A Practical Guide to

NETWORKING, PRIVACY & SECURITY IN iOS 10

By Glenn Fleishman

Welcome

Welcome to *A Practical Guide to Networking, Privacy, & Security in iOS 10*, version 1.0.0, published in September 2016 by Aperiodical LLC.

This book describes how to use your iPhone, iPod touch, or iPad with iOS 10 on Wi-Fi and cellular/mobile networks securely, making connections with ease while protecting your data and your privacy. It also covers Bluetooth, tracking an iOS device, the Apple Watch, differential privacy, Personal Hotspot and Instant Hotspot, two-factor authentication with an Apple ID, using AirDrop and AirPlay, and solving connection problems.

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This book was written by Glenn Fleishman. The cover illustration is by Christa Mrgan.

Introduction

The book is divided into three major sections:

Networking should be simple, and security should be automatic. And money should grow on trees. Despite how intuitive it is to pick up and use an iOS device, requiring little thought as to how it connects to a cellular or Wi-Fi network, it becomes quite complex as soon as you drill down to any details. This is especially true when connectivity fails,and you try to troubleshoot.

Privacy is a subject that deserves much more attention than it's gotten in the past—and people are starting to pay attention. Your information is your own to choose how it's shared, whether it's your location, your food preference, or your address and phone number. iOS provides tools that enhance your ability to control that.

Security is an even denser area. Apple makes the default choices in iOS reasonably secure, but to ensure real protection for your data—while your bits are traveling through the æther or in the event that your device is stolen—you need to know how it all works.

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NETWORKING

It's true that an iOS device can be used without a live network connection, but its natural state is always hooked up. In the first part of the book, you'll learn how to work with the three types of iOS wireless communication—Wi-Fi, cellular, and Bluetooth—for general connectivity, with personal hotspots, for audio/video streaming, and for file transfer.

Connect to a Wi-Fi Network

Wi-Fi works quite simply in iOS, but there's a lot of hidden detail. In this chapter, you'll learn how to interpret the Wi-Fi settings view, manipulate custom network settings, and troubleshoot common problems.

Join a Network

Open the Settings app and tap Wi-Fi to view nearby networks. Networks that use the same network name for both bands or on multiple base stations appear as a single entry. Tap a network name to attempt to join it.

> ***Not seeing an expected network?*** *See* ***Wi-Fi Troubleshooting****.*

The first time you tap a network name to connect, your device joins the network immediately unless encryption is enabled on the network. In that case, you are prompted for a password; once you've entered the password and tapped the Join button, you join the network.

> **Note:** For more on connecting with a password or other methods, see **Connect to a Secure Wi-Fi Network** in the Security section of the book.

> **Tip:** Are you tired of your device popping up a list of nearby Wi-Fi networks while you're trying to do something else? Turn off Ask to Join Networks, described a couple of pages ahead.

Once your iOS device joins a network, the network name and any associated login information is added to an internal network list. Unlike in Mac

OS X and Windows, you can't examine this list and remove entries. The device uses this list to re-join a network when it is in range.

> **Tip:** You can remove a stored network's entry only when you're connected to it. See **Forget This Network**.

Apple Watch Wi-Fi

The Apple Watch can connect via Wi-Fi to reach its paired iPhone when the phone is out of Bluetooth range, and to carry out a limited set of tasks when the iPhone isn't available at all. But there are a number of provisos:

- The network uses the 2.4 gigahertz (GHz) band. (See **Wi-Fi Troubleshooting**.)
- The iPhone with which the Watch is associated must have previously connected to the network.
- The iPhone connection must be active over Bluetooth when the Watch encounters the Wi-Fi network for the first time.
- The network doesn't have a portal or login page.

Since the release of watchOS 2 in 2015, the Watch can use Wi-Fi directly for many features.

Managing Wi-Fi Connections

iOS centralizes Wi-Fi management in the compact space of the Wi-Fi settings view (**Figure 1**). To reach it, open the Settings app and tap Wi-Fi.

The Wi-Fi view always has three elements, with optional fourth and fifth items:

- **Wi-Fi switch:** Tap this switch to disable and enable the Wi-Fi radio. The currently connected network, if any, appears beneath the switch.
- **Personal Hotspot(s):** If an iPhone or iPad is nearby running iOS 8.1 or later, it appears as a Personal Hotspot, whether or not that feature is active. (This is the Instant Hotspot feature described—and shown in figures—in **Turn On via Another Device**.)

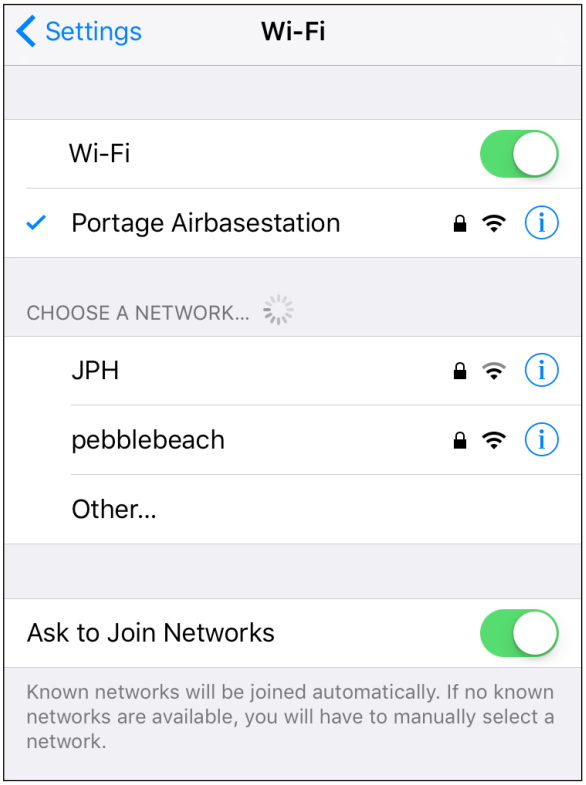


Figure 1: *The Wi-Fi view has a list of available networks.*

- **Choose a Network:** In this area, you may see a list of networks. Each entry in the list has three or four elements:
  - **Network name:** A network uses this name to *advertise* itself to Wi-Fi adapters that are looking to make a connection. The network name is also called the SSID (Service Set Identifier) in some of the geekier base station configuration tools.
  - **Security recommendation:** If you connect to a network that isn't encrypted, this message is displayed.
  - **Lock icon:** A lock may appear, indicating that there's some form of protection on the network.
  - **Signal-strength indicator:** One, two, or all three radio waves in the indicator are black (starting at the bottom) to show the strength of the signal being received by the device.

- **Information:** Tapping the info ⓘ button—carefully, because it's a small target—reveals technical details about the network, as well as an option to forget the network. For more about these details, see **Drill Down to Network Details**, a few pages ahead.

- **Set Up an AirPort Base Station:** This option appears only if your device detects a nearby unconfigured Apple-branded base station. (I talk more about that in ***Take Control of Your Apple Wi-Fi Network***, a guide to wireless networking with Apple base stations and hardware, published by Take Control Books.)
- **Ask to Join Networks:** With this switch, choose whether to be alerted about nearby networks to which the device hasn't previously connected.

