units. You simply cannot afford to plug your Macintosh and hard drive into the wall or into a surge suppressor and forget about them. Your oversight here can cause you great pain and suffering.

For a city dweller, a blackout can either be a fun party or a disaster. For a Macintosh owner, it’s always the latter—whatever you were doing when the lights went out, Murphy’s law says that it was probably important. This is one instance in which you don’t want to listen to your neighbor down the block who says, “nah, you don’t need one of those, just get a surge suppressor and save yourself some money.” Go talk to the telephone company about UPS—they are religious about them.
A small UPS can save the day for you. Think of it as a surge protector with a battery attached plus some minor switching electronics. You are talking about a $200 to $400 investment here. When the ac power goes away, it quickly switches over to an inverter that provides replacement ac power uninterrupted—as if nothing had happened. Without a UPS, your safest course of action is to turn off your Macintosh after a power hit. Sometimes the power surges a few times before the power company fixes the problem—none of these surges does your Macintosh any good.

I was minding my own business, working at my Macintosh one sunny day, when in the middle of the day, the power went out. When it came back on, my Macintosh came on, but I got that sickening feeling in the pit of my stomach as the screen sat there with the dreaded blinking question mark icon. No hard drive. The power hit knocked out my hard drive—it still rotated, but some of the data was scrambled. Luckily, the data was backed up, but I still had to go through all the steps to restore it. Cut to the same scene six months later—this time at night. The power went out, the UPS came on and I resumed working—in the dark. Not exactly. By the light of my Macintosh screen. My next step was to save what I had been doing. If nothing else, you will sleep better at night. In my case, the UPS paid for itself in only one power outage.

Your UPS can do the same for you. This is not a paid endorsement. It’s free and from experience. Put a UPS next in line on your shopping list after your new hard drive and before any new backup hardware. What good does it do to back up what you might need in the future if you don’t take care of what you are working on today? Trust me on this. You’ll love yourself in the morning—after a power hit happens. And if your neighbor comes over and says, “gee, I lost all my data in that power hit, one minute it was there and the next—” just nod your head sympathetically, offer condolences, then offer to show off your new UPS when it’s polite to introduce it into the conversation.

A few words about sources

Whatever Macintosh and hard drive you are now using or plan to use, it is certain that a slicker, faster, cheaper, or lighter one will be developed in the future. The same statement, even more strongly, can be made for Macintosh software. The avalanche of new products coming regularly from Apple and third-party software and hardware manufacturers requires that you adopt some sort of procedure, tailored to your own set of circumstances, ensuring your Macintosh setup is reasonably up to date. How do you do it? Easy. Read. Talk with others. Visit shows. Then formulate your own opinions and procedures.

The Macintosh world is unique. The Macintosh user benefits from a combination of dedicated, focused media, events, distribution methods, and user groups unlike those found in any other industry. There are a wide variety of information sources to assist you. This is not intended to be an all-inclusive list. I can only touch on the highlights here, so many other excellent sources will not be included—but you will undoubtedly find them in your search.

Mail order is in

In some geographic areas there is an unusual concentration of good dealers to assist you and that you assist in return by buying from them. But you can benefit from the mail order
channel regardless of where you are located. Virtually anything can be purchased through the mail: books, magazines, software, hardware, accessories, up through complete systems.

How do you deal with this channel? I have found a very simple process works for me. If I am buying a commodity item and I am not already buying that item from a vendor I am familiar with, I'll stick with one of the major mail order suppliers who advertise in the pages of the Macintosh magazines. If it's a new item on the market or a new item for me to buy, I'll go directly to the manufacturer or supplier, large or small, and place a small order for it. If the product, their service, and the price measure up, I'll favor them with a larger order. If not, I'll buy from another source or even return the product.

The mail order sources for the products mentioned in this book have already been listed at the end of each chapter so they will not be repeated here.

Magazines are in

The Macintosh community is blessed with an amazing selection of outstanding weekly and monthly magazines to suit every palate. They, as much as the enthusiasm of the Macintosh users themselves, are responsible for the spread and absorption of the Macintosh into the mainstream of computer culture.

