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TAKE CONTROL OF

# YOUR M-SERIES MAC

*by* **GLENN FLEISHMAN**

**\$8.99**

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# Read Me First

Welcome to *Take Control of Your M-Series Mac*, version 1.1, published in April 2021 by alt concepts inc. This book was written by Glenn Fleishman and edited by Joe Kissell.

This book will help you configure and protect your Apple silicon M1-based Mac. You will learn to manage new features and work with its advantages and constraints, while understanding the comprehensive changes across hardware and macOS from Intel Macs.

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## Updates and More

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## What's New in Version 1.1

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This version includes three key updates and a few minor changes, in addition to fixing some typos and small errors.

### New iMac and iPad Pro with Apple Silicon

Apple announced two new devices with M1 processors on April 20, 2021—new models of iMac and iPad Pro—and this edition reflects those additions to the M1 line. (The iPad Pro is not a Mac, but it's somewhat Mac like, given how the Mac has become more iPad like.)

This introduction also included a Magic Keyboard with Touch ID for all M1-based Macs, allowing the keyboard's Touch ID sensor to communicate securely over wireless with a Mac's Secure Enclave. This allows Touch ID to work with a Mac mini, the new iMac, and as an external keyboard option for M1 laptops.

### More Detail about Startup and Recovery

Details about the unique startup process and recovery processes available on the M1 keep appearing, we understand them better and test them, and Apple updates support documents.

That's the case with the difference between *erasing* the internal SSD drive on your M1 Mac and a *failure* of that internal drive. I learned some interesting differences that are now incorporated into the book, particularly in [Reinstall with the Personalization Error](#), which helps you through a problem that can occur when trying to reinstall macOS.

I also explain why [When an SSD Is Dead, External Volumes Don't Work](#), which also explains why the startup volume generally isn't truly erased, and why that's a problem if you manage to actually wipe it.

### Big Sur 11.3 Released

Big Sur 11.3 was released since version 1.0.1 appeared, and made a few changes that affect M1 Macs.

This update to Big Sur includes changes to how iOS and iPadOS apps can manage or emulate input, too. To the Touch Alternatives feature, Apple added a Game Control emulator to help with video game input. It also moved Touch Alternatives' on/off control and its explanation into Preferences, as I explain in [Use Mobile Apps](#).

Apple brought *hibernation mode* or “safe sleep” to M1 Macs in this release, letting them slumber more deeply in a power-conserving manner. See [Sleeping Safely](#).

Big Sur for Intel and M1 Macs may let macOS look to your calendar appointments to ensure you have enough battery power when optimized charging is enabled. A clever person found the change in the Big Sur code during beta testing, but Apple hasn't explicitly listed it as a feature. Read the changes in [Examine Your Charging in macOS](#).

Reports during 11.3's beta testing indicated that Apple removed access to Rosetta in some countries. We don't know if that ultimately made it into the release version—or why! They didn't tell us or anyone else if so. One presumes it's related to intellectual property. See [How Emulation Works on an M-Series Mac](#).

## Other Updates

Outside of Apple-driven changes, Parallels released [Parallels Desktop 16.5 for macOS](#), native for both M1 and Intel Macs, taking their virtual machine for M-series Macs out of beta and now charging for a license. See [Install and Use Windows](#).

The previous version of this book didn't discuss the built-in video camera in M-series Macs. I've added that, explaining what Apple did to enhance the quality of a 720p camera on the laptop models. See [Front-Facing Cameras](#).

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## What Was New in Version 1.0.1

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A reader asked whether applications are also on the sealed Big Sur system volume. The answer is: yes, but only some of them. This is now

spelled out in [Which Apps Are Locked Down?](#) (Thanks to reader Linda for asking a question that led to adding this update, and to Howard Oakley for providing me direction on where to find the details.)

In the section on the special revive and restore operations to fix firmware issues that could arise with your Mac and make it non-responsive, a reader pointed out that Apple’s laptop USB-C charging cable is an appropriate option for the task, and that a Mac tech site found a Thunderbolt 3 cable worked for them. See [Revive or Restore a Startup Volume](#). (Thanks to reader Jeremy.)

# Introduction

The new series of Apple silicon Macs that use the company's M1 system-on-a-chip offers remarkable advances in performance, battery life, and memory utilization. These new models sport a range of firmware and hardware changes that make them different in many ways from all Macs that come before them.

This includes unique advantages, such as running iOS and iPadOS apps, and providing even stronger protections baked into hardware against attackers trying to take over your Mac.

