TAKE CONTROL OF
BACKING UP YOUR MAC

by JOE KISSELL
$14.99

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The data on every Mac should be backed up to protect against theft, hardware failure, user error, and other catastrophes. This book helps you design a sensible backup strategy, choose and configure the best backup hardware and software for your needs, and understand how to make your backups as painless as possible.

If you want to share this ebook with a friend, we ask that you do so as you would with a physical book: “lend” it for a quick look, but ask your friend to buy a copy for careful reading or reference. Discounted classroom and Mac user group copies are available.

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You can access extras related to this ebook on the web (use the link in *Ebook Extras*, near the end; it’s available only to purchasers). On the ebook’s Take Control Extras page, you can:

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Basics

To review background information that might help you understand this book better, such as finding System Preferences and working with files in the Finder, I recommend reading Tonya Engst’s ebook *Take Control of Mac Basics*.

In this book, when I use the term *disk* by itself, I generally mean your Mac’s primary internal storage device—whether that’s a mechanical hard drive, an SSD, or other solid-state storage. (Apple, after all, still uses the term “Macintosh HD” as the default name for your Mac’s startup volume, even when it’s not stored on a hard disk.) A *drive* is a physical device for storing data; a single drive can comprise one or more *volumes*, or logical storage devices. The volume that contains the copy of macOS currently used to boot your Mac is your *startup volume*. I’ll specify *hard drive* when I need to talk specifically about the little boxes with spinning platters.

What’s New in Version 3.1

Version 3.1 is a minor revision that brings this book up to date with macOS 10.14 Mojave and various changes in hardware and software. Along with numerous small edits, this version contains the following significant changes:

- Added a lot of new information in *What’s New in Mac Backups*, including mentions of the end of Prosoft Data Backup and of Apple’s Time Capsules, the beginning of Retrospect Solo, continuing changes related to APFS, and things owners of new Macs equipped with T2 chips will need to know about backups.

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• Included more information about snapshots in APFS; see the note in Snapshots and File Lists and changes to the sidebar Local Snapshots

• Removed various mentions of Data Backup and other products that are no longer available

• Added information in Retrospect and Retrospect Tips about the new Retrospect Solo app

• Made several mentions of Jeff Carlson’s new (and highly relevant) book Take Control of Your Digital Storage

• Updated Creating a RAID with SoftRAID to discuss issues relating to APFS volumes

• Stripped most of the discussion of Time Capsules from Network Storage Devices

• Updated Configure a Drive in El Capitan or Later to cover cases in which APFS is a suitable format

• Added a sidebar about putting APFS Bootable Duplicates on HFS Plus Volumes

• Included notes in Test Your Duplicate and Use Your Bootable Duplicate about booting Macs with T2 chips from external drives

• Gave a different example of a cloud backup service in HIPAA and Cloud Backups

• Added a potential downside to Backblaze in Self-Contained Cloud Backup Services

What Was New in the Third Edition

The book you’re now reading has a long and complex history, having gone through various title changes, splits, and merges stretching all the way back to 2004—and the third edition of this book (version 3.0) represented not only a change in its version number but also in its title.

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After I purchased Take Control Books from TidBITS Publishing Inc. in May 2017, I decided to bring this book back under the Take Control umbrella. That meant reverting to its previous title and incrementing the edition number by one (even though there were, in effect, two editions of the book between the second and third).

It would take many pages to detail the differences in each iteration of the book (and the third edition alone contains hundreds of changes), but here are the most significant changes since *Backing Up Your Mac: A Joe On Tech Guide*, version 2.1:

- Updated the entire book for compatibility with macOS 10.13 High Sierra; see *APFS Evolves in Mojave* for an overview
- Removed coverage of CrashPlan, except for the explanation of why I no longer recommend it; see *CrashPlan for Home Is Finally Gone*
- Removed coverage of FireWire (which hasn’t been seen on new Macs in many years) and eSATA (which was never a built-in option), while saying more about Thunderbolt 3 and USB-C
- Updated information on various cloud storage and backup services; see *Use a Cloud Backup Service*
- Expanded *Factors to Reevaluate* to cover Optimized Storage (in 10.12 Sierra and later) and network backups
- Added a new chapter, *Choose Local or Network Backups*, to explore the relative merits of using a hard drive connected directly to your Mac versus a NAS, Time Capsule, or Mac server
- Removed coverage of Synk, which has been discontinued

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• Totally reorganized, updated, and expanded the Choose Backup Hardware chapter; new topics include Decide on a Storage Configuration and Evaluate Network Storage Options

• Added a sidebar on why to Keep Time Machine Backups Separate from Other Data

• Updated the Configure and Use Time Machine chapter to cover High Sierra changes (such as the new topic Use a Mac as a Time Machine Server), add advice, and remove obsolete information

• Updated the tips for using Arq, ChronoSync, and Data Backup in Use Other Versioned Backup Software

• Updated the instructions for using Carbon Copy Cloner and SuperDuper! in Create and Use a Bootable Duplicate

• Updated Self-Contained Cloud Backup Services with new information on Acronis True Image and IDrive, and updated information about Backblaze and DollyDrive

• Updated BYOS (Bring Your Own Software) Internet Backups with current pricing, plus information on Wasabi

• Updated Back Up Data from the Cloud with current details about several providers
Introduction

The first time I thought seriously about backups was right after I lost a valuable, irreplaceable piece of data—an email message sent to me by a celebrity—as the result of a disk crash. That was more than 20 years ago, and ever since, I’ve practiced and preached diligent Mac backups. After all, Macs may be fantastic computers, but they’re still subject to electronic and mechanical failure, theft, human error, and many other problems that could cause anyone to lose data.