I have referenced the monthly magazines *Macworld* and *MacUser* repeatedly in the text. I cannot say enough about them. From the beginning they were a cut above any other computer periodicals I have ever received.

*MacWEEK* is another outstanding publication, perhaps the best weekly I have ever received. They are legendary in the Macintosh community for reporting the facts just as they happen, straight off the cuff—even if they absorb a little heat in the process from Apple and others for being a little too soon and a little too accurate in their reporting.

As a minimum, you should be subscribing to:

*Macworld*
P.O. Box 51666
Boulder, CO 80321-1666
(800) 234-1038

*MacUser*
P.O. Box 56986
Boulder, CO 80321-6986
(800) 627-2247

*MacWEEK*
P.O. Box 5821
Cherry Hill, NJ 08034
(609) 428-5000

Three other magazines you should subscribe to, although they are not Macintosh-specific, are:
Two shopper's guides are available to assist you quarterly and annually:

**Macintosh Buyer's Guide**  
5615 W. Cermak Rd.  
Cicero, IL 60650-2290  
(800) 826-9553

**Macintosh Product Registry**  
660 Beachland Blvd.  
Vero Beach, FL 32963-1794  
(407) 231-6904

There are many other magazines from which you might benefit that serve niches in the Macintosh market and other aspects of the personal computer field, but the above should get you started.

**Computer shows are in**

Again the Macintosh community is blessed. No other industry has a dedicated user event that you can attend once a year and actually see and hear it all. The Macworld Exposition, held in the Spring in San Francisco (serving the West coast) and in the Fall in Boston (serving the East Coast) is the one event every Macintosh user should plan to attend at least once, if not annually. It normally attracts around 50,000 people. Unlike other trade shows, it caters specifically to Macintosh products and, except for one industry day, specifically to the Macintosh end user.

To learn more about it, contact:

Mitch Hall Associates  
P.O. Box 4010  
Dedham, MA 02026  
(617) 361-3941

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User groups are in

Although every industry has its user groups, in the Macintosh community this phenomenon has been raised to an art form. There is nothing else that can give you as high a return on, and as much benefit from, your low annual dues investment. Only minutes of networking at a monthly general or special interest group meeting can save you hours, if not days, of time. Later on, when you have established relationships within the group, you can accomplish the same networking over the telephone.

The user groups are a marketing force to be reckoned with as well. The monthly meetings of the larger user groups such as Berkeley, Boston, and Portland (OR), regularly attract industry leaders who know this fact very well. An auditorium full of experienced, opinionated, and intelligent Macintosh users is also a force to be reckoned with. But it is a two-way street, and the industry leaders go back with much useful marketing feedback.

A simple phone call to Apple Computer gets you the number of the Macintosh user group nearest to you. Call (800) 538-9696, ext. 500.

Local dealers are in

Hey, how about that, even they made the list. This is another resource you might consider and it's right underneath your nose. Where I live (Portland, Oregon) there are five Apple dealers—Alpha Computers, BizMart, The Computer Store, Computerland, and Heath/Zenith. There is also one very Macintosh-knowledgeable independent dealer—Mac Friends. I hope you are similarly blessed in your area.

Ahhh, but there are rules to obey here. When you use the resources of your local computer store, remember it's a two-way street. The person on the other side of the counter from you is being compensated for his or her time in assisting you. So, use these resources wisely. If someone has just pulled 50 monitors off the shelf for you to take a look at before making your selection, do not go and buy your monitor from a mail order source after giving that person a polite thank you. They will not be excited about working with you again. And you've probably heard "What goes around comes around."

If you're getting good assistance from a store and from a sales person, it's just good manners and taste on your part to compensate them for their efforts by bringing them your business. Sure, you might pay more. But it will certainly pay dividends to you over the long haul.

Consultants are . . . consultants

Remember the movie, "The Good, The Bad, and The Ugly"? That's the whole book on consultants in short form. My best advice is, find one whom you can trust, who is empathetic to your needs, who knows what he or she is talking about, who is reasonably priced, and who is there for you when you need him or her.