*Take Control of Your M-Series Mac* digs into the important stuff that lets you take advantage of new features, while also performing routine tasks that have changed in large and small ways, such as backing up your Mac and protecting it.

That starts with understanding how the M1 chip works, what makes it different from Intel processors, and how to migrate successfully from an Intel Mac. The book then moves into specifics: How do I back up an M1? Can I create a backup on an external drive that I can boot from? How do you manage the absurdly long battery life? What's different when I restart in recovery mode?

The book also digs into system security, which covers the Big Sur-specific changes available to all Macs with the particular spin you find in an M1 Mac. Finally, I explain the ins and outs of using iOS and iPadOS apps in macOS, and the early stages of running Windows within macOS on an M1.

**Note:** Because we know the M1 is just the first in what will be a series of chips, we chose to title this book with the term "M-Series." As I write this, the book covers the M1, the only Apple silicon so far released, but future versions will incorporate information about new chips and Macs.

# M-Series Quick Start

This book both teaches you about how the M-series chips work and the differences they have from Intel processors, and offers insight into areas like battery life, backups, security, and recovery. You can read most of the book in any order.

## ***Start with background:***

- It's useful to understand how the M-series chips work and how Apple baked security right into the chip; see [How Apple Silicon Works](#) and [How Security Is Baked In](#).
- Learn about the extended battery life with M-series Macs and how to measure and manage it; see [Work with Extended Battery Life](#).

## ***Prepare for and recover from problems:***

- Understand how backups work in Big Sur with an M-series chip; see [Back Up Your M-Series Mac](#).
- Get to know recoveryOS, the new special boot option for reinstalling macOS, controlling security, and more; see [Understand recoveryOS](#).

## ***Dig into Security:***

- Figure out whether FileVault's extra protections work for you; see [Protect a Drive with FileVault](#).
- Learn about Big Sur's extra protections for system files; see [Protect a Drive with FileVault](#).
- Modify system security for specific purposes; see [Protect a Drive with FileVault](#).

## ***Run Something Different:***

- Most iOS and iPadOS apps can be installed and run on an M-series Mac; see [Launch iOS and iPadOS Apps on Your Mac](#).
- You can run a pre-release version of Windows that works on M-series processors today; see [Install and Use Windows](#).

# Learn M-Series Details

The new M-series chips are profoundly different from the Intel generation they supersede. For those who have read up on the architecture of an iPhone or iPad, the M1 Apple silicon will seem familiar; those who haven't may feel at sea. In this chapter, I explain how a system on a chip (SoC) works, what's different from the Intel world, and how Apple bakes security into hardware in their own silicon.

You don't have to be a chip-head or a hardware expert to understand the details that follow, nor will there be a test at the end. The idea is to give you a sense of what's new—and sometimes extraordinary—inside the M1, and how special features enable entirely new capabilities.

**Tip:** If you find chip-based technical detail not quite as interesting as I do, skip ahead to [How Security Is Baked In](#), which is more critical to understanding parts of the rest of the book.

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## How Apple Silicon Works

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A traditional CPU-based system wastes a lot of time and energy moving data between it and other chips across a circuit board. Every time memory is manipulated, a security coprocessor needs to perform encryption tasks, or graphics operations have to be offloaded to a GPU (graphics processing unit), there's a huge amount of signaling and voltage that consumes power, delays actions, and generates heat.

A computer will often also have separate chips for each type of *controller*, a combination of firmware and processor that manages communication with hardware devices. That includes standards like Thunderbolt, USB, and PCIe that connect your computer to printers, displays, and drives. (PCIe is typically used to connect expansion cards in computers with slots.)

## Separate Controllers Allow Greater Throughput

Some controllers come in multiples to create separate data paths, or *buses*, for different ports or sets of ports. The M1 Macs apparently have two controllers for Thunderbolt 3/USB 4, allowing two buses with up to 40 Gbps of throughput on each.

For reasons best known to Apple, the higher-end iMac models released at the end of April 2021 have four USB-C ports, but only two are Thunderbolt 3/USB 4—the other two are “plain” USB 3.1 Gen 2 (10 Gbps) versions that don’t allow for video or networking.

A computer also needs radio chips for Bluetooth and Wi-Fi (and sometimes cellular), as well as storage chips packaged as solid-state drives (SSDs).