> **Tip:** If Ask to Join Networks is off, you won't be alerted about new networks nearby when a known network isn't available. However, the Choose a Network list always shows all named networks around you.

Drill Down to Network Details

For most network connections, you don't need to go beneath the surface. However, for an unusual connection, such as one requiring a fixed, or static, network address or a different domain name server than the network's default, go to Settings > Wi-Fi and then tap the info ⓘ button for the current network (a checkmark is by the listing) to set up the connection details.

The resulting view has the network name at top and three or four configuration areas, depending on the network (**Figure 2**). Let's look at each.

Unsecured network

Apple added a fairly severe warning about using an unencrypted network connection in iOS 10. It displays "Security Recommendation" in the main Wi-Fi view, and then explains further in this details screen. And it has a link to follow to get even more information.

Forget This Network

Tap the Forget This Network button to remove the network from the list of previously joined Wi-Fi networks. This also disconnects the device from the network immediately and prevents it from connecting to that network automatically in the future. Forgetting a network can solve network problems, too, by letting iOS dump any corrupted or cached information before the next time you connect.

Auto-Join/Auto-Login

As described in **Auto-Join and Auto-Login the Next Time**, these options appear only for hotspot networks for which the device has retrieved settings that allow it to make an automatic web-based login.

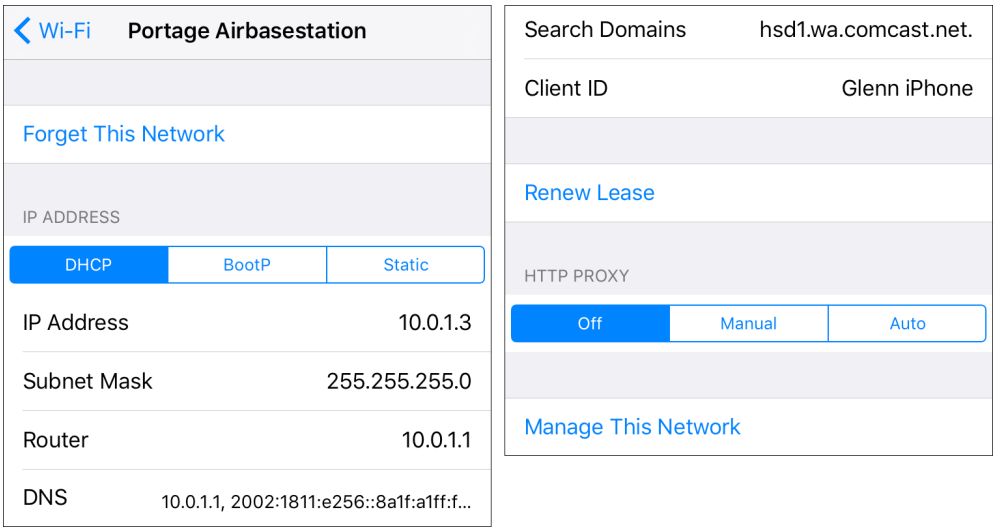


Figure 2: *You can view or set network connection values. (Top of view at left; bottom at right.)*

IP Address

The IP Address section covers TCP/IP values used for the Internet's addressing and routing system, divided vertically into sections. You start with three kinds of standard network connection methods, which you can see as the DHCP, BootP, and Static buttons near the top of Figure 2, above. Tap a button to display the related choices underneath. You should almost never need to change these values. DHCP (Dynamic Host Configuration Protocol) is the most common method of obtaining an address.

DHCP lets your mobile gear request a network address from a router on the network, and then use it to interact on the local network and beyond. When your device uses DHCP to get an address on the local network, you can't change the IP Address, Subnet Mask, or Router fields, as those values are provided by the DHCP server on the router.

DNS (Domain Name System) is used to convert human-readable domain names, like `www.glennf.com`, into machine-readable IP addresses, like `173.255.209.35`. The DNS field in the DHCP settings can be modified or added to. This can be useful if the network to which you're connected has poorly run or slow default DNS servers. Use a comma to separate multiple entries.

Use the Client ID Field for a Fixed Network Address

On a home or work network, you may want to assign a fixed address to your devices. Apple offers this option as DHCP Reservation in the AirPort Extreme, Time Capsule, and AirPort Express base stations.

In your device's DHCP settings, if you set Client ID to a unique value, like `Glenn's iPad 4`, you can set your base station to assign the same local network address to your device every time it connects over Wi-Fi to the network.

This is useful if you want to use a consistent IP address to connect to certain apps that provide network services, like Air Sharing HD and GoodReader, for remote access to file storage. For details on configuring DHCP Reservation, read my book ***Take Control of Your Apple Wi-Fi Network***, published by Take Control Books.

Tip: Unfortunately, you can't set DNS globally for iOS—you can set it only for individual network connections. It may not be worth the effort to set it for connections you use infrequently, but it's worthwhile for a network that you use often, such as your home Wi-Fi connection.

For certain network configurations that you will never have to enter for a public Wi-Fi network, you may need to tap the Static option and enter settings for IP address, subnet mask, router, and DNS. Those values would be provided by a system administrator or an ISP. Likewise, BootP is almost never used anymore, but remains for backward compatibility.

The Renew Lease button is specific to DHCP. A lease is the assignment of an address by DHCP to your device. A lease can have a duration (like 15 minutes or 15 days). Occasionally, when you seem to have a network address but can't connect, tapping Renew Lease will obtain a new address and resume connectivity.

HTTP Proxy

This option, located at the bottom of the detail view, is typically used only in companies and schools. It redirects web requests that you make to the Internet at large to a local server that handles them indirectly. It also allows the use of a caching proxy, in which recent pages retrieved by anyone in an organization are fed to you from this server instead of from the remote web site. This reduces bandwidth consumption.

Manage This Network

On a network that uses Apple's Wi-Fi hardware, this button will appear. Tap it, and it launches the AirPort Utility app if it's installed, or prompts you to download it if not. The app lets you view the network's configuration, make changes, and examine some details of operation.

Turn Wi-Fi Off

Whenever the Wi-Fi radio is active, even if you aren't connected to a network, it's scanning for networks, which can slowly drain the battery. If you're nowhere near a network you can access or if you want to conserve battery life, turn off Wi-Fi by tapping Settings > Wi-Fi and then setting the Wi-Fi switch to Off. (See **Airplane Mode** for more details.)

Capture the Page

iOS has a clever feature that lets it display a hotspot network login screen and, in some cases, remember the login and other details. However, you can get stuck reconnecting to the same network.

You'll find these types of networks in public places such as cafés, libraries, and airports. After you connect to the network, which appears as

open and unprotected, you're required to launch a browser and view a hotspot connection page (also called a captive portal) before you can use the Internet.

Normally, to reach the captive portal, you must try to visit any web site in a browser, and have your browser be redirected by the network to the login page. Instead, iOS (and Mac OS X since Lion) does a test that detects such redirections whenever you connect to a Wi-Fi network.