And they are out there, believe me. A good Macintosh consultant will make you feel like you have just died and gone to heaven. Treat yourself.
Books

History  Books on the history of the Macintosh include:


Macintosh  In addition to this book, you might find these books helpful:

Glossary

A/UX  Apple's version of UNIX, the near industry standard multiprogramming, virtual memory operating system. Apple's advantage is that their version of UNIX has a Macintosh interface front end, making it more user friendly and easier to use while retaining all its powerful features.

access time, average  The amount of time it takes the computer to find and read data from a disk or from memory. For a hard disk it is defined as seek time (time to find the track) plus settling time (time to stabilize over the track) plus latency time (time to bring the sector data on the track under the head). Some manufacturers ignore both the average consideration and the latency factor to publish better times.

ADB  Apple Desktop Bus is now the Apple standard serial communication bus that allows you to connect up to 15 input devices such as keyboard, mouse, joystick, puck, other pointing/motion devices, and graphics tablets to your SE and newer Macintoshes. It allows the devices to be connected in daisy chain fashion, providing increased flexibility at minimal increase in cost.

ANSI  Stands for American National Standard Institute, which sets standards for devices such as computer terminals.

Apple menu  The menu farthest to the left in the menu bar, indicated by an Apple symbol, from which you choose desk accessories.

AppleTalk  The system of network software and hardware used in various implementations of Apple's communications network.

application  Short for application program.

ASCII  Abbreviation for American Standard Code for Information Interchange. Binary numbers from 0 to 127 represent the upper- and lowercase letters of the alphabet, the numbers 0 to 9, and the several symbols found on a keyboard. A block of eight 0s and 1s are used to represent all of these characters. The first 32 characters, 0 to 31, are reserved for noncharacter functions of a keyboard, modem, printer, or other device. Number 32, or 0010 0000, represents the space, which is a character. The numeral 1 is represented by the binary number for 49, which is 00110001. Text written in ASCII
is displayed on the computer screen as standard text. Text written in other systems, such as WordStar, has several other characters added and is very difficult to read. Another 128 character representations have been added to the original 128 for graphics and programming purposes.

backup A copy of a disk or of a file on a disk. Backing up your files and disks ensures that you won’t lose data if the original is lost or damaged.

baud A measurement of the speed or data transfer rate of a communications line between the computer and a printer, a modem, or another computer. Most present day modems operate at 1200 baud. This is 1200 bits per second or about 120 characters per second.

bezel A plastic or metal plate typically covering the front of a floppy or hard disk mounted in a computer case or chassis.

binary numbers Computers “think” in binary language, or 1s and 0s. The circuit is either “on” or “off.” In computer terms, each individual 1 or 0 is called a bit. In mathematical terms, the number 2 raised to a power is a binary number. If I had three bits in a row, 111, that represented binary numbers with values of 2⁰, 2¹, and 2², their base ten values (the numbers we think in) would be 1, 2, 4, and would represent the number 7. By changing the 1s and 0s pattern, the sum of their digits could represent any number from 0 to 7, or eight different values. In this way, computer values are changed to those we understand and vice versa.

bits A contraction of binary and digits. The smallest unit of information that a computer can hold. The value of a bit (1 or 0) represents a simple two-way choice such as yes or no, on or off, positive or negative.

boot or bootstrap or reset The process of the Macintosh turning on, checking that its memory is okay, checking that its stored parameters are set as they should be, and turning over control to the user. A small amount of the program that does this is stored in ROM. Using this, the computer “pulls itself up by its bootstraps.” A reset is sometimes necessary to get the computer out of an error message or bomb dialog box if it is hung up for some reason.

buffer A buffer is usually some discrete amount of memory that is used to hold data. A computer can send data thousands of times faster than a printer or modem can utilize it. But in many cases the computer can do nothing else until all of the data has been transferred. The data can be input to a buffer, which can then feed the data into the printer as needed. The computer is then freed to do other tasks.