On an Intel-based Mac (or an AMD- or Intel-based computer of any kind), the processor is a generic model available to any manufacturer. The rest of the chips required to make up the computer are largely commodity items, sourced based on cost and features. Apple uniquely has often designed or had made to its spec some secondary chips to provide a specific set of features or meet certain performance criteria.

But taken altogether, every CPU-oriented computer is a Frankenstein, however nicely assembled and however well every part works together.

In contrast, a system on a chip combines nearly every function into a single hunk of silicon. It is more like an organism designed in the lab and produced from scratch, in which each part is designed to work with each other. Instead of lumbering along and occasionally delivering 100-page soliloquies (Go read *Frankenstein!* The monster really does that!), a SoC is a thing of efficient beauty, as described in detail below.

# Migrate from an Intel Mac

Most of us aren't starting from scratch when we set up an M-series Mac. We have a previous computer with an Intel chip built in that has an operating system with a particular configuration, and software and files that go with it.

First, if you haven't yet purchased an M1-based Mac or want the full details on hardware aspects, read [Pick the Right New Hardware](#). External displays are one of the key stumbling blocks when planning a purchase or (if you already own an Apple silicon Mac) when trying to figure out how to expand.

Then read [Run Old and New Code on an M1](#) and the rest of the chapter to understand how Mac apps written for Intel models can run on an M1 chip, and the limitations of that for now.

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## Pick the Right New Hardware

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Apple offered just three models of Mac at its introduction of M-series chips: the MacBook Air, the 13-inch MacBook Pro, and the Mac mini. In April 2021, they announced an M1-based iMac. While the chips run fast and offer nearly identical features, there are some slight differences that can affect migration.

### **M2 and Beyond!**

It's become increasingly clear with the introduction of the M1-based iMacs that Apple has chosen a specific set of hardware capabilities for the M1 that includes the limits described below. I now expect quite clearly that an M2 chip is slated to add more "professional" features, like support for more external monitors and the inclusion of more than two Thunderbolt 3/USB 4 ports.

## Processor, GPU, and Neural Engine

Oddly, a key aspect of most other Mac purchases is nearly the least-important factor with an M1 Mac. Every model save one comes with the same eight-core CPU, eight-core GPU, and 16-core Neural Engine.

The exception? The least-expensive MacBook Air and iMac models sport a seven-core GPU option, even though the chip is manufactured in the same way as eight-core versions. Experts believe reflects a yield issue on the M1 chip: some have a single core that fails, and rather than ditch the chip, Apple uses the otherwise perfectly fine SoCs in two Mac models.

That allows Apple to offer the entry-level version of the MacBook Air at \$899 and iMac at \$1,299, both with 8 GB of RAM and a 256 GB SSD. To bump up to eight GPU cores, you pay a minimum of \$1,149 for a MacBook Air with 512 GB of SSD storage; with an iMac, the leap is to \$1,499, which includes two USB-only ports and a power adapter with gigabit Ethernet, both described below, and a Touch ID keyboard.

## Display Limits

The most significant difference between the laptop models and the Mac mini, and likewise between the M1 laptops and their preceding Intel counterparts, is in the number of external displays each supports.

**Note:** All displays connected to Intel and M1 Macs can refresh at up to 60 hertz (Hz), regardless of resolution.

### Resolutions Defined

To be confusing, there are multiple resolutions available with the same abbreviation. Here's the rundown:

- ✦ 4K: 4096 pixels wide by either 2304 or 2160 pixels tall
- ✦ 4.5K: 4480 by 2520 pixels (early 2021 iMacs)
- ✦ 5K: 5120 by 2880 pixels
- ✦ 6K: 6016 by 3384 pixels

# Back Up Your M-Series Mac

With each system release in the last few years, Apple has layered on more protection for system files and software. These improvements have made it ever harder for any kind of hacker, local or remote, to mess around with macOS to grab your data, watch you while you work, or commit other mayhem. In fact, Apple is so restrictive as of Big Sur that even when you're logged into a running copy of macOS as the root user via the Terminal, you can't make any changes to system files!

Generally, that's good. But where it's bad—or at least tricky—is in creating a full backup of your system that you can use to start up your Mac as an external drive, and restore exactly after erasing your Mac or to a new system. The M1 makes this *even harder* by having a unique combination of hardware features and requirements.

I would argue this is not bad, even though it can be irritating. In conversations with TidBITS editor Adam Engst and Take Control publisher Joe Kissell, I am increasingly convinced that bootable backups of your Mac may be less important now than ever before.