Immediately after your iOS device joins a Wi-Fi network, it tries to connect to Apple's web site. If it doesn't get through, it assumes that it has reached a captive portal. Then, the next time anything happens on the device that requires Internet access (like retrieving email), iOS displays a special screen showing the portal's web page as if it were in Safari.

The hotspot network's captive-portal page will typically ask that you do one of the following (rarely more than one):

- Read a set of terms and conditions for use and tap an Agree button; enter an email address and tap an Agree button; or check a box that says "I agree" and tap a Submit button.
- Require that you register an account to use the network at no cost. With an account, you can log in and use the network.
- Require that you either pay for a connection to the network using a credit card, or enter login information for an active account on the network or an active account of a roaming partner.

After you carry out any of those actions, iOS should close the special screen and Wi-Fi service should be available. These pages are still often absurdly not customized for mobile devices, and the type and buttons are tiny. You'll need to pinch to zoom in almost all of the time.

Connect to a Captive Portal If It's Not Detected

If the special screen doesn't appear, you can reach the captive portal by launching the Safari app. Most of the time, the previously visited page in Safari will try to load; if you have a blank page, enter any site address, like `example.com` or `apple.com`, and tap Go.

After you enter any required data, the login system should redirect you to the web page you tried to visit in the first place.

Mobile Device Hotspot Access via Boingo

You have an alternate way to pay for hotspot access. Boingo Wireless resells access at a flat monthly rate to over 400,000 hotspots worldwide. Boingo's **iOS** and other apps automatically join free networks, too, bypassing the special screen and login procedure you often have to go through.

Boingo has two unlimited usage plans that each cost $9.95 a month (and half off on the first month), with only a monthly service commitment. The mobile plan lets you connect to any of its hotspots worldwide using up to two phones, tablets, cameras, or the like at a time. A North and South America plan allows two devices of any kind, including laptops, at a time.

Boingo also has regional and global plans, as well as an hourly and pay-as-you-go service. While Wi-Fi is typically free in America, elsewhere in the world Wi-Fi for a single night at a hotel or a few hours in a coffeeshop can cost more than the monthly plan.

Apple doesn't let hotspot apps run in the background to manage logins. You must launch the Boingo app before you connect, and it handles getting you in.

Auto-Join and Auto-Login the Next Time

The next time you visit a hotspot network that you've previously accessed, iOS will automatically join the network and attempt to use the same credentials or button clicks that you used the previous time to gain access. This can lead to problems if that information is no longer valid or if the device doesn't present it correctly.

In my testing, iOS often shows the same screen for login again without automatically filling it, especially if there's an Agree button to tap in order to avoid you agreeing to terms that might have changed.

You can disable joining and logging in to the network again in this fashion by turning off Auto-Join or Auto-Login for the connection, an option that is available only when you are connected to the Wi-Fi network, even if you haven't logged in or proceeded past the connection web page (**Figure 3**).

To turn off Auto-Join or Auto-Login, follow these steps:

1. In the Settings app, tap Wi-Fi.
2. In the Choose a Network list, tap the info ⓘ button to the right of the network name.
3. In the configuration view, switch off Auto-Join, Auto-Login, or both.

Time-Limited Hotspot Access

Some hotspots limit your use to a specific period of time. This might be implicit, using your unique network adaptor's ID—its MAC (Media Access Control) address—or another bit of tracking information based on when you first accepted a network's terms of services.

Some locations with hotspots give you a network code to enter at a portal page, which grants you access for a fixed amount of time. In those cases, you should turn Auto-Login off; otherwise, the next time you connect, it may attempt to enter a one-time use code that's expired, and it may be difficult to connect properly with a new code.

Figure 3: *When you connect via a portal to a hotspot, the detail page provides additional options.*

Wi-Fi Troubleshooting

Although Wi-Fi generally works well, you may at times be unable to get a live network connection. Here is troubleshooting advice for common cases.

Can't See Wi-Fi Networks or a Network You Need

If your device can't see any Wi-Fi networks or a network you think should be available:

- If your device shows no Wi-Fi networks, swipe from the bottom to reveal the Control Center (or launch Settings) to be sure that Wi-Fi isn't turned off. This has happened to me more times than I'd like to admit.
- It's possible that you are out of range. Move the device closer to where you know (or think) a base station is located. Although every iOS device sports an excellent Wi-Fi radio, Wi-Fi reception can be blocked by thick obstructions, such as solid stone and brick walls, or by walls made of chicken wire covered by plaster.
- Wi-Fi networks can operate over two frequency bands: 2.4 gigahertz (GHz) for the 802.11b, g, and n standards, and 5 GHz for the 802.11a, n, and ac standards. However, not all iPhones or iPod touches have 5 GHz radios. iPhones before the iPhone 5 and iPod touches before the 5th generation can't access 5 GHz networks, and neither can the Apple Watch. (All devices support 2.4 GHz, however.) It's rare but possible a network you need is only operating in the 5 GHz band.

Note: It's also possible that the base station, not your handheld, is in trouble. And I have seen the Wi-Fi radio in an iOS device fail intermittently or completely, requiring that the device be entirely replaced.

No Wi-Fi Signal Strength in the Indicator

You've selected a network and, if necessary, entered a password, and tapped Join—but the signal-strength indicator in the upper left still shows gray radio waves instead of black. This means that an initial connection was made, but then you quickly moved too far away from the base station, or the base station was shut down or restarted with new information. If the connection process had failed while underway, you would have seen a notification alerting you.

Try connecting again. If that fails, restart your device: Press the Sleep/Wake button until you see a red slider for powering down. Slide it, wait until the spinning indicator disappears and the screen goes entirely black, and then hold down the button again for a few seconds. An Apple icon appears and the device starts up.

Too Many Wi-Fi Networks

There are times when so many Wi-Fi networks in the vicinity may make it hard to select the one you want to join. If you know the network's exact name, you can type it in:

1. Launch Settings.
2. Tap Wi-Fi.
3. Slide down until you can tap the Other button (**Figure 4**).
4. Enter the network name exactly and, if there's a password:
   a. Tap Security.
   b. Select the method (almost certainly WPA2).
   c. Tap Other Network to return to the previous screen.
   d. Enter the password in the Password field.
5. Tap Join.

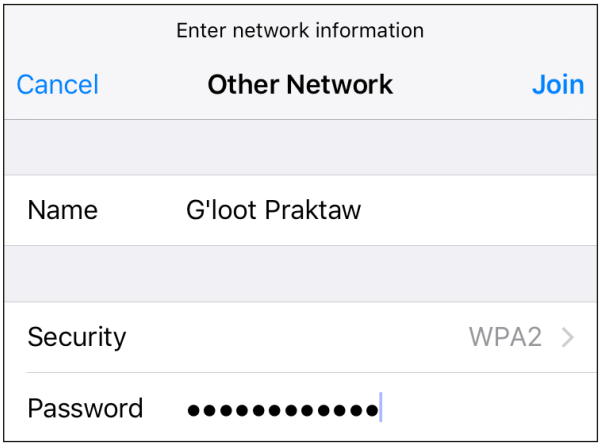


Figure 4: *The Other Network option lets you enter a network name and optional password from scratch.*

Tip: If you don't know the kind of network security on the network you're trying to join and you have a Mac nearby, hold down the Option key and select the Wi-Fi menu, then hover over the network name. A small popup displays the security type.