bug The early computers were made with high voltage vacuum tubes. It took rooms full of hot tubes to do the job that a credit card calculator can do today. One of the large systems went down one day. After several hours of troubleshooting, the technicians found a large bug that had crawled into the high voltage wiring. It had been electrocuted, but had shorted out the whole system. Since that time any kind of trouble in a piece of software or hardware is called a bug. To debug it, of course, is to try to find all of the errors or defects.

bus Wires or circuits that connect a number of devices together, or a path over which signals travel. Typically refers to the input and output paths to the Macintosh such as the Nubus cards in the Mac II family and the expansion bus slot in the Mac SE.

byte The smallest computer word or character consists of 8 bits and is called a byte. These 8 bits can be arranged in 256 different ways (2 × 2 × 2 × 2 × 2 × 2 × 2 × 2
= 256, or $2^8$. Therefore, one byte can be made to represent any one of the 256 characters in the ASCII character set. It takes one byte to make a single character.

**cache memory** High speed memory in front of regular processor memory to speed up the computer. When the computer writes data in main memory, it leaves a copy of it in cache memory too. When the computer goes to read data, it looks first in cache memory. If it finds the data there, it doesn’t bother to look in main memory. If the cache and program loops are of the right size, the computer hardly ever looks in main memory. As a result, everything runs a lot faster.

**capacity** Refers to the amount of binary data in 8-bit bytes that can be stored on the hard disk’s multiple surfaces. Be aware that not all hard disk capacities are stated equally. Capacity is difficult to pinpoint accurately until after the disk is installed in the computer and formatted, because different computer types, controllers, formatting software, and disk drives produce different results.

**cdev** Stands for control device, an Apple or third party program that, when installed in the System Folder, appears as an icon in the Control Panel, and modifies a portion of the Mac’s interface. For example, you can click on the cdev in the Control Panel to gain access to settings controlling mouse movement, the desktop pattern, the keyboard responsiveness, and colors of menus, as well as more powerful functions.

**CD ROM** Stands for compact disk read-only memory. A convenient and compact way of storing and distributing large volumes of data.

**character** A letter, a number, or an 8-bit piece of data.

**chip** An integrated circuit, usually made from a silicon wafer. It is microscopically etched and has thousands of transistors and semiconductors in a very small area. The 80286 CPU used in the AT has an internal main surface about one-half-inch square. It has 120,000 transistors on it.

**clipboard** A holding place for temporarily storing text or graphics.

**CPU** Stands for central processing unit. The engine or chip that drives your Macintosh.

**consultant** Someone who is supposed to be an expert who can advise and help you determine what your computer needs are. Similar to an analyst. There are no standard requirements or qualifications that must be met, so anyone can call themselves an analyst or consultant.

**desktop** The screen or environment that the Apple Macintosh initially presents to the user, just like working at a real desk.

**dialog box** A window or full-screen display that pops up in response to a command.

**directory** Either a listing that contains the locations and names of a hard drive’s files and folders, or specific area (track and sector) of a drive containing a group of files.

**DMA** Stands for direct memory access. Some parts of the computer, such as the disk drives, can exchange data directly with the RAM without having to go through the CPU.

**DOS** Stands for disk operating system. Also shorthand for MS-DOS and PC-DOS, the software engines that drive the majority of the IBM-compatible clone computers. Transparent to the user in the Macintosh environment.

**DOS PC** Denotes a personal computer which utilizes the IBM DOS operating system as opposed to utilizing the Macintosh operating system, UNIX, or something else.