In this chapter, you learn about how Big Sur organizes its system and data files, and learn a strategy for making bootable backups—and whether you need one at all.

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## Learn About Big Sur's Organization

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Apple plays a long game. In 2016, they started to preview APFS (Apple Filing System), a freshly conceived filesystem that was optimized for SSDs, allowed a better organization of data beyond partitions, and incorporated lessons learned since Mac OS Extended (or HFS Plus) replaced an even earlier filesystem, plain old HFS, back in 1998.

In APFS, you can still *partition* a physical drive, allowing you to divide up available storage into different pieces. But within a partition, you can have one or more *containers*, which can dynamically resize as needed for their contents, which can be one or more *volumes*. Each volume has a *role*, which defines the kind of data they contain, like System, Data, Backup, Recovery, Preboot (a special volume handled at startup), and so on.

With the release of macOS 10.13 High Sierra in 2017, the macOS installer converted all SSD-based Macs to use APFS. The next year, 10.14 Mojave converted hard disk drive and Fusion drive Macs during an upgrade or installation.

But it wasn't until 10.15 Catalina that we saw the real picture, when Apple introduced the concept of *volume groups*. These are sets of separate volumes in an APFS container that can present to the Finder as a single, bound-together unit. A startup container has multiple invisible volumes plus a volume group with system and Data volumes inside. Links between the two volumes let you navigate through a single entity in the Finder as if you were navigating just one volume. Nifty, but complicated.

In previous versions of macOS, Apple relied on System Integrity Protection (SIP) to lock down system-file modifications (see [Control Big Sur's System Integrity](#)). With Catalina, Apple went further: all system files are placed on the system volume, including all the apps Apple built into macOS. This system volume set to be read-only. The operating system prohibits modifications. Your user data is on the Data volume, which can be read from and written to.

Big Sur goes one step further to ensure the system can't be fiddled with, as I describe in complete detail in [Control Big Sur's System Integrity](#). During an installation or update of Big Sur—on both Intel and M-series Macs—the installer creates a *Signed System Volume* by producing a cryptographic “seal” when installation is finished. If the seal can't be validated at startup, your Mac won't boot into macOS, and it tells you to reinstall the operating system.

# Work with Extended Battery Life

There's a point while reading superlatives when your eyes rightly glaze over. I know I have a very low limit for it. Which is why I sometimes feel like a huckster and shill when people ask me about the battery life of an M1-based Mac laptop. It's ridiculous. It's absurd. I'm nearly embarrassed to talk about it, because it's *so dangd huge*.

Apple's M1 chip consumes energy so efficiently that it can carry out processor-intensive tasks over a long period of time and consume what seems to be somewhere between one-third and one-half as much battery power as a comparable Intel laptop. Sometimes, even less.

And when you're performing more normal tasks, like reading articles in a web browser or using a word processor, or simply leaving your Mac active and not engaged in working on it, the battery seems to go on and on and on and on. I've taken my Mac off power and left it by accident, and several hours later come back and find that its charge remains nearly full.

I'd wager that for some people, they could work for two full business days in a putative post-pandemic world of commuting or travel without plugging in. That's the kind of performance associated with an iPad.

In this chapter, I detail how Big Sur charges and manages batteries, so you understand how best to keep your battery in fine fettle. And how to use macOS and third-party tools to keep on top of current time left and charging cycles to maximize battery life *and* longevity.

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## How Batteries Charge and Cycle

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Lithium-ion (Li-ion) batteries are a modern miracle that effectively made mobile devices feasible, as well as electric cars and much else.

Unlike previous generations of batteries used in vehicles and electronics—odd bedfellows there—Li-ion batteries hold energy densely while discharging slowly when not in use. They also lack the dreaded “memory effect” found in older rechargeable batteries, when a battery that’s not fully discharged starts to get stuck at a maximum recharge limit that’s far below its actual maximum capability.

Developments a few years ago allowed manufacturers to move away from a battery-cell approach, in which Li-ion batteries were in a form factor similar to alkaline and nickel metal hydride (NimH) rechargeable ones. A “polymer” form of Li-ion allows them to be shaped in all sorts of ways. Apple used this effectively to fill in all the empty spots in an iPhone with battery, and to create the equivalent of layered shingles of batteries to fill the insides of laptops.

The real limit with Li-ion batteries is carefully charging them to the safest full capacity. Overcharging one of these batteries or battery packs can lead to excessive heating, which can cause a fire.