Correct Password Not Accepted

As described in the chapter, **Connect to a Secure Wi-Fi Network**, a network that requires either a password or a username and password will reject your device if you enter it improperly.

But what if you're positive you're entering the password or username and password absolutely correctly?

- Check whether you were given the password with correct capitalization, which counts in Wi-Fi passwords as in others.
- Spaces can be part of WPA2 passphrases, but are often hard to indicate if someone has written down the password. Confirm you're not missing a space.

No Internet Service after Connecting

You connected to a Wi-Fi network but cannot access the Internet from any programs you try. Here's how you can figure out what's wrong.

Check a Web Page with Safari

The most common cause of this problem is that you've connected to a network, likely a hotspot network but possibly a guest network, that requires a password, button tap, or other action.

Launch Safari and try to reach any page, such as google.com:

- If you are redirected to a login page, follow the instructions. You may need to pay for access, or you may have connected to a network that requires a password; consult **Capture the Page** for more information.

  Remember to forget: *Because you've connected successfully to the Wi-Fi network, even though you haven't been granted access to the Internet, you need to remove the network from the list of those you've previously joined or you'll have this problem every time you're in range. Tap Settings > Wi-Fi, tap the info ⓘ button beside the network name, and then tap Forget This Network. Confirm.*

- If Safari throws up a connection error, try the next fix.

Check or Ask about the Base Station

If you're on a network where you can control the base station or ask someone who has access (a friend, barista, network administrator, or the like), you might ask them to confirm that there's no problem.

In some cases, a base station can continue to provide service to users who are already connected, but not properly allow new users to connect. Some have limits, as low as five or 10 connected devices, and that limit may only rarely be hit.

Check IP Address Settings

This may sound obscure, but it's an easy way to see if your device is obtaining a network address from the router you've connected to. To check on your assigned IP address, follow these steps:

1. In Settings, tap Wi-Fi.
2. Tap the info ⓘ button to the right of the currently connected network's name.

   The IP Address section should be set to DHCP for almost all networks; another value should be chosen only if you've been told otherwise. (See **Drill Down to Network Details**, earlier in this chapter.)

   If the IP address starts with `169`, then iOS wasn't able to obtain an address from the network. The `169` address range is self-assigned, meaning the device gave itself an address that can't be used on the network, and stopped checking.

   Here are several ideas for fixing the IP address:

- Tap Renew Lease; this causes iOS to ask again for a network address. If successful, the IP address will change from a number starting with `169` to an address starting with another range, typically `192.168` or `10`.
- In the main Wi-Fi view, tap the Wi-Fi switch to Off, wait a moment, and tap it back to On. Tap the network name's info ⓘ button to see if the address is now assigned.
- If you're at an event or a hotspot venue, ask the network's operator, the front desk, or whomever. The router may have crashed. (You can look around and see if other people look frustrated, too.)
- Restart the device. Press the Sleep/Wake button until a red slider appears. Slide to power off. Wait until the spinning indicator disappears and the screen turns black. Hold the button down again for a few seconds. An Apple icon appears, and the device starts up.

Make a Mobile Hotspot

Every iPhone and every "Wi-Fi + Cellular" iPad has, in addition to a Wi-Fi radio, a built-in data modem that lets the device access high-speed mobile data networks. The logical question in the iPhone's early years was: why can't we use that same modem with our laptops (or other devices) when we're traveling instead of having to buy a separate cellular modem or router and pay a separate monthly service fee?

Fortunately, Apple followed the suit of other smartphone makers and added Personal Hotspot, which lets you use your phone or tablet as a conduit to the mobile Internet. While the name implies a Wi-Fi hotspot connection, which is one component of it, you may also use Bluetooth or USB with desktop computers and other devices to extend access. All three methods may even be used simultaneously.

Personal Hotspot's availability varies by carrier, although operators around the world offer it: **consult this list by Apple** to check on yours. In North America, all carriers in America and Canada allow its use except for two tiny ones in Canada.

In America, the four largest carriers include mobile hotspot use in most or all of their plans—bandwidth consumed by a hotspot counts just like data used by an iPhone or iPad. A few plans limit or throttle hotspot data.

Which models? *In releases prior to iOS 9, some models that could install the latest iOS version couldn't use every Personal Hotspot feature. But every iPhone model and Wi-Fi + Cellular iPad model that can use iOS 9 or later can use every option.*

Note: In this chapter, I talk about a mobile hotspot or Personal Hotspot to refer to all the features, but I use the term *tethering* when the discussion is specifically about Bluetooth or USB.

Turn On Personal Hotspot

There are two ways to turn on the Personal Hotspot feature: directly on your iOS device or through another computer or iOS device.

Whenever you use these methods, the device that turns on the Personal Hotspot then automatically connects to it.

WARNING! *Devices that connect to a Personal Hotspot typically don't treat it any differently than a regular Wi-Fi or Ethernet network—which can mean it's easy to rack up huge amounts of usage. You will want to pause or disable sync services, like Dropbox, and online backup systems, like Backblaze or CrashPlan. You may also want to avoid using any streaming video services or digital media downloads while connected via a Personal Hotspot.*

WARNING! *Some cellular operators limit your use of Personal Hotspot after you use a certain amount of data, or they throttle all the devices on your account to 128 Kbps on their network after that point.*

Turn On in iOS 9 or Later

Enable it in Settings > Cellular Data (iPad) or Settings > Cellular (iPhone).

Tap Personal Hotspot to open the Personal Hotspot screen. Now you can switch the hotspot on and set a Wi-Fi password. The screen is also full of connection information (**Figure 5**).

After the first time you tap On, Personal Hotspot appears as an option on the Settings app's left pane (iPad) or main screen (iPhone) so you can access it quickly.

Figure 5: *The Personal Hotspot view lets you turn access on or off as well as set a Wi-Fi password.*

Turn On via Another Device

If you have multiple iOS devices running iOS 8 or later, or the right vintage of Mac running Yosemite or later, you can take advantage of Instant Hotspot, a feature that lets you turn on Personal Hotspot from another device.

Instant Hotspot is part of Continuity, a set of connections between your iOS devices and between iOS and Mac OS X. However, the devices must meet a list of conditions for Continuity to work:

- You have iOS 8.1 or later or OS X 10.10 Yosemite or later installed on the computer or device you're using to activate the hotspot, and at least iOS 8.1 on the device you're using as a hotspot.
- Your Mac is a model released in mid-2012 (MacBook Air and MacBook Pro) or later (Mac Pro, Mac mini, and iMac).
- Your iOS device was released in the last 3 to 4 years. (See **complete list**.)
- Your iPhone and the other iOS device or Mac are signed in to the same iCloud account.
- Both devices have Bluetooth enabled and are on the same Wi-Fi network.