My first book about Mac backups was published in 2004. Back then, I found that many readers still needed convincing that hard drives were better for backups than CDs, that backups ought to run without manual intervention, and even that backups were worth the bother in the first place. When Apple introduced Time Machine as a built-in backup feature in Mac OS X 10.5 Leopard in 2007, backups became easier to perform and harder to ignore. Although Time Machine isn’t the only way (or even, necessarily, the best way) to back up your Mac, it has done more to popularize the concept of Mac backups than anything that came before it, and it set a new standard for usability.

If you don’t back up your Mac at all—or if you do so only haphazardly—this book will help you over the initial hump of getting started with a solid backup plan. Having great backups no longer requires lots of money, time, or technical expertise. You can be up and running in a couple of hours, after which things will run mostly on their own, and the only time you’ll have to think about your backups is when it comes time to restore lost data—something you won’t have to fear anymore.

On the other hand, if you already have a backup system, it might be time for you to update it. Technology changes rapidly, and you could find that a different approach (or newer hardware, software, or cloud services) will serve your current needs better.

This book explains how to develop a solid backup strategy, what your hardware and software choices are, how to set everything up, what pitfalls you may encounter, and how to restore your data if disaster...
strikes. Rather than explore every alternative, I guide you gently but firmly into a fairly narrow set of options that should yield excellent results for the vast majority of Mac users.

Before we get started, I need to mention a few qualifications:

- This book is primarily for people who need to back up either a single Mac or a small network—not for system administrators who need to back up dozens or hundreds of machines. As a result, I say little about the high-end equipment and enterprise-grade software used for backing up large networks.

- I don’t cover command-line software such as `cp` or `rsync`. My goal is to make the process as simple as possible—ideally, without requiring you to know anything about Unix or using the Terminal utility to configure and interact with your backups.

- Although I provide basic guidance for performing backups with several popular apps, I can’t give you foolproof, step-by-step instructions for setting up every backup app you might use. But by the end of this book, you should have enough information to determine, with the help of your software’s documentation, the preferences and settings that will produce your desired outcome.

- To make this book easier to read, I’ve included specific instructions only for OS X 10.9 Mavericks and later, including macOS 10.14 Mojave. Although much of this material applies generally to Macs running older versions of OS X, I don’t spell out any differences. Also, although I don’t cover Windows extensively, do see Back Up Windows Files and Volumes, which discusses backing up Windows when it’s running on your Mac.

- I’ve put certain information—like feature comparisons of Mac backup hardware and software—in online appendixes.
Quick Start

First things first: most people do not need to read this entire book! There’s a lot of detail here for those who want it, but if your backup needs are unexceptional, you can skim much of this material. Even so, don’t skip Plan a Backup Strategy, which outlines the basics and helps you understand the hardware, software, and setup advice I give later.

For all readers, the following points should help you understand what I cover where, and which parts you’re most interested in.

Decide on a backup strategy:
• If you don’t already have a backup system in place, start at the beginning, with the Plan a Backup Strategy chapter. You’ll soon Understand Joe’s Basic Backup Strategy, which revolves around three key components: versioned backups (containing multiple copies of files as they existed at various points in time), a bootable duplicate (a complete, bootable copy of your startup volume), and offsite storage (in case something wipes out your Mac and the backup media sitting right next to it).

• If you’re already backing up your Mac (even if your strategy is based on recommendations from an earlier version of this book), read Reassess Your Backup Strategy to find out what’s new and which Factors to Reevaluate to determine whether any changes are in order.

Assemble the components:
• Consider whether the best approach for your situation is to store your backups on hard drives (or other devices) directly connected to your Mac(s), or on network servers or appliances. See Choose Local or Network Backups.

• Decide whether Time Machine is a good match for your needs, and if not, select a different app to perform versioned backups. Read Choose Backup Software for a feature overview, then pick an option...
noted in Explore Versioned Backup Features or consult the online appendixes for details and sources.

- **Choose Backup Hardware**—such as a hard drive or two, and/or a network storage device—to store your backups on.

- **Prepare Your Hard Drive** with the right number and type of partitions and volume formats for the types of backups you want to do.

**Set up your backups:**

- If you’ve chosen to use Time Machine for versioned backups, read Configure and Use Time Machine. Otherwise, see Use Other Versioned Backup Software to learn how to configure a versioned backup and verify that you can retrieve stored files.

- Make a bootable copy of your startup volume, schedule it for regular updates, and test it to make sure it works with the advice in Create and Use a Bootable Duplicate.

- One way or another, **Store an Extra Backup Offsite**—either by physically moving backup media or by signing up for an online backup service.

**Address problems and unusual situations:**

- If your disk dies, your Mac is stolen, or an important file goes missing, don’t panic; read What to Do When Disaster Strikes.

- After months or years of backing up your Mac, you may run out of space on your backup disks, or you may become concerned about the long-term viability of your backup media. Discover what to do about this in Manage Your Media.

- Find out how to deal with backup needs that don’t fit neatly into the duplicate or versioned categories in Consider Special Backup Needs. As appropriate, read Back Up Digital Photos, Deal with Huge Volumes of Data, Back Up While on the Road, and Back Up Windows Files and Volumes.
This book focuses on the strategies, hardware, and software I can most heartily recommend based on extensive personal and professional experience. I’m going to give you my expert advice, and although that will include areas in which you can choose among several options, in this book I’m framing the decision simply. I’ll be telling you, “Today’s choices are lasagna, fried rice, and ratatouille (and by the way, my lasagna is pretty darn good)” instead of saying, “Choose anything from the Joy of Cooking.”

If you follow my suggestions, you can rest easy knowing that your data is safe—and you won’t break the bank or waste days of work setting things up. And even if you opt out of any of the three main components I recommend in my basic backup strategy, you’ll do so with both eyes open.