**Warning!** If you ever see a bulgy part of a device where its battery is, immediately stop charging the device, and if possible put it in a metal bucket on a concrete floor where there’s air circulation. Bulging typically happens when internal safeguards in the lithium-ion cells have been damaged or it’s been overcharged, and a runaway reaction can occur that can result in a dangerous fire. [This Macworld column](#) I wrote has additional safety and disposal advice as does [this Battery University article](#).

This is why “100%” isn’t really 100% when it comes to Li-ion charging. Even with a fresh device, the “100%” charge is 100% of what the battery maker and the device maker decide is the safest amount to charge a given battery. There’s always additional capacity that’s left in reserve to avoid overheating.

There’s also an inflection point in charging at 80% of current capacity. Below 80%, a charger in a device charges at effectively full speed, although devices with battery temperature sensors factor that in, such as Mac laptops that can run Catalina and Big Sur.

# Understand recoveryOS

Apple's separate recovery operating system (recoveryOS) has been a vital part of troubleshooting your Mac since it first appeared about a decade ago. It's also where you go when you need to make changes to certain low-level and security settings that can't be modified while macOS is running.

## The Many Names Used with Recovery on an M-Series Mac

Apple seems to be in a transition point about what it calls this special boot mode on a Mac. The best we can figure it at Take Control Books is that there are three terms in use:

- ✦ *Recovery mode* is the generic term for a recovery boot process in macOS, iOS, iPadOS, and all Apple operating systems.
- ✦ *macOS Recovery* used to be the term that referred to restarting into Mac recovery mode. If you start up an Intel Mac by holding down  $\mathbb{R}$ -R, the app that appears has a header labeled macOS Recovery, in fact. macOS Recovery is used in some of Apple's user-facing manuals and documentation online.
- ✦ *recoveryOS*, a term we first saw in the Apple Platform Security document (aimed at security researchers and system administrators) and in some IT-focused guides, refers to the special limited-purpose operating system that runs recovery mode on a Mac. On an M-series Mac, when you restart in recoveryOS, there's no header label. It's only when you click Options and authenticate that the main recovery "app" appears and is still labeled macOS Recovery—this is just confusing and may change. (And you might be prompted at the login window, if you delay entering your password for a while, to restart in... "Recovery OS.")
- ✦ Recovery Assistant is a hidden assistant that aids with fixing a Mac when its system volume loses its integrity in a way I describe how to fix in [Reinstall with the Personalization Error](#).

Since we're only talking about M-series Macs in this book, I have chosen to use the term recoveryOS for the general state of booting in recovery mode, because it's the most consistent available name.

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# Restart in recoveryOS

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To enter recoveryOS on your M-series Mac:

1. Choose Apple  > Shut Down.
2. When you see your Mac has powered down, hold down the power button until you see a prompt that says “Loading startup options.”
3. A set of one or more drives appears along with a gear icon labeled Options. (It may take tens of seconds for all drives to appear.) To continue with Options, you select Options, click Continue, select an account, enter its password, and click Continue.
4. A screen appears on which you can click to select from among four tasks or choose other options from the Utilities or Apple  menu.

I describe how all these options in step 3 and 4 work across the rest of this section.

## M-Series Macs Have Fewer Boot Modes

Intel Macs have a variety of keyboard shortcuts and buttons you can press to trigger starting up in [several different modes](#), like internet recoveryOS, diagnostics, Safe mode, Single User Mode, and others.

[M-series Macs have just four](#): macOS, recoveryOS, fallback recoveryOS (described below), and safe mode (described next).

## Start Up in Safe Mode

In safe mode, macOS won't load any kernel extensions (*kexts*) you've added. This can solve startup problems related to buggy extensions. You won't need it often.

To boot in safe mode, restart in recoveryOS as above. In Step 3, hold down the Shift key when your startup drive appears, click Continue in Safe Mode, and release the Shift key. Your Mac restarts in safe mode. Restart again to boot up normally.

# Manage System Security

Apple has built in a number of excellent protections in recent years against a combination of physical intrusion, in which someone can sit down in front of your Mac and attempt to break in, and system integrity, in which system files have been increasingly immutable.

In this chapter, I explain three major elements of system security that are different on an M-series Mac and that you may find yourself needing to work with or around.

**Note:** For a full dive into macOS security for Intel and M-series Macs, read my book [Take Control of Securing Your Mac](#).