**DRAM** Stands for dynamic random access memory. A type of memory that must constantly be refreshed, or recharged. Primary type of memory used in PCs.
FDHD  Stands for floppy disk high density—Apple's latest floppy drive 1.4Mb standard.
Finder  The part of the Apple Macintosh software that creates and maintains the user environment, keeps track of files on the desktop, etc.
FKey  A utility program that is activated by pressing a keyboard sequence at any time, no matter which program the Mac is running.
floppy disk  A disk made of flexible plastic, as opposed to a hard disk, which is made of rigid material. The term floppy was formerly applied to disks with thin, flexible disk jackets, such as 51/4-inch floppy disks. With 31/2-inch floppy disks, the disk media itself is still flexible, but the jacket is made of hard plastic. Original Mac diskettes were 400K capacity single-sided diskettes, and then 800K double density diskettes were introduced. These were followed by today's high-density standard, the 1.4Mb capacity drive used by Apple's FDHD Superdrive.
folder  An icon that contains a group of files to set them apart from others in a drive's directory. Folders can contain either files or other folders.
fonts  The different types of print letters such as Gothic, Courier, Roman, Italic and others.
formatting  The process which puts specific track and sector "pockets" into the hard disk, building exact locations where you can later find data. To quickly move data on and off the disk, certain tracks are identified as directory tracks. These contain information flags or pointers which point to or identify the location of data on the disk.
fragmentation  When a diskette or hard disk has data that has been changed several times, pieces of the files are located on different tracks and sectors. This slows down writing and reading of the files because the head has to move back and forth to the various tracks. When these files are copied to a newly formatted diskette, each file is written to clean, contiguous tracks, decreasing the access time to the diskette or hard disk.
gigabyte (Gb)  One billion bytes.
hard disk cylinders, tracks, sectors  Like a phonograph record, floppy and hard disk platters have information stored on each side. Unlike a phonograph record's spiral, a computer disk's platter is recorded in concentric areas. Each side of a platter is called a cylinder. Tracks are the pattern of concentric circles or rings on the disk's surfaces established by the formatting software onto which the data is written. Frequently, the words cylinder and track are used interchangeably. Sectors are the subdivided portions of the tracks. They are also called blocks, and refer to a specific location on a given track onto which data is written. A Mac disk might be formatted with 512 bytes of data in a sector or block. The interface reads or writes one sector at a time regardless of the amount of data actually being read from or written into the sector.
hard disk platters  Also called the hard disk media. A rigid disk made from aluminum, a metallic alloy, or glass coated on both sides with a thin magnetic oxide layer. Comparable to the flexible disk medium in a floppy diskette, typically made of thin plastic with an even thinner magnetic coating on both sides.
hard disk size, height  Size refers to the diameter of the disk inside the enclosure, or its width (51/4 inches and increasingly 31/2 inches today). Height is a carryover from early IBM DOS PC days. Full height refers to a disk that takes up the entire height of the original PC front bezel opening, designed to fit 51/4-inch-wide disk cases. Half height means half that dimension, or two drives in the same space. Today, new Macs
feature one-third height (approximately one inch high) 3 1/2-inch disk drives.

**hard disk heads** Like the tone arm of a phonograph record, the hard disk read/write heads go to any spot on the disk instantly and transfer information at a very high rate once there. Hard disk heads float on a cushion of air and never touch the platter's surface. On a floppy drive, heads on opposite sides of the media press it between them and tiny electromagnets at the tip of the heads either read or write data.

**hertz (Hz)** A unit of frequency of vibration or oscillation expressed in cycles per second. For example, the Mac 68000 CPU operates at 8 megahertz (8 MHz).

**HFS** Stands for Hierarchical Filing System. The Macintosh filing system that lets you divide the files on a disk into specific groups, or directories and subdirectories.

**icon** A graphic representation of an application program, program file, or a file folder (to hold either) on the Apple Macintosh desktop. A mouse can be pointed to an Icon and double clicked to open the application or file. A key feature of the easy-to-use Macintosh graphical interface.

**init** Stands for initializing software. After an init program is placed inside the System Folder of a startup drive, it automatically runs when you start up your Macintosh.

**initialize** To prepare a blank disk to receive information by organizing its surface into tracks and sectors; same as format.

**input/output (I/O)** The process by which information is transferred between the computer's memory and its keyboard or peripheral devices.

**installer** An application program provided by Apple that facilitates the installation of cdevs and updated System files on the Macintosh. Some third party programs, such as TOPS, have their own installer programs.