**Understand Joe’s Basic Backup Strategy**

The strategy I want you to follow consists of three key parts:

- **Versioned backups:** Use Time Machine or another backup app to store *versioned backups*—multiple copies of each file, so you have both the latest version and numerous previous versions. Update your versioned backups incrementally (copying only new or changed data each time) at least daily, and preferably more often.

- **Bootable duplicate:** Create a bootable duplicate of your startup volume on an external hard drive, and update that duplicate regularly.

- **Offsite copies:** Keep at least one backup copy of your important data somewhere safely away from your Mac—in another building, at least, and perhaps even in another part of the world (in the latter case, by using a cloud backup service).

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Tip: Later in this chapter I also talk about how cloud-based file syncing services (which are different from backup services) can supplement your backup strategy. See Can Cloud Sync Simplify Backups?

In most cases, you can use a single external hard drive for both versioned backups and a bootable duplicate—for example, by dividing it into two partitions (see Prepare Your Hard Drive) or by using backup software that creates a versioned bootable duplicate (see Bootable Duplicates with Versioning). You might choose to add a second drive for extra peace of mind. But I’ll also discuss using online storage for versioned backups, which counts as an offsite copy and could reduce the amount of hardware you must buy.

Furthermore, my goal is to automate nearly all of this so that backups happen in the background without your having to remember anything, press buttons, run apps, or intervene in any other way. And I’ll try to make even the setup process as painless as possible.

Because I want you to understand why I make the recommendations I do and how the whole process works, I spend just a few pages describing my suggested backup strategy in more detail and outlining what choices you’ll make along the way. (If you’re already on board with my basic strategy, you can skip these details and go straight to Choose Backup Software.) As you read, I suggest that you jot down a few notes about hardware that you may want to purchase, software features that seem important to you, or special questions relating to your circumstances to keep in mind as you continue reading the book.

Later on, I provide instructions for every part of the process, so don’t worry if the details still feel fuzzy as you read this introductory topic. I also talk about situations in which this basic strategy requires modifications—for example, when you’re backing up multiple computers on a network, or backing up a laptop Mac while traveling.
Reassess Your Backup Strategy

If you’re reading this book for the first time, you may not already have a backup strategy, in which case feel free to skip this chapter for now and move on to Choose Backup Software. But I suggest returning to this chapter in a year or so, by which time you may benefit from its recommendations. If you already have a backup strategy, though, read on to learn the best way to proceed.

Just as I reevaluate my own stance every so often, you too should periodically reassess your backup strategy in light of new information. If you read an earlier incarnation of one of my books and set up your backup system based on what I said years ago, I’d like you to reassess your strategy right now. In any case, put a reminder on your calendar for one year from now to come back and (re)read this chapter, then reassess your strategy again!

I want to begin with a brief “state of the union” look at what has changed in the last year or so (as I write this in early 2019), and then say a few words about Factors to Reevaluate as you reconsider your backup strategy, both now and every year. Feel free to skim this chapter to see which topics are applicable to you; you might want to jot down a few notes about those topics to help you identify items to concentrate on as you reformulate your backup approach.

What’s New in Mac Backups

Since version 3.0 of Take Control of Backing Up Your Mac in December 2017, a number of things have changed that affect Mac backups. I present the highlights here in a number of different categories.
Prosoft Ends Development of Data Backup

One of my long-recommended Mac backup apps, Prosoft’s Data Backup, has now marched off into the great beyond. More precisely, development has stopped, and although the company still sells the app, it comes with limited support and is fully functional only up through 10.12 Sierra. I’m sad to see it join the ranks of other previous favorite backup apps such as Synk and CrashPlan Home. Speaking of which...

CrashPlan for Home Is Finally Gone

In August 2017, Code42 Software discontinued its consumer online backup service, CrashPlan for Home, but let people who had recently signed up run out their subscription. The last of those grandfathered accounts expired in August 2018. I covered the saga in my TidBITS article CrashPlan Discontinues Consumer Backups. But the long and the short of it is that CrashPlan, which I’d heartily recommended for many years—for both local versioned backups and online backups—is now off the table.

Well, for some people, it’s not entirely off the table. CrashPlan does have a backup service for small businesses that’s still available, even to consumers with just one computer to back up. But it costs twice as much as CrashPlan for Home did; it lacks popular features of the consumer version, such as peer-to-peer backups; it still uses a clunky, Java-based client; and it means entrusting your data to a company that has shown itself not to be trustworthy.

There are lots of other cloud backup services. I’ve switched to Backblaze (see Self-Contained Cloud Backup Services) for my family’s online backup needs, and I discuss other options later in this book. But candidly, none of them have the breadth of features, the flexibility, or the overall value that CrashPlan for Home offered, so my enthusiasm about cloud backups as a whole has become, shall we say, more muted.
Choose Local or Network Backups

Before you go too far in designing a backup plan, you should take a moment to ponder whether you’ll back up to a local storage device (that is, one connected *directly* to a Mac with a cable) or to a device located somewhere else on your (wired or wireless) network—or both.

In years past, I assumed that in most cases, each Mac would have one or more backup drives of its own, and that network backups were mainly for locations with more than a few Macs or with exceptional backup needs of some sort. Now, however, the decision seems less obvious, and network-based backups of one sort or another seem like a good fit for a wider range of people.

In this brief chapter, I help you think through the pros and cons of both local and network backups. Whether you choose to use one approach or the other (or a combination), your decision will help inform which software and hardware you use; I discuss those choices in the next two chapters.

**Note:** This decision affects only the backups in your home and office, and is thus independent of whether to use a cloud backup service (see *Use a Cloud Backup Service*, later).