  On a Mac, select the Wi-Fi menu, and choose the device in the menu under Personal Hotspot (**Figure 6**).

  On another iOS device, launch Settings, tap Wi-Fi, and choose the device in the Personal Hotspots list (**Figure 7**).

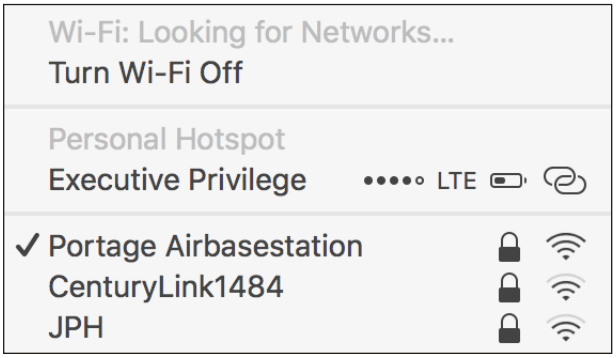


Figure 6: *Instant Hotspot puts an iOS device into your Wi-Fi menu in OS X.*

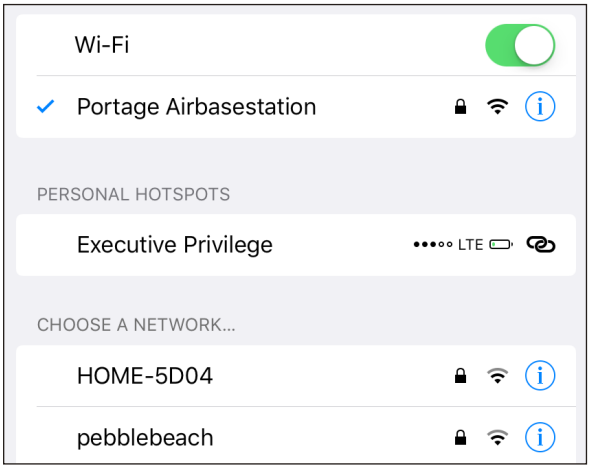


Figure 7: *In iOS, pick a device from the Personal Hotspots list.*

Even if you're not planning to connect, you can see the battery life, signal strength, and connection strength of your iOS device as a compact set of graphics in the menu or list.

You Can't Always Use Cell Data while Talking

It can be a little confusing to tell whether an iPhone can continue to have an active cellular data connection while a voice call is underway. On some carrier networks, data is suspended; on others, it slows; and all that is changing right now, with the right iPhone models, too. Wi-Fi data always works during a voice call, but when you're using Personal Hotspot, you're always relying on the cellular network for data backhaul.

Because of both the different cell technology employed by AT&T, T-Mobile, and most other networks around the world (called GSM), and that used by Sprint and Verizon (known as CDMA), and the generation of hardware you have, the option to talk and use data at the same point depends on both your carrier and your phone model. (All iOS 9-and-later-compatible CDMA iPhones can also be activated on GSM networks, typically for roaming or switching carriers.)

Digital cell technology is divided up into second-, third-, and fourth-generation (2G, 3G, and 4G) standards, plus some interim ones like EDGE (2.5G) and 3G+ (often called 4G). 2G was the first to carry digital voice, and all forms of it allow either data (at dial-up modem speeds) or voice, but not both at once.

The 3G standard that GSM network operators picked could carry voice and pure data at once, but Sprint and Verizon opted for a flavor of network that would carry data only over 3G. Some non-Apple CDMA phones have two radios, to allow a 2G voice call and a 3G data connection at the same time.

LTE is a 4G standard, designed so voice and data would intermingle for all phones and carriers. However, phones and networks were upgraded before the voice part, Voice over LTE (VoLTE), was ready to go. Even today, the way that VoLTE was implemented by cell companies, the carriers can't connect VoLTE calls between their networks.

Data networking today when a call comes in

As a result, you see the following behavior on most iPhones and on most networks when there is an incoming call or you place a call:

- **Verizon, Sprint, and most CDMA networks:** Data use, including Personal Hotspot, is immediately suspended.
- **AT&T, T-Mobile, and GSM networks:** Data use continues, but is shunted to a 3G, 3G+, or pre-LTE 4G network.

  If you don't answer a call or when you hang up, data use returns to the highest-speed available network.

Data networking with a VoLTE call

The list of requirements to make or receive a VoLTE call is daunting at the time of this writing:

- **Requires an iPhone released in 2014 (iPhone 6/6 Plus) or later.** Even though earlier iPhone models seemingly had the circuitry, these models are the only ones supported by major American carriers, and likely worldwide by others.
- **Must be on the same network.** VoLTE doesn't yet work between carrier networks, only for calls that comprise parties on the same network.
- **Carrier must have deployed.** AT&T, T-Mobile, and Verizon have upgraded their LTE networks completely. Sprint plans to wait for a future carrier interoperable version of VoLTE.

If you meet these requirements—and the moon is half full and it's a Tuesday—receiving a call or placing one will happen over VoLTE, and your Personal Hotspot or other data use will continue at full LTE speeds.

Yes, it's a mess.

> **Note:** Alongside VoLTE, carriers have been rolling out HD Voice, a higher-quality compression algorithm for voice calls. It sounds more like a Skype-to-Skype or FaceTime Audio call than a cellular call. Most VoLTE rollouts are happening alongside HD Voice, which also doesn't work across different carrier networks. Sprint is rolling out HD Voice alone.

Set a Wi-Fi Password

When you first turn on Personal Hotspot, iOS creates a strong WPA2 password. To connect a device over Wi-Fi to the hotspot, you must enter this password on that device.

The default password created by your phone is sometimes a sequence of recognizable words and numbers; other times, it may appear to be random. (At one point, the difference seemed to be by carrier, but now it's impossible to tell.)

You can't decide not to use a password at all, but you may choose to compose your own. You have to pick one that's eight characters or more, although you can make that `12345678` if you must. Tap to enter your own password.

For this kind of connection, where it's not a base station in a fixed location that someone might try to access, I suggest thinking of an eight- or nine-letter word and adding two punctuation marks to the end, like `memorable?%`.

Extra Security with Personal Hotspot

Using USB, Bluetooth, or Wi-Fi to connect to a hotspot device provides a strong layer of security around your connection, which is reassuring if you're at a location like a coffee shop, where the network may not be well secured. USB is a physical connection and can't be monitored. Bluetooth has its own strong automatic security. Apple's required use of WPA2 Personal for Wi-Fi ensures protection there, too. (See **Connect to a Small Network**.)

Although the backhaul to the mobile broadband network isn't impregnable, it does require either a dedicated effort to crack your particular communication or a wiretap at the carrier to intercept data. Personal Hotspot lets you secure the local link at a location where you would otherwise use Wi-Fi but where I would recommend using a VPN (virtual private network) to prevent interception by those around you.

Name Your Wi-Fi Network

The Wi-Fi network has the same name as your iOS device. This is typically your name, or that of whichever account you used to set up the iOS device (**Figure 8**). If you don't feel like broadcasting your account name whenever you turn on Personal Hotspot, you can change it.