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## Protect a Drive with FileVault

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The current version of FileVault was developed for Mac OS X 10.7 Lion way back in 2011, where it combined two separate features: software-based full-disk encryption (often called FDE) with a special startup and login mode that worked with a fully encrypted disk. (Apple later added dedicated silicon to Macs to accelerate encryption.)

With the introduction of the T2 Security Chip in Intel Macs, Apple separated FDE from the FileVault login mode. On T2-equipped Macs and M-series Macs, which have a Secure Enclave, the internal drive is always encrypted. FDE is always on and can't be disabled.

Intel Macs still require a special startup mode in recoveryOS, but M-series Macs no longer do: they boot into macOS directly.

So what's the difference with an M-series Mac between FileVault enabled and disabled? Here's the distinction:

- With FileVault *disabled*, the startup process automatically retrieves the volume's security key in a process mediated by the Secure Enclave. The Data volume is decrypted even before an account

password is successfully entered. That leaves an inch of room for an attacker to try gain access, difficult as it might be.

- With FileVault *enabled*, a Mac with Apple silicon boots from the System volume; the Data volume remains fully encrypted. Once the password for a user account is successfully entered, macOS can retrieve the encryption key that protects the Data volume, and unlock it for use.

**Note:** If the SSD drive were removed from a Mac—which in modern Macs is nearly infeasible—the decryption information would remain in the Secure Enclave that’s left behind. But taking the whole computer still leaves the problem of breaking into the Secure Enclave, which has proven so far highly resistant to attack.

## How macOS Manages FDE

While FDE is not a feature of FileVault as such with an M-series Mac, since encryption is always enabled, FileVault does mediate how a Mac’s startup drive becomes available after it starts up or restarts.

Full-disk encryption puts a layer between the operating system and a storage drive that automatically decrypts all information coming off the drive and encrypts it as it’s written. This means all information whenever it’s stored on the drive—when it’s *at rest*—is fully encrypted. This includes when the Mac is in use and when it’s powered down.

Only while a Mac is active is stored information vulnerable to interception, as macOS must hold the encryption key in memory to allow it to encrypt and decrypt data on the fly. This allows macOS to treat an encrypted volume as if it were effectively not encrypted at all while in use, including letting you share the volume over a network; back it up to an external drive, a networked volume, or an internet service; and use sync services like Dropbox, iCloud Drive, and OneDrive.

Whenever any Mac with FileVault enabled is shut down—whether an M-series model or a pre-T2 Intel Mac—its startup drive is an inaccessible vault, with no more information accessible than a lump of solid metal. The key material necessary to decrypt its data can’t be accessed.

# Launch iOS and iPadOS Apps on Your Mac

One of the most surreal things you can do on an M-series Mac is install and launch apps designed for iOS and iPadOS. Because the M-series Mac has a compatible ARM-based processor, mobile apps can run across those three platforms. (macOS apps can't run in iOS or iPadOS...yet?)

Not every iOS and iPadOS app can run, but most can. Touch-based actions have to be mapped to ones that can be performed with a mouse, trackpad, or keyboard, too. But it's a surprisingly seamless process.

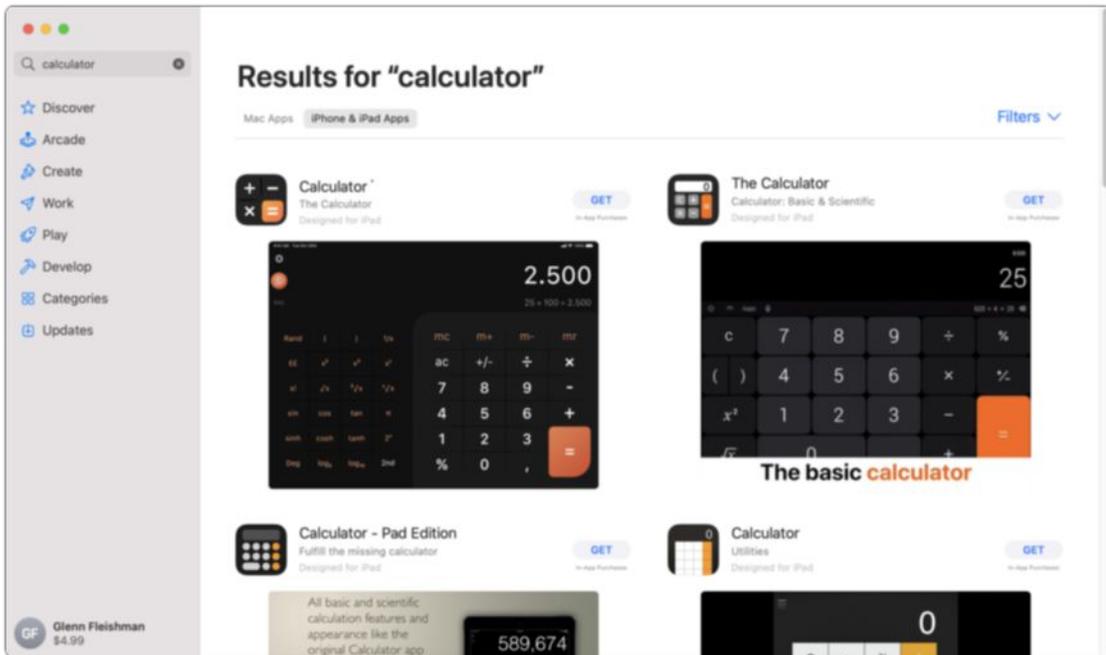
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## Find and Install Mobile Apps