**interface** Hardware or software that follows a distinct set of rules and allows communications between two systems.

**interleave** The speed of the computer attached to the hard disk might not be fast enough to read or write all the data from one sector in a single rotation of the disk. To avoid this problem, disks initially being formatted to work with slower Macintoshes have their sectors "interleaved." A "slow" Mac Plus requires a 3:1 interleave. That means the next "logical" sector from which the controller reads or writes data actually skips two sectors over from the last "physical" sector located on the disk. A "faster" Mac SE requires a 2:1 interleave. The next logical sector read or written actually skips one sector over from the last physical sector located on the disk. Mac IIs, Mac SE 30s, and up use a 1:1 interleave. The next logical sector read or written by the controller is identical with the physical sector located on the disk.

**K, kilobyte** 1024 bytes or $2^{10}$ bytes. Two multiplied by itself ten times equals 1,024.

**logic board** A large circuit board that holds RAM, ROM, the microprocessor, custom-integrated circuits, and other components that make the computer a computer.

**megabyte (Mb)** One million bytes (or 1,048,576 bytes to be precise); a measurement of disk or memory storage capacity.

**megahertz (MHz)** One million cycles per second; a measurement of frequency.

**MFS** Stands for Macintosh Filing System. An older filing system on the Macintosh that did not allow the arrangement of a drive's files into various subdirectories.

**memory** A high-speed temporary storage area next to the main computer used to store data and its location information.

**memory, RAM** Random access memory. Computer memory that provides the main
internal storage available to user for programs and data while the power is turned on; erased when power is turned off. RAM memory only temporarily stores data. No power, no data.

**memory, DRAM** Dynamic RAM, so called because it has to be constantly refreshed, or recharged. Primary type of memory used in PCs.

**memory, SRAM** Static RAM, composed of transistors that remain in their current state (on or off) until changed, or power is removed. SRAM can be very fast and does not need to be refreshed.

**memory, PRAM** Parameter RAM. A small amount of RAM, powered by the Mac’s internal battery, set aside to store a few user-definable settings so they are not lost each time the Mac is turned off.

**memory, ROM** Read-only memory. This is a permanent storage medium that is uniquely “programmed” with data. Think of it as a chip with thousands and thousands of tiny fuses on it that are either blown or intact, in accordance with the instructions. It gives any computer its unique personality by telling it how it will execute certain instructions.

**menu** A list of choices or options. A menu-driven system such as that of the Apple Macintosh makes it very easy for persons new to computers to learn how to use them.

**microsecond** One millionth of a second, or $10^{-6}$ seconds in math notation.

**mouse** A pointing device that controls the movement of a cursor on the screen.

**MTBF** Abbreviation for “mean time before failure.” An average of the time between failures, usually used in describing a hard disk or other components. An MTBF rating of 50,000 hours does not mean each hard disk will last that long before needing repair. It means that in a population of 50,000 hard disks, 1 will fail every hour, 24 hours per day. This means that about 18 percent of the drives will have to be repaired before year’s end. During a 3-year period, over one-half (54 percent) of the original 50,000 hard disks will require some amount of service.

**nanosecond (ns)** One-thousandth of a microsecond, or in math notation $10^{-9}$ seconds—a very short time. Used to measure speeds of SIMM memory chips, i.e., an 80 ns SIMM is capable of operating faster than a 120 ns SIMM.

**network, networking** The act of connecting two devices together, similar or dissimilar, or the resultant product after it has been done.

**path** The route from a disk directory through folders or subdirectories to locate a particular file or folder.

**pathname** The written expression of a path. A file called Memo inside a folder called Work on a disk called Data would have the pathname Data:Work:Memo. Pathnames always contain colons between the directory, folder, and file names, without any extra spaces.

**peripheral card** A removable printed-circuit board that plugs into one of the computer’s expansion slots, allowing the computer to use a peripheral device or to perform some subsidiary or peripheral function.

**peripheral device** A piece of hardware such as a video monitor, disk drive, printer, or modem, used in conjunction with a computer and under the computer’s control. Peripheral devices are often (but not necessarily) physically separate from the computer and connected to it by wires, cables, or some other form of interface. Such devices often require peripheral cards.
ports  Access connections to gain entry to the Macintosh to instruct it what to do and give or receive data to/from it. Usually serial, SCSI, or ADB, but can also exist via direct attachment to the CPU chip or a special connector interface.