Local Backups

With a local backup, you plug your hard drive or other storage device into a Mac and let your backup software run. (Time Machine starts automatically, as do some third-party backup apps; other software requires either an explicit schedule or that you manually run backups after attaching a drive.) When it’s done, you can disconnect the drive and hook it up to another Mac if you have one.
The biggest advantage of a local backup is *speed*. Even if you have a fast network, chances are your backup and restore operations will complete much more quickly over a cable—especially if that cable uses Thunderbolt 3. Another advantage is that any backup software that can create a bootable duplicate can do so with a locally attached drive, whereas only a few apps can create bootable duplicates over a network (see *Network Backups*, ahead)—and none of them can make bootable duplicates to a NAS device or Time Capsule (even if it has an external disk connected).

The downside to local storage is that backups and restorations can occur for a given computer only while the drive is connected, and if you forget to connect the drive, you won’t have a backup at all. You may end up doing a lot of plugging and unplugging—and more so if you’re moving a single drive between computers. And, if you have a laptop and you actually use it on your lap (as opposed to a desk), having an external drive attached can be a real hassle.

Keep in mind that local storage need not be a single external hard drive; it could also be a RAID or other multi-drive assembly. See *Decide on a Storage Configuration* for further details.

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**Network Backups**

In a network backup, one computer (or other device) typically functions as the backup server—the machine to which your backup drive(s) are physically connected. Files from your other machines (which function as clients) are copied over the network onto each backup drive.

If you have multiple computers—especially if one or more of them is a laptop that gets moved around a lot—network backups can be far more convenient than local backups that require being physically tethered to an external drive. They require virtually no intervention; just leave all the necessary devices turned on and, assuming you have your backup software configured appropriately, the computers on your network will back themselves up automatically as needed.
Choose Backup Software

In this chapter, I help you decide which backup software to use for versioned backups and which to use for bootable duplicates. (You might choose the same app for both purposes, but as we’ll see, the best app for one type of backup isn’t necessarily best for the other.)

Decide If Time Machine Is Best for You

Time Machine is the backup software built into the Mac starting with OS X 10.5 Leopard. Apple’s goal was to make backups as easy as possible, and compared to anything that came before it, Time Machine is certainly much simpler to set up and use. In some cases, you can set it up and turn it on with a grand total of one click! It’s hard to beat that. Anything that makes backups easier and thereby encourages more people to use them gets a gold star in my book.

However, Time Machine is not ideal for everyone. Before getting into the details about setting up and using it (see Configure and Use Time Machine), I want to tell you what I like and dislike about it, and look at a few situations in which it may be the wrong solution. For those people who need different software, I point you in the right direction with a discussion of features to look for and examples of other versioned backup apps I can recommend.

Without a doubt, Apple got a lot of things right about Time Machine:

• The user interface is elegant, if unusual.

• I love how I can restore files right in the Finder, and how I can restore missing email messages from within Mail.

• I appreciate the fact that my MacBook Pro can back up files using Time Machine even when I’m away from my desk and a Time Machine volume (see Local Snapshots, later in this book).

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• Time Machine supports encryption for both local and network backups, and also lets me choose multiple destination disks (which it rotates among automatically).

• You can back up either to a locally attached hard drive or to any of several kinds of network destinations (including a NAS device, an AirPort Time Capsule, and another Mac)—whatever you find most convenient.

All that is fantastic, and in many respects better than the competition. And yet, having used Time Machine since day one, I find the shine wearing off, for several reasons:

• Time Machine’s approach doesn’t scale well to large amounts of data. For one thing, backing up lots of large files takes far longer than it should, because Time Machine always copies entire files rather than using delta encoding as many other backup apps do (see Delta Encoding, ahead). And, even if your Time Machine drive has plenty of storage space, by the time you have several months’ worth of backups the sheer number of files seems to bog down Time Machine and make simple operations unreasonably sluggish.

• Although Time Machine is supposed to be almost invisible in ordinary use, it sometimes uses up far too many system resources. If I notice the fan on my wife’s MacBook Pro start to wail, it’s usually because Time Machine happens to be running.

• Time Machine is pretty good at restoring individual files and folders from a specific point in time, but it falls down in a number of common usage scenarios. For example, suppose your hard drive dies and you replace it with a bootable duplicate you created last week—and now you want Time Machine to restore only the files that changed since last week. There’s no easy way to do that (see Finding Recently Backed-Up Files).

• One of Time Machine’s flashiest features when it was introduced was the capability to restore individual items within apps like iPhoto, Mail, and Contacts (previously called Address Book). Indeed, Time Machine remains the best way I know of to restore
Choose Backup Hardware

You’re almost certainly going to need one or more external hard drives for your backups. (Even if you use a Time Capsule, other network storage, or a cloud backup service, you’ll need a separate external hard drive at least to store a bootable duplicate.) You can find hard drives with every imaginable combination of capacity, speed, interface, and case design—and the selection changes constantly.

In this chapter, I start by walking you through the calculations of how much storage capacity you’ll need for backups (see Decide on Capacity). Then, in Decide on a Storage Configuration, I help you understand whether you should be looking for standalone hard drives, a RAID or other multi-drive enclosure, a NAS or similar network storage device, or drives that you’ll hook up to another computer on your network that will function as a backup server.

I end the chapter with a few thoughts on Hardware You Should Probably Avoid.

Tip: In this chapter I’m concerned exclusively with hardware for storing backups, but if you want to know about storage devices more generally—or if you want far more information than I can provide here about file systems, RAIDs, and other storage topics—I recommend reading Jeff Carlson’s Take Control of Your Digital Storage.

Decide on Capacity

The most important consideration in a backup drive, by far, is its capacity—how many gigabytes or terabytes of data it will hold. In general, the bigger, the better. In fact, I could simply recommend, as a rule of thumb, that you get the largest hard drive you can afford.