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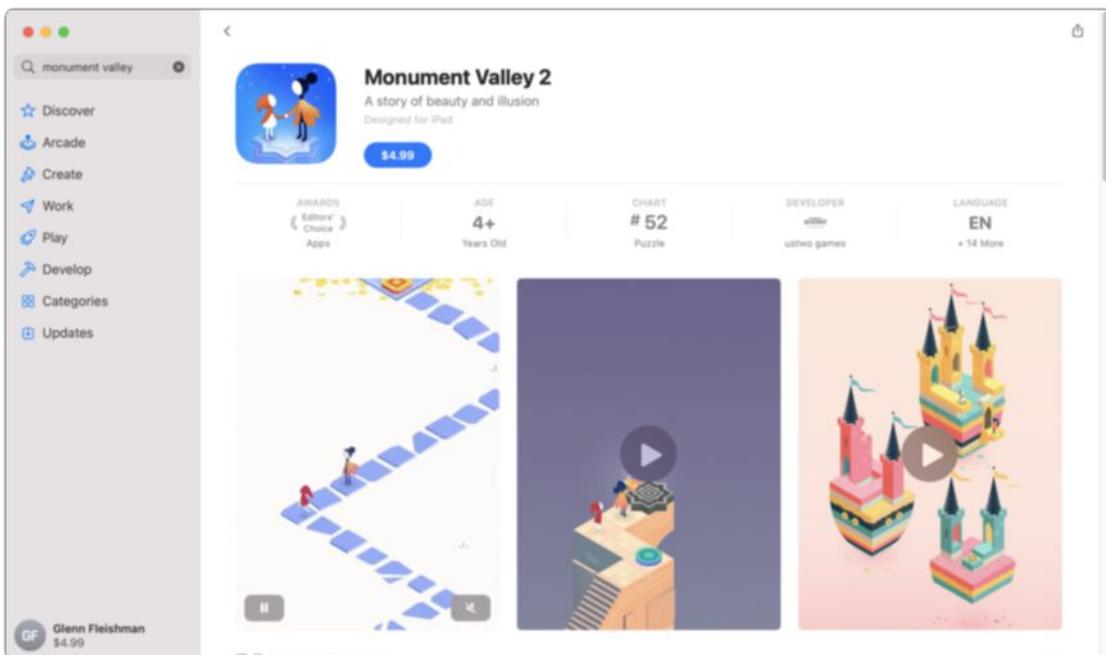
The Mac App Store now offers both macOS apps that developers have made available for download, sale, or subscription through Apple, and iOS and iPadOS apps.

Unfortunately, you can't browse through categories to find mobile apps. You have to either follow a direct link to an iOS or iPadOS app or search by keywords or by name. For instance, search for "calculator" and you will see two items under "Results for 'calculator'": Mac Apps and iPhone & iPad Apps. Click the latter link, and the results are all mobile apps (**Figure 20**).



**Figure 20:** The App Store lets you select iPhone & iPad Apps in search results.

All apps will show either “Designed for iPhone” or “Designed for iPad.” Apps designed for both appear to show only the iPad label, though. Obtaining an app and downloading it is just the same as with any Mac app in the App Store or in the iOS and iPadOS App Stores (**Figure 21**).



**Figure 21:** Just click the price, confirm the purchase, and the game is downloaded to your Mac.

# Install and Use Windows

A popular use of high-performance Macs has been to run Windows. At times, the fastest machine that could run Windows was in fact a Mac. Apple even made this an authorized function way back in 2006, by adding Boot Camp, a utility that manages installing Windows and starting up your Mac into it.