To change the name, visit Settings > General > About > Name and enter a new name. Or, with the device connected to iTunes via either USB or Wi-Fi, click the device's icon in the top bar in iTunes, then click its name to select it, which highlights the name. Type a new name, and click again or press Return.

You need to turn Personal Hotspot off and back on for the new name to be broadcast.

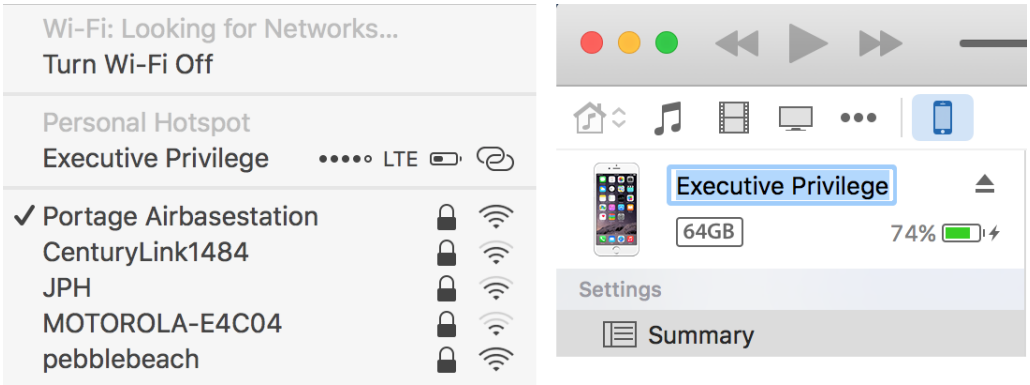


Figure 8: *The Wi-Fi network name (left) is identical to the name of your device, which you can see in iTunes (right) or in Settings.*

Consider Turning Off Certain Radios

Now that you've turned on Personal Hotspot, you might not want it to be available through Bluetooth or Wi-Fi, because nearby devices of yours might accidentally connect to it. The only way to prevent a connection from a device with the right credentials is to turn off the Bluetooth or Wi-Fi radio.

> ***WARNING!*** *Disabling radios turns off OS X Continuity features and Apple Watch connectivity.*

To turn off Bluetooth, tap Settings > Bluetooth and slide the switch to Off. To disable Wi-Fi, tap Settings > Wi-Fi and slide the switch to Off. With either or both Bluetooth and Wi-Fi turned off, the Personal Hotspot feature pops up a warning when it's switched on (**Figure 9**).

You can also change the Personal Hotspot Wi-Fi password to prevent devices that previously connected from gaining access again (see **Set a Wi-Fi Password**, slightly earlier).

Connect to Personal Hotspot

With Personal Hotspot on, you have three choices for how to connect:

- **Wi-Fi:** Any Wi-Fi–equipped device can connect just as if the iOS device were a wireless router. Up to five devices can connect via Wi-Fi. (Verizon and Sprint used to limit this to three, but that appears to be lifted.)

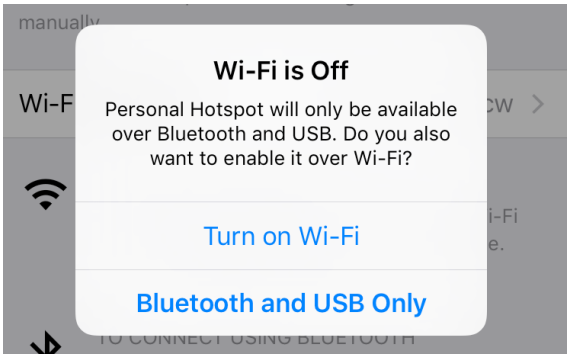


Figure 9: *iOS prompts you to turn on any disabled networking types.*

- **USB:** Plugging your computer into your iPhone or iPad gives you a high-speed data connection that you know works as long as the cable isn't bad. The downside? Being literally tethered.
- **Bluetooth:** This method requires more steps to make a connection initially, but it gives you cable-free flexibility. Most Bluetooth-equipped devices can connect through this method, including iPhones, iPod touches, and iPads. No more than three devices may connect via Bluetooth at the same time.

> ***Pick Wi-Fi or Bluetooth?*** *Wi-Fi can consume more battery power than Bluetooth, so you might opt for Bluetooth tethering. However, the data rate isn't stellar: Bluetooth 4.0 has a raw data rate of 3 Mbps for continuous connections, and an effective throughput of 2.1 Mbps. That's far below GSM 3G/4G rates and well below LTE rates. It appeared first on the iPhone 4s and the 3rd-generation iPad, and is found on all later models.*

There is a maximum of five total connections across all these methods. If you have five devices connected and try to connect another, the connection will be refused.

I explain how to make a connection shortly; for now, I want to mention that once you make a connection, a blue pulsing banner appears across the top of the iPhone or iPad's screen (**Figure 10**). The banner shows the number of devices connected, too.

If the phone or iPad is on standby, a smaller status banner appears on the Lock screen when you wake it (**Figure 11**).

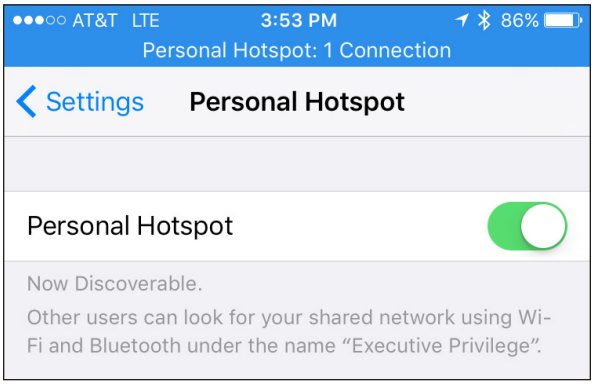


Figure 10: *A banner lets you know whenever your device is acting as a cellular modem for a computer via USB, Wi-Fi, or Bluetooth.*

Figure 11: *The Lock screen also shows whether the hotspot is active, with a tiny superscript numeral revealing how many clients are connected.*

Note: Windows computers, Android phones, and other devices can also connect via Wi-Fi; many devices can also connect via Bluetooth; and Windows at least can also tether via USB. The process is identical on those platforms to hooking into a Wi-Fi, Bluetooth, or USB shared network, and it neither needs special software nor displays any special indicators as in iOS and Mac OS X.

Access via Wi-Fi

Using Wi-Fi to connect to a Personal Hotspot is the easiest case because no special setup is required. You use whatever method you normally employ to connect to a Wi-Fi network from the device, and I provide directions for several common operating systems just ahead. The name of your iOS device is the name of the Personal Hotspot network.

Connect via Wi-Fi in Mac OS X

In Mac OS X, you can use the Wi-Fi menu on the menu bar to select the Personal Hotspot network by name:

1. Click the Wi-Fi menu to see a list of available networks.
2. Choose the network's name.
   - For an iOS 8.1 or later Personal Hotspot and Yosemite, it appears as it does in Instant Hotspot: an item with the cellular connection type, battery level, and signal strength (**Figure 12**). (If Personal Hotspot is not active on the device, selecting the hotspot in the OS X menu turns it on.)