However, if you can’t afford an especially large drive, or if the amount of data you have to back up is exceptionally large, you may want more
guidance. So, figure out the size you’ll need for duplicates, then the size you’ll need for versioned backups, and finally the total size to look for.

**Duplicate Size**

You’ll store, on your external hard drive (or a partition thereof), an exact, bootable copy of your Mac’s regular startup volume. (If you use a Time Capsule, NAS, or other network storage destination that can’t store bootable duplicates, you’ll need an entirely separate drive for this purpose.) But the volume that stores your duplicate needs to be only as large as the amount of data on your startup volume, not necessarily the whole disk. For example, if your Mac came with 1 TB of storage but you’ve filled up only 500 GB of that space, you can fit a duplicate on a 500 GB disk or partition. (If you’re creating Bootable Duplicates with Versioning, you’ll need to add more space to accommodate the older versions.)

Over time, though, you’ll add more files to your Mac, so if you cut it that close, you’ll soon outgrow your backup drive. Therefore, I suggest that you allot at least one and a half times the amount of space currently occupied on your startup volume for a duplicate. So, if you have 500 GB of data on your startup volume, you want at least 750 GB for the duplicate. More space is perfectly fine, to give you even more room to grow.

To find out how much space on your startup volume is being used, select the your disk’s icon in the sidebar of any Finder window. Then press ⌘-I to display the Info window (Figure 1). The number after “Used” is the amount of space currently occupied on the disk.

**Tip:** If you can’t locate your startup volume in the Devices category in the sidebar, go to Finder > Preferences > Sidebar and select the “Hard disks” checkbox.
Prepare Your Hard Drive

You’ve just unpacked your brand-new hard drive (or two), and you’re ready to get busy backing up. You might be able to plug in the drive and start working with it immediately, but it depends. Some hard drives come formatted for Windows computers, for example, while others might be formatted for a Mac—or not at all. Some come pre-loaded with utilities and demo software. Some might use the wrong partition map scheme for your computer, possibly preventing Time Machine from being able to see or use the drive. And if you’re not going to plug a hard drive directly into your Mac, but rather put it inside, or attach it to, a network storage device, still other considerations apply.

In short, because each situation is different, you should take a few minutes, before you do anything else, to make sure any new hard drives you’ve obtained are configured correctly for your needs.

If you have a NAS, Time Capsule, or other network device, its built-in drive(s) should come preconfigured as needed, so you don’t have to worry about anything in this chapter for that device (but skip ahead to Network Backups for additional factors to consider). However, you must still follow these steps for the external drive you use to store your bootable duplicate, and any external drive(s) you decide to attach to your Time Capsule or NAS.

Note: For a RAID, Drobo, or other locally attached, multi-drive enclosure, the rules are highly variable; consult the manufacturer’s instructions or website to learn whether or how you must format the drives.

Choose a Partition Map Scheme

Your hard drive contains a tiny block of information called a partition map or partition table that describes things like how many volumes
the drive has, how large they are, and where they’re located. The way information is stored in this little block of data is called the *partition map scheme*, and the choice of scheme is crucial to how the drive can be used. Windows PCs generally use a scheme called the Master Boot Record (MBR) Partition Table; pre-Intel Macs used a scheme called Apple Partition Map; and Intel-based Macs by default use a newer and more advanced scheme, GUID Partition Map (or GUID Partition Table). The partition map scheme affects the entire drive, regardless of how many partitions it has or how those partitions are formatted.

The majority of hard drives are configured at the factory to use the MBR scheme, because that’s the norm on Windows. In most cases that’s fine; if you plug such a drive into your Mac, it will most likely work as a backup drive without any intervention. However, it’s worth noting that Time Machine can’t use volumes larger than 512 GB on an MBR-partitioned drive. (That’s because Time Machine requires the Mac OS Extended format, also known as HFS Plus, and HFS Plus volumes can’t be larger than 512 GB on an MBR-partitioned drive.)

You normally need not worry about this; if you select a disk to use as a Time Machine destination and it’s partitioned using the MBR scheme, macOS will offer to repartition it for you as a GUID disk automatically. But, if you don’t want to use the *entire* disk for Time Machine backups—for example, if, as I suggest, you want to divide the disk into a partition for Time Machine (or other versioned backups) and a partition to hold a bootable duplicate—then you should manually repartition the disk *before* handing it over to Time Machine. As you do, you should check the partition map scheme, because changing it requires erasing all the data on the disk; that’s obviously something best done before you’ve copied any of your personal files onto it.

Although there are a couple of ways to check your drive’s partition map scheme, I recommend using Disk Utility—and then just leaving it open, because you’ll be using it to format your drives in just a moment (see *Configure Your Drive*). Follow these steps:

1. Open Disk Utility (in */Applications/Utilities*).
2. In High Sierra or later, choose View > Show All Devices.

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Configure and Use Time Machine

If you’ve decided to use Time Machine for versioned backups, read this chapter to learn everything you need to know about using it. (If you’ve chosen other software for versioned backups, skip ahead to Use Other Versioned Backup Software.)

Apple says it takes just one click to set up Time Machine; while that may be true in rare cases, it’s usually a bit more involved. This chapter walks you through the details of setting up Time Machine, backing up and restoring files, and other activities.

As I explained in Decide If Time Machine Is Best for You, my enthusiasm for Time Machine is not what it once was. I still use it, but not as my only form of versioned backups, and not on all my Macs. Therefore, even though this chapter is fairly long, I make no attempt to be comprehensive here, especially when it comes to troubleshooting.