PostScript  LaserWriter and other PostScript-compatible printer’s page description language, used to specify how a file is printed.

PMMU  Abbreviation for paged memory management unit. Used with A/UX and Apple system 7.0 software to give multiprogramming and virtual capabilities.

PRAM  Parameter RAM. A small amount of RAM powered by the Mac’s internal battery, set aside to store a few user-definable settings so they are not lost each time the Mac is turned off.

price performance  A measure of efficiency when one factor is divided by the other. Also enables different types of objects to be compared easily by setting up a standard of price and performance.

QuickDraw  A built-in instruction set your Macintosh uses to represent text and graphics on its screen.

RAM  Stands for random access memory. Computer memory that provides the main internal storage available to use for programs and data while the power is turned on; erased when power is turned off. RAM memory only temporarily stores data. No power, no data.

rdev  Stands for resource device. A software driver for an external device such as a printer, network modem, or file server. An rdev appears as an option in the Chooser after it is installed in the System Folder.

ribbon cable  A type of cable with multiple conductors bonded together to lie flat.

ROM  Stands for read-only memory. It does not change when the power is turned off.

SCSI  Stands for small computer system interface. A fast parallel hard disk interface system developed by Shugart Associates and adopted by the American National Standards Institute (ANSI). The high-speed SCSI bus allows up to seven devices (disk drives, CD-ROM drives, tape drives, scanners, printers, etc.) to be connected, each generating its own input and output traffic on the bus.

SCSI ID number  A numeric identification of a SCSI device connected to a Mac. Each SCSI device must have a unique ID number from 0 to 6. ID number 7 is reserved for the Macintosh.

sector  A section of a track on a disk or diskette.

serial  The transmission of one bit at a time over a single line.

server  A computer whose files are made available to other computers on a network.

SIMM  Single in-line memory module. A SIMM typically consists of two to eight individual RAM chips attached to a small printed circuit card. Some IIci and IIfx SIMMs use nine chips; the extra one is for parity, a quick way of checking your memory’s health. Memory was revolutionized by use of SIMMs. First introduced with the Mac Plus in 1986, SIMMs made it possible to add additional memory easily to the Macintosh Plus logic board and to any Macintosh developed since then.

slots  Refers to the connectors or connections used for additional boards to be added to an SE, SE 30, or Mac II family computer.

SRAM  Stands for static random access memory. It is composed of transistors that remain in their current state (on or off) until changed, or power is removed. SRAM can be very fast and does not need to be refreshed.
Startup Disk  The drive whose System file is used to start a Macintosh.

static    Refers to an electrical charge picked up by a user that can be very damaging to
delicate electronic computer circuitry, and magnetic media; precautions should be
taken against it.

subdirectory   A collection of files grouped together inside a directory of files. On the
Macintosh under HFS, subdirectories are known as folders.

submin D   A connector type typically used with the logic boards of Macintosh com-
puters for SCSI, floppy, and video monitor connections.

suitcase file   A storage file for fonts or desk accessories.

SWIM    Stands for super Wozniak integrated machine and is the latest in the family of
chips (following the IWM) that reduce complex floppy disk controller circuitry onto a
single chip.

synchronous   Able to perform two or more processes at the same time, such as sending
and receiving data, by means of a mutual timing signal or clock.

System, System icon, System software   Stands for the Apple’s Macintosh operating sys-
tem software, transparent to the user, represented by an icon in a folder which resides
on the desktop.

System 7.0   The latest in the family of Apple systems and the first one to introduce multi-
programming and virtual capabilities to the Macintosh environment.

terminators   Physical devices used to begin and end a chain of SCSI devices. May be
resistor packs or cable plugs. The first and last SCSI devices connected to a Mac in a
chain must each have a terminator.

throughput   The amount of data input a device is able to handle; a measure of capacity.

tracks   A pattern of concentric circles or rings on the disk’s surfaces, established by the
formatting software, onto which the data is written.

trash icon   An icon to which the user points in order to delete a file.