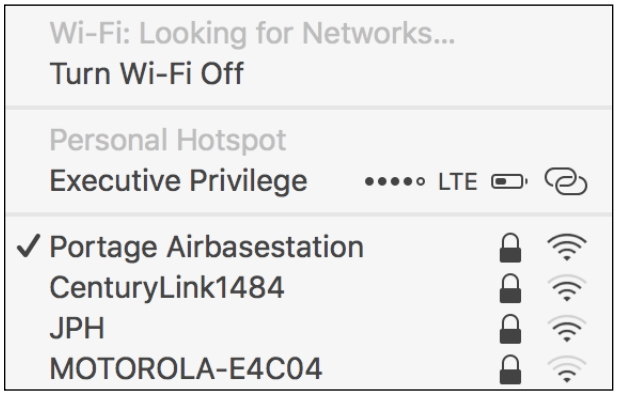


Figure 12: *Select the hotspot under Personal Hotspot.*

   - For an iOS 8.0 or earlier, or with earlier versions of OS X than Yosemite, Personal Hotspot shows up in the main list of networks with a linked-chain icon just to the left of the signal strength icon (**Figure 13**).
3. Enter the password, and click Join (**Figure 14**).

Figure 13: *In iOS 8.0 and earlier, the Personal Hotspot's network name appears in the Wi-Fi menu's networks list.*

Figure 14: *Enter the network's password to connect.*

Future connections: *If you leave Remember This Network checked, you won't be prompted in the future for the password. The flip side of that benefit is that it's difficult to prevent future automatic connections when the personal hotspot's Wi-Fi connection is active.*

You're now connected. Your Mac will stay connected as long as the Personal Hotspot feature is active. The next time you turn on the Personal

Hotspot, your Mac will reconnect if you stored the password and if your Mac isn't already associated with a Wi-Fi network.

Disconnect from Personal Hotspot Wi-Fi

To stop using the Personal Hotspot, hold down the Option key and then select the Wi-Fi menu. Now select Disconnect From Network Name and your link is severed.

Don't auto-join in the future

If you want to prevent the Mac from connecting automatically in the future, follow these steps:

1. Launch System Preferences and select the Network pane.
2. Select Wi-Fi in the list at left.
3. Click the Advanced button.
4. From the Wi-Fi pane, select the Personal Hotspot network, then click the minus button to delete it.
5. Click OK and then click Apply.

Connect via iOS

In iOS, you use the Settings app to connect to the Personal Hotspot network:

From and to an iOS 8.1 or later device

1. Select Settings > Wi-Fi.
2. Choose the network from the Personal Hotspots list (**Figure 15**).
3. Enter the password when prompted.

You are now connected. The chain icon appears at the left of the iOS status bar instead of the normal Wi-Fi icon.

To or from an iOS 8.0 or earlier device

1. Select Settings > Wi-Fi.
2. Choose the network from the list. Personal Hotspot networks are shown with a special chain icon in iOS 4.3 and later.

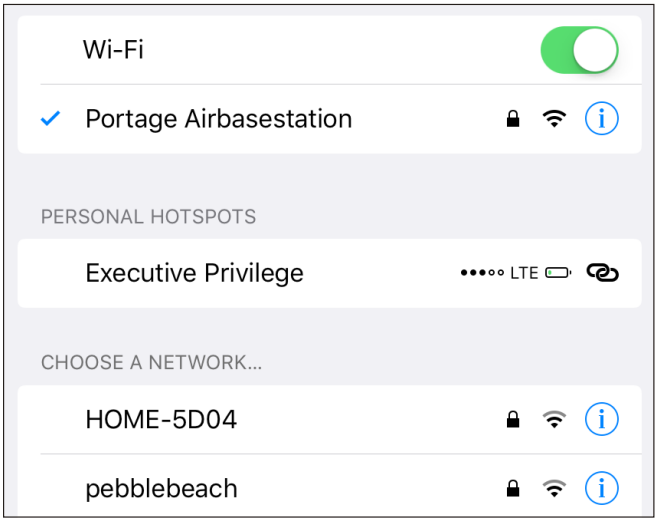


Figure 15: *Look in the Personal Hotspots section (above) or for the chain icon.*

3. Enter the password when prompted.

   You are now connected. The chain icon appears at the left of the iOS status bar instead of the normal Wi-Fi icon.

Automatic reconnection

As long as the password is stored for the iOS network and isn't changed, your iOS device will reconnect automatically whenever it's in range and the Personal Hotspot Wi-Fi connection is active. To stop using the mobile hotspot right away, choose another network from the list or turn off the Wi-Fi adapter.

If you want to prevent connecting automatically in the future, while the hotspot connection is active, tap the blue info button next to the network name and then tap Forget This Network. This removes the network's stored setting and disconnects the device from the Personal Hotspot immediately.

Disable Wi-Fi sharing in iOS

To turn off the hotspot on the device that is sharing its connection, just tap Settings > Personal Hotspot and then turn off the Personal Hotspot switch. Or, you can tap Settings > Wi-Fi and turn off Wi-Fi entirely.

You can also block all existing connections from client devices by changing the Wi-Fi password on the Personal Hotspot screen. This will also prevent devices with a stored password from reconnecting automatically or manually until you provide the changed password.

Tether with USB in Mac OS X

With Personal Hotspot enabled, connect your hotspot device to your computer using a USB cable. The first time you enable Personal Hotspot and plug the device into a Mac via USB, Mac OS X alerts you that the interface is added and the Mac's Network system preference pane adds an adapter entry (**Figure 16**).

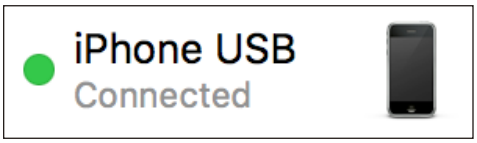


Figure 16: *An entry appears in the adapters list.*

Mac OS X automatically activates a tethered link and turns that red dot green.

> ***Not active?*** *If you're not seeing this, you may need to launch iTunes the first time you tether. iTunes doesn't seem to have anything to do with USB tethering except initial activation.*

To halt the active USB tethering connection, disconnect the USB cable. Alternatively, you can disable the iOS adapter profile. In the Network system preference pane in Mac OS X, select the iPhone USB or iPad USB adapter, and then from the gear pop-up menu, choose Make Service Inactive. Click Apply in the lower-right corner.

Connect with Bluetooth

On your hotspot device, make sure Bluetooth is turned on: swipe up from the bottom to show the Control Center and check that the Bluetooth icon is active. If it's not, tap it. (You can also manage Bluetooth from the Settings app.)

Once you're sure it's enabled, you can make a Bluetooth connection from Mac OS X or iOS, as I describe next.

Bluetooth uses less power than Wi-Fi, almost nothing in standby mode, so a Bluetooth connection could allow both an iOS device and a paired piece of hardware to work longer without AC power.