Time Machine Basics

Time Machine has three visible components:

- A preference pane in System Preferences (Figure 7).
- An app found in the Applications folder, in Launchpad, and, optionally, in the Dock (Figure 8).
- A Time Machine menu in the main menu bar. (You can enable or disable this menu with the “Show Time Machine in menu bar” checkbox on the Time Machine preference pane.)
Choose a Destination

Assuming you’ve followed the steps in the previous chapter, you already have a hard drive formatted and ready to go; this could be a standalone device connected to your Mac, a NAS, a Time Capsule, or a drive attached to another Mac on your network. (If you’re planning to use another Mac as a Time Machine server and you haven’t set that up yet, you should do so first—see Use a Mac as a Time Machine Server—
Use Other Versioned Backup Software

If you’ve decided to create versioned backups using an app other than (or in addition to) Time Machine, set that up now. I wish I could give you step-by-step instructions for using each one of those apps, but that would take too many pages (and you can read the app’s documentation for help). Instead, I want to give you a few tips for each of several good choices, all of which I mentioned back in Choose Another Versioned Backup App. Although I’ve used and can recommend each of the apps I mention here, I don’t pretend that this is an exhaustive list. There are many other excellent options, and you can read about them in the online appendixes.

Later in the chapter, I also give several general pointers about things like power management and testing versioned backups.

Arq Tips

Arq is an increasingly popular choice for people who want the benefits of cloud storage but also want greater control over their data than cloud backup providers offer—and the freedom to choose inexpensive cloud storage. If you use Arq for your versioned backups (or are considering doing so), keep the following in mind:

• **All cloud storage is not created equal.** Arq supports lots of different cloud storage providers, some of which are so inexpensive that they seem almost too good to be true. As I point out later, in BYOS (Bring Your Own Software) Internet Backups, some cloud storage services limit your upload rate—perhaps only after you’ve transferred a given amount of data or number of files in a certain month. The result can be that backups are disappointingly slow. So read your provider’s fine print and try some speed tests with a few gigabytes of data before you start to upload files by the millions.

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• **Backups run on fixed schedules.** Compared to, say, Backblaze, which backs up your data continuously, Arq can run any given backup no more often than once per hour. So, if you’re moving to Arq from a competitor that backs up files as often as you save them, you might need to adapt your thinking and behavior, because Arq won’t make such frequent copies. (In addition, running less frequently means each backup is likely to take longer.) You can, however, work around this somewhat by setting up multiple backups to the same destination; make them identical except for the time. (For example, make the first one hourly on the hour and the second one hourly on the half hour.)

• **Mind your settings.** Arq helps you avoid unexpected expenses by letting you set a budget (the maximum amount of storage space your backups can occupy on any given cloud service), but this feature is disabled by default—and even when it’s on, your budget is enforced only at an interval you set (such as every 30 days). So review the settings carefully for each destination and make sure you’re taking advantage of Arq’s money-saving features.

• **Arq supports local backups too.** Although Arq is best known as a backup app to be used with cloud destinations, you can also choose local hard drives, network volumes, or NAS devices as destinations. That makes it much more versatile than most cloud backup apps and lets you use the same app for both local and cloud-based versioned backups. Alas, Arq lacks the capability to make bootable duplicates, so you’ll still need a separate app for that.

**Note:** Although I haven’t tested them in any detail, a number of newer backup apps are broadly similar to Arq (in the sense of focusing on versioned backups to user-supplied cloud storage, but with the option to do local backups too), and if that’s the general path you want to take, you might also consider looking into [CloudBerry Backup](https://www.cloudberry.com/), [Duplicacy](https://duplicacy.net/), and [Duplicati](https://duplicati.org/).
Create and Use a Bootable Duplicate

Along with versioned backups, bootable duplicates are a key component of a complete backup plan. They let you get back to work quickly in the event of a hard drive failure, give you a useful troubleshooting tool, and make upgrading to a new version of macOS safer.

You can’t make a bootable duplicate by copying files in the Finder; you need a special utility. Lots of apps can do this, but in this chapter I focus on two—Carbon Copy Cloner and SuperDuper!—that specialize in this one task and do an excellent job at it.

**Warning!** Remember, you cannot store duplicates of two drives on the same volume, even if you put them in separate folders; the result will not be bootable. They must be on separate partitions or on entirely separate drives. Oh, and let me reiterate yet again: you cannot create a bootable duplicate onto a NAS or a Time Capsule (or even an external drive connected to one of these).

Carbon Copy Cloner and SuperDuper! can make one-off duplicates, but they can also run automatically on a schedule, updating the duplicate with just the files that are new or changed since the last run, and deleting files on the destination that are no longer on the source disk. I recommend scheduling your duplicate to update itself at least once a week (daily is even better) as well as right before any macOS update.

I should mention that by default, making a duplicate of your startup disk will not also duplicate the hidden Recovery HD partition that Apple installs automatically with macOS. That is to say, if you boot from your duplicate or restore an entire disk from your duplicate, you won’t be able to use macOS Recovery unless you reinstall macOS on the disk—something you should never have to bother with if you have a bootable duplicate. That’s not a serious concern, though, in that the point of Recovery is to give you a way to repair and restore your Mac if
you don’t have another bootable disk—a situation you won’t find yourself in if you have a bootable duplicate! However, Carbon Copy Cloner can duplicate the Recovery HD partition if you so choose; consult the app’s documentation for instructions. (Unfortunately, SuperDuper! can’t do this trick.) In addition, a free utility called Recovery Partition Creator can add a Recovery HD partition to an existing disk.

Duplicates of Non-Boot Volumes
This chapter is about making an exact copy of your startup volume so that you can boot from it later. But you may have other internal or external drives as well, and although duplicating them wouldn’t result in a bootable backup, it may still be worth considering (either instead of or in addition to versioned backups for those drives).

I say this for two reasons:

✦ If a secondary drive dies and you urgently need to get back to work with the data that was on it, having a duplicate that you can swap out in minutes is better than waiting the hours it would take to restore a whole drive from a versioned backup. (This is the same reasoning I apply to bootable duplicates.)