TTL   Stands for transistor to transistor logic. An electrical interface definition which
also applies to the simplest, lowest cost class of monitors.

UNIX   The industry standard, multiprogramming, virtual operating system developed
and supported by AT & T.

user groups   A club or a group of people who use computers. Often the club will be
devoted to users of a certain type of computer; usually anyone is welcome to join.

virtual memory   A feature that allows certain operating systems to designate a portion of
the disk space as a part of memory in a manner transparent to the user, so that larger
programs function as if they were memory resident all the time.

volatile   Refers to memory that loses stored information when power is lost (e.g.,
RAM). Nonvolatile memory would be that of a hard disk or tape.

word length   Earlier computers and chips “thought” in word lengths of 8, 12, 16, and
24 bits. They defined and moved data in chunks of that size. Two raised to that number
defined the limit of memory they could directly address. Most of today’s com-
puters and chips use 32 bits and are able directly to address four billion address
locations (2^32 or four gigabytes).

WYSIWYG   Pronounced “wizzywig.” Stands for “what you see is what you get.” One
of the benefits of the Mac interface is that what you see on the screen is reproduced
faithfully by the printed output. Apple specified that Mac-compatible displays have a one-to-one ratio between the 72 dots per inch on the display and the 72 dots per inch at which the Apple Imagewriter prints. This feature, used by many software applications, produces high quality output in less time because intermediate steps are saved when the layout for the final print product is done on the screen.
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About the accompanying disk

To use the public domain and shareware programs on the enclosed disk, move your read-write tab to a locked position and copy the files you want to your hard drive. (You can use Command-A if the disk is shown in the active window to select all the files.)

Some programs include separate documentation files; these programs are in folders with the documentation. If the program you want is in a folder, open the folder by double-clicking. Start the program you want by double-clicking on its icon.

The programs included are:

ADBProbe
Commander v1 (folder)
DisKeeper v1.2
Layout v1.9
MemINIT 2.0
MODE32 (folder)
RAM Check v2.0
SCSIInfo (folder)
SCSIProbe-cdev v2.07, New INIT v3.0 (folder)
SCSI Identifier v1.4
Speedometer
System Picker v1.0b9 (folder)
Version v1.0 (folder)

Standard Macintosh conventions, such as Command-Q to quit, apply.
Here's the most complete, easy-to-use source of practical advice available on how to keep your Macintosh hard disk working to its full potential. In *Macintosh Hard Disk Management*, Bob Brant does much more than just explain how to manage files and applications, he also takes a close look at the hard disk itself—how it works, how to keep it running properly, and how to fix it if it breaks down.

Conveniently organized into three sections—Hardware, Operating Your Hard Drive, and Optimizing Your Hard Drive—this one-of-a-kind guide has the answers to all the questions you might have:

- What's the best hard disk to buy and where should I get it?
- What does SCSI mean and why is it important?
- Should I use Macintosh System 7 or an earlier version?
- How do I format and initialize my hard disk, and install programs?
- How should I organize my hard disk?
- How do I maintain and troubleshoot a hard disk?
- How do I back up data on my hard disk?
- What utilities should I use to manage my hard disk?

... and many more. You'll learn everything you need to know about running your hard disk with any of the latest Mac models—including the LC, IIfi, IIfci, and Classic—with System 7 or earlier versions of the Macintosh system software. Brant covers all kinds of Macintosh storage media, from standard 20Mb hard drives to high-capacity optical and tape devices. Plus, several utilities—including ADB Probe, Connectix Mode 32, RAM Check, System Picker, DisKeeper, Speedometer, and Layout—are included on disk.

About the Author

Bob Brant is a full-time Macintosh consultant, specializing in providing hardware and software solutions to a wide range of business clients. After working for ten years with Digital Equipment Corporation and Data General, Brant gained experience in a variety of sales and management positions with Businessland, Nynex, Microage, and a regional computer reseller in the northwest. He holds a degree in electrical engineering from the University of Denver.