With the first M-series Macs, that went out the window. There's no Boot Camp, and no production release of Windows for M1 Macs.

**Note:** Emulators that could pretend to be an Intel processor don't yet exist for Apple silicon, either. As noted in [Run Old and New Code on an M1](#), the only way to run Intel-based operating systems on a Mac is to have an Intel Mac.

That could change, however. Apple's head of software engineering, Craig Federighi, [told Ars Technica back in November 2020](#) that Microsoft could opt to license ARM-based Windows for Mac users.

As of April 2021, there is one simple way to run a limited version of Windows on an M1 Mac: Parallels Desktop for macOS version 16.5, which added native M1 support.

Start by obtaining the version of Windows 10 that works with ARM installations. It's in beta, so you can't simply purchase or download it. However, Microsoft makes it extremely easy to set up a free developer account and download it.

Here's how to get the Windows 10 for ARM beta:

1. Start with [the Windows Insider Preview Downloads page](#) for "Windows 10 Client ARM64 Insider Preview." You will be prompted to login in. If you don't have an Outlook.com or Live.com account, follow the steps offered to create one.
2. Return to the downloads page, if you aren't automatically redirected. You should be prompted to agree to Windows Insider terms.

Make sure you read what you're agreeing to and then check the boxes offered.

**Note:** Editor Joe Kissell found himself stuck at step 2. He wasn't able to agree to terms and proceed. Instead, he had to register separately for a Windows Insider account and complete the process from within an existing running copy of Windows 10. I didn't encounter this.

3. Click "Windows 10 Client ARM64 Insider Preview - Build *xyz*"; a build number appears in lieu of *xyz*, and will change over time. The download is roughly 9 GB and will be named something like [Windows10\\_InsiderPreview\\_Client\\_ARM64\\_en-us\\_21286.VHDX](#).

Set the file aside until you've completed one or both of the next two emulator installations.

**Note:** After you complete an installation with an emulator, follow the instructions in Windows 10 when prompted to log in to the account associated with your Windows Insider membership. You will also get instructions on enabling optional diagnostics, which is required to download incremental updates to Windows 10 in the beta program.

Now purchase [Parallels Desktop for macOS](#) version 16.5 or later, which costs \$79.99 per year for a new license or \$49.99 per year if you're upgrading from a previous version or adding a license to run the software on an additional Mac.

After installing Parallels Desktop and entering the activation code provided on purchase, follow these steps:

1. Launch Parallels Desktop from the Applications folder.
2. Navigate to the Windows 10 Client ARM64 installer file or click Find Manually and drag and drop it into the window.
3. Follow prompts to create the virtual machine, which are quite straightforward. You can opt to configure some settings before launch, but those can also be changed afterwards.

# About This Book

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## About the Author

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Glenn has written oodles of books since the 1990s. Most recently, those include *Take Control of Securing Your Mac*, *Take Control of Zoom*, *Take Control of iOS & iPadOS Privacy and Security*, and *Six Centuries of Type & Printing*. Glenn writes for the *Economist*, *Increment*, *Macworld*, and TidBITS on topics as varied as the longest-running metal foundry in America, the unique nature of sheriffs in America, and how syndicated cartoons were distributed to newspapers in the 1920s.

(Photo credit: Lynn D. Warner)

### Shameless Plug

As part of my historical interest in type and printing, I created a project in 2019 called the Tiny Type Museum & Time Capsule. It's a real, tiny museum full of type and printing artifacts, new and old, in a handmade case, coupled with a letterpress-printed book, [\*Six Centuries of Type and Printing\*](#), covering the development of printing from Gutenberg to the present (with some background on pre-Gutenberg printing). You can find out more about the museum and obtain your own (a few remain in April 2021) at [tinytypemuseum.com](http://tinytypemuseum.com).

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## About the Publisher

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alt concepts inc., publisher of Take Control Books, is operated by [Joe Kissell](#) and [Morgen Jahnke](#), who acquired the ebook series from TidBITS Publishing Inc.'s owners, Adam and Tonya Engst, in 2017. Joe brings his decades of experience as author of more than 60 books on tech topics (including many popular Take Control titles) to his role as Publisher. Morgen's professional background is in development work for nonprofit organizations, and she employs those skills as Director of Marketing and Publicity. Joe and Morgen live in San Diego with their two children and their cat.

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