✦ Some types of data you may store on a secondary drive don’t lend themselves well to versioned restoration. For example, if you restored a single photo from your Photos library, the Photos app might not display it. Photos relies on a database to tell it what items are where, and restoring the photo wouldn’t modify the database. You need to restore the entire library from a backup, not just an individual photo. And restoring that much data will likely go quicker from a duplicate than from a versioned backup.

You can create and update duplicates of non-boot volumes following exactly the same procedure you use for your startup volume.
Store an Extra Backup Offsite

No matter how many backups you have or how often you update them, they do you no good if they disappear along with your Mac—as they likely will in the case of theft, fire, or any other serious disaster. I urge everyone to take the precautionary step of keeping a second copy of their backups safely away from their Mac, preferably in another building altogether. You can do this with a second hard drive—or, more easily and economically, with a cloud backup service.

Which type(s) of backup should you store offsite? As you’ll recall, the main purpose of a bootable duplicate is to get you back up and running immediately after a disk failure or other crisis, and it can’t perform that function if it’s offsite. So, although you’re welcome to store an extra duplicate offsite if you like, I think of offsite storage as being more appropriate for versioned backups.

Use an Extra Hard Drive

If you purchase two or more hard drives, you can set each of them up the same way. Then, back up to one drive for a week, switch to the other one, and take the first offsite. Repeat this rotation every week or so, and you’ll be safe in the knowledge that if you lose your first backup, a second one is still available that’s no more than a week out of date.

Although you can use this process with just two drives, having three is more convenient (although, of course, more expensive). At any time, you’ll have one drive (A) in use, your next-most-recent one (B) onsite, and your oldest one (C) offsite. When you rotate the drives, you bring your oldest one (C) back onsite and make it active, while taking what has now become the oldest drive (B) offsite—and so on.
The safest way to keep multiple backup drives is to set them up separately. Configure one drive with partitions for duplicate and versioned backups. Set up Time Machine (or another versioned backup app) and let it run; also create a bootable duplicate. Then disconnect the drive and repeat the entire procedure with a second drive. If you use Time Machine, you can configure multiple destination drives, and Time Machine switches between them automatically (see Choose a Destination).

If you use a Time Capsule, you can’t just swap out its internal drive whenever you feel like it (it’s a pain to do, and it voids the warranty). You can, however, keep your backups on an external USB drive connected to your Time Capsule and then swap that drive from time to time—perhaps reserving the internal drive for media sharing.

You may be wondering where exactly “offsite” could be in your case. Here are some suggestions:

- Your place of work
- A neighbor’s or relative’s home
- A storage unit
- A safe deposit box

Don’t keep an offsite backup in your car (or your garage!), which is, if anything, more susceptible to damage and theft than your home. Heat and cold extremes in your car can also hasten data corruption. If you want as much security as possible with a trade-off of less convenience, keep the drive in a safe deposit box at your local bank.

Taking care of your media is just as important as making proper backups in the first place. If your backup disk is lost or damaged, it does you no good. So whatever else you do, be sure to store your backup media in a cool, dry place away from significant sources of light, static electricity, vibration, and other hazards (such as inquisitive pets or children). This may seem obvious, but it pays to remember that you’re doing backups in the first place because your data is valuable—perhaps even irreplaceable.
What to Do When Disaster Strikes

You’ve diligently performed the backups recommended in this book, and then, one fateful day, disaster strikes. It might be a small disaster (one important file is missing) or a large one (your whole computer is missing). In any case, the very first thing you should do is take a deep breath and remind yourself that everything is going to be fine. Once you’re finished not panicking, proceed with the instructions here, depending on the nature of your disaster.

Restore Individual Files

The easiest problem to recover from is a small number of files that are missing, or for which you need an older version. Follow these steps:

1. If you backed up the files using Time Machine, try restoring them using the steps in Restore Data with Time Machine; or, if you used another versioned backup app, follow the developer’s instructions (check the Help menu) for restoring your files.

2. If the files are missing from your backup, check your bootable duplicate. Connect the drive (if it’s not already attached) and navigate to the location on the disk where the file should be. If it’s there, copy it to your main disk.

3. If steps 1 and 2 don’t work—for example, if your entire backup drive is missing—move on to your secondary backup. That may mean fetching an extra backup drive from another location and following steps 1 and 2 again, or using your internet backup app to find the file in your online backup.
Warning! If you need to restore data from a photo management app (such as Photos), virtualization software, or any app that uses a database-like structure, restore the entire data unit (photo library, virtual machine, or whatever) rather than individual files within it, or data corruption may result. You might prefer to restore these from a duplicate; see Duplicates of Non-Boot Volumes.

Restore the Data, Not the App
I can’t tell you how many times I’ve heard someone say, “I’ve lost my data from App X, so I want to restore the app from my backups. How do I do that?” I always reply that restoring the app is the wrong thing to do.

Nearly all apps—even those, like Contacts, Calendar, and Photos, that aren’t based on documents—store their data separately from the app. If information is missing or crashes occur, chances are virtually nil that the app itself is broken, and restoring it won’t bring back your data.

Instead, figure out where the app stores its data (a quick Google search can often help) and restore those files. If that doesn’t work, try restoring the app’s preference file(s) too.

Use Your Bootable Duplicate
In some situations it’s clear that your problem is worse than a few missing files. If your Mac won’t start up—it gets stuck at a blue or gray screen or displays a flashing question mark icon—turn next to your bootable duplicate. Also use your duplicate if many files seem to be missing or damaged, apps won’t launch, you’re unable to start the Mac using macOS Recovery, or it exhibits other similar system-wide misbehavior. Follow these steps:

1. Attach the drive containing your bootable duplicate. (Remember, it must be directly attached to your Mac; you can’t boot from a duplicate over a network.)
Manage Your Media

For many people, a backup drive may sit on a desk for years, quietly doing its thing without any intervention. For others, two or more drives may be shuttled between locations to provide offsite storage. But in either case, your backup drive (or other media) won’t last forever. So, in this brief chapter, I look at What to Do When Your Disks Fill Up and explain why you should Consider Long-Term Archive Storage.

What to Do When Your Disks Fill Up

Your bootable duplicates and versioned backups should continue updating themselves happily for some time. But sooner or later, the drives you use for backups will fill up. (Whether this takes a few months or a few years depends on the rate at which you accumulate new data and the size of your backup disks.) When this happens, you have two options: buy new drives and start over, or recycle. By “recycle” I don’t mean throw your drives in a blue bin; I mean erase them and reuse them for a new set of backups.

One argument for starting fresh is that new drives are virtually always more reliable than old ones. Another is that you can save your old drives as a long-term archive, in case you need to see what you backed up a few years ago (assuming the drive continues to work after all that time). On the other hand, recycling media saves money, not to mention physical storage space. And most people have little need for backups stretching back more than a couple of years.

The choice is entirely yours, but I can give you some tips either way.

If You Recycle Old Backups

For versioned backups, you may want to recycle your drives on a regular basis, before they fill up. By periodically erasing them and starting over with a full backup—instead of relying indefinitely on
incremental additions since a single full backup long ago—you reduce the risk of data loss due to file corruption or misbehaving backup software. How often you recycle your media is up to you, but in general I’d suggest recycling every one to two years.

Do, however, be aware that when you recycle media, you lose all the versioned backups stored since you started that particular cycle. In addition, if you recycle more than one set of media (for example, two or three hard drives), stagger them: do one, wait a week or two, then do the next one, and so on. That way, if you suddenly discover that you’ve erased the media containing an old file you need, you’ll still have a chance to recover it easily from another set of backup media.

For bootable duplicates, as long as there’s enough free space on your destination disk, you can simply erase the disk and start over from scratch. But if you’re running out of space on the disk or partition you use for duplicates, then your only options are to repartition the drive—either expanding the partition for duplicates if there’s enough room or repurposing a multi-partition drive as a single-partition drive—or to erase the disk, use it for something else, and buy a new, larger drive to use for bootable duplicates from now on.

**Tip:** If you’re erasing a disk anyway, this is a good time to reassess partition sizes (see Decide on Capacity). If your disk or home folder is significantly larger than before, consider changing the partition sizes to better accommodate your current needs.

**If You Archive Old Backups**

When you see that your backup media is close to being full—or when your drive’s warranty has run out and you start losing faith in it—you can set it aside, buy new drives, and start new sets of backups.

Unfortunately, as I discuss just ahead in Consider Long-Term Archive Storage, hard drives make a poor choice for long-term storage (though an older hard drive that you wouldn’t trust for backups may be fine for casual, noncritical uses). In other words: yes, do buy new drives, but
Consider Special Backup Needs

Although duplicates, versioned backups, and offsite storage cover most situations the typical user will encounter, some people have special backup needs that don’t quite fit the mold.

I’m thinking, for example, of users with vast numbers of digital photos and those who Deal with Huge Volumes of Data because they work extensively with the gigantic files required for digital video or pro audio apps. In other special cases, you may need to Back Up While on the Road (especially photos) or Back Up Windows Files and Volumes.

Each of these situations may require additional steps beyond conventional duplicates and versioned backups.

Back Up Digital Photos

If you have no more than a few gigabytes of photos on your Mac, you can back them up along with the rest of your data and not take any special steps. But the ease of snapping photos and videos with an iPhone or iPad—and the increasing resolution of files from iOS devices and DSLRs alike—has increased the likelihood that a Mac user’s photo library will extend to tens or even hundreds of gigabytes (my own is over 150 GB—yikes!). With the growing number and size of your images, you may find that duplicates and versioned backups alone don’t meet all your backup needs.

Luckily, numerous tools, services, and strategies exist for the express purpose of making photo backups as painless and secure as possible. Consider these options in addition to (or, if you prefer, instead of) duplicates and versioned backups.

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iCloud Photo Library

If you manage your photos with Apple’s Photos app, you can take advantage of iCloud Photo Library to store copies of your photos offsite. It’s not exactly a backup, but it provides at least some protection for your photos. (If you don’t use Photos, there’s nothing to see here; move along to Photo Sharing Services.)

The basic idea of iCloud Photo Library is that all your photos and videos from Photos sync to Apple’s servers, and from there to all your other Macs and iOS devices. Although that sounds both simple and wonderful in theory, in practice it’s an odd and confusing process. I spell out all the details in my TidBITS article iCloud Photo Library: The Missing FAQ.

You’ll have to pay for storage above 5 GB of data, though prices are roughly in line with most online storage and backup services. It’s probably worth it for the convenience of having the same photos on all your devices, not to mention easier sharing.

But even though iCloud Photo Library stores copies of all your photos in the cloud, it’s not quite the same thing as an online backup. The difference is that if you delete or modify a photo on one device using iCloud Photo Library, that change propagates to all your other devices. (In this sense, it’s a bit like IMAP email: the server holds the master copy of each item, until the client says to delete it; then it’s deleted from all clients.) You do get 30 days to recover anything you accidentally deleted, but that’s not much of a safety net. If you realize on day 31 that you deleted a photo you need, you’re out of luck. With conventional backups, by contrast, you can usually decide how long backups are kept (which can be indefinitely).

Even so, if you can afford the storage (and the bandwidth—iCloud Photo Library transfers an enormous amount of data), it’s not a bad idea to it use as a partial solution to photo backups.
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