Note: I cover Bluetooth in more detail in **Set Up Bluetooth** if you'd like to learn more.

Bluetooth tethering with Mac OS X

Follow these steps to set up a Bluetooth connection between your hotspot device and a Mac running Yosemite or later (instructions are substantially different in earlier versions of OS X):

1. Launch System Preferences, and select the Bluetooth pane.
2. Your iPhone or iPad should appear in the list of devices (**Figure 17**). Click Pair. (If it doesn't appear, check that Bluetooth is enabled on the iOS device and that it's within a few dozen feet of your computer.)

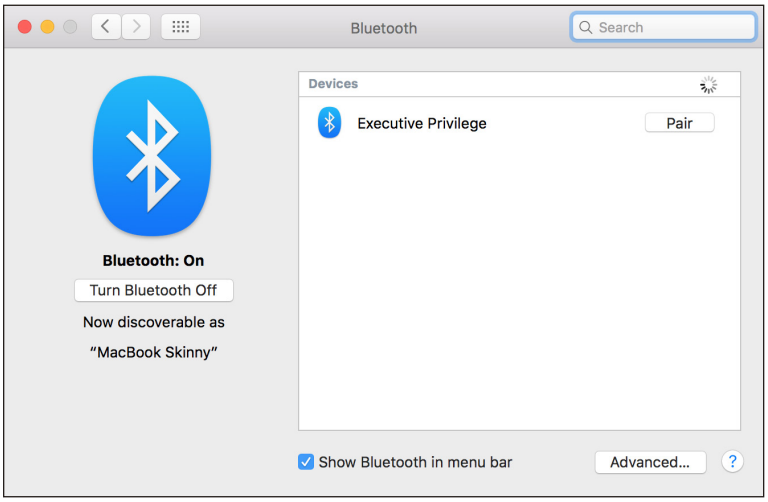


Figure 17: *Initiate pairing from OS X.*

3. A pop-up dialog appears with a 6-digit code. On the iOS device, a similar confirmation dialog pops up (**Figure 18**).

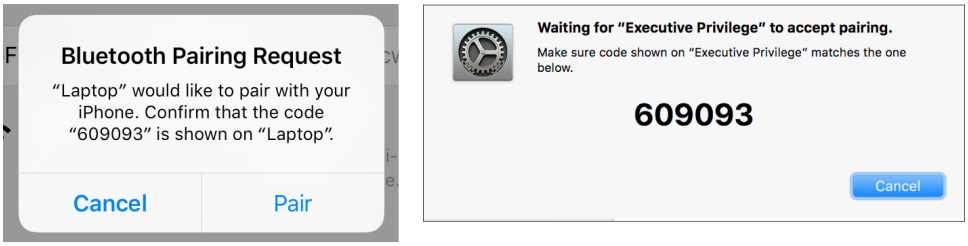


Figure 18: *The Mac and iOS device both display the same code.*

4. Confirm that the code is identical, which prevents a so-called man-in-the-middle attack with someone nearby trying to intercept the connection. (That's very unlikely, but it could happen.) The additional cue is the name of the device. Click Pair on the hotspot device. On the Mac, your iOS device should now appear in the list (**Figure 19**).
5. Now, in System Preferences, click Show All, then select Network.

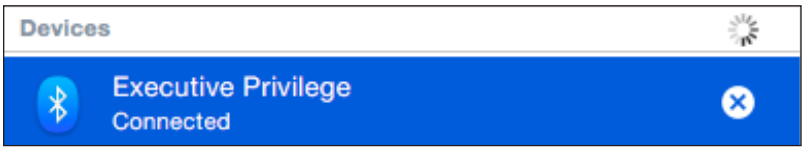


Figure 19: *The device is paired in OS X and connected.*

6. In the adapters list at left, you'll notice a new Bluetooth PAN entry; *PAN* stands for Personal Area Network, and it's the kind of network that Bluetooth creates. Your device should be selected in the Device pop-up menu (**Figure 20**). Click Connect.
7. On the Mac, you'll see the Status label set to Connected (Figure 20), and if the Bluetooth system menu icon is showing, it will have dots bisecting it horizontally. On your hotspot device, the Internet tethering banner will appear.

   To disconnect Bluetooth tethering, you can do any of the following:

- In the Network preference pane, with Bluetooth PAN selected in the adapters list, click the Disconnect button.

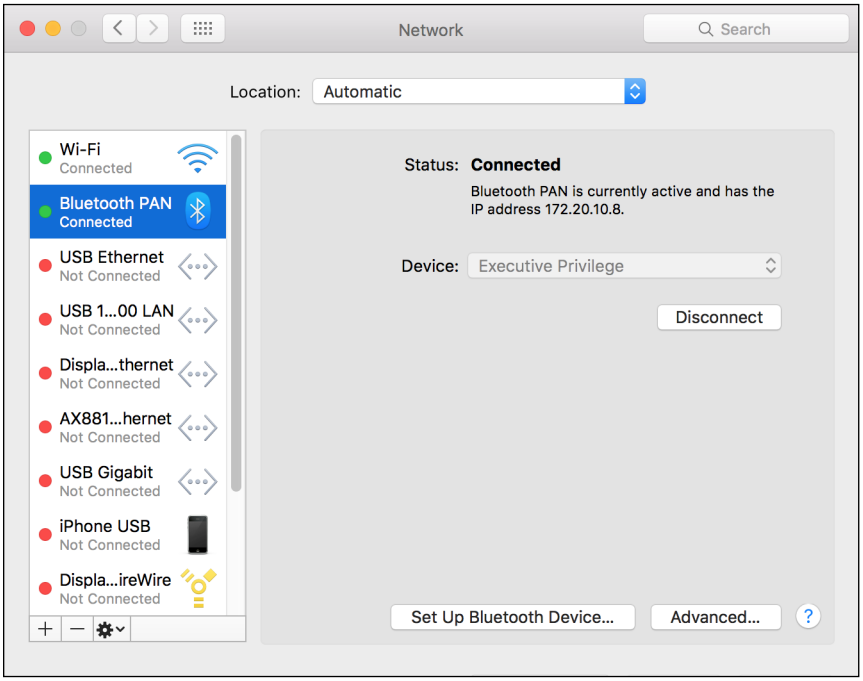


Figure 20: *The Network preference pane lets you manage the connection over USB.*

- On your hotspot device, in Settings > Personal Hotspot, tap the Personal Hotspot switch to Off.
- Turn off Bluetooth networking. In iOS, tap Settings > Bluetooth; on the Mac, look in the Bluetooth system preference pane or the Bluetooth menu on the menu bar.

Bluetooth tethering with iOS

Although all iOS devices have Wi-Fi built in, Bluetooth consumes less battery power and may be a more appropriate choice. You can set up a Bluetooth connection between any iOS device running iOS 4.3 or later and a hotspot device quite simply:

1. View Settings > Bluetooth.
2. If Bluetooth is off, tap the switch to turn it on.
3. Tap the Personal Hotspot in the list of Devices (**Figure 21**).

   Both devices show confirmation dialogs (**Figure 22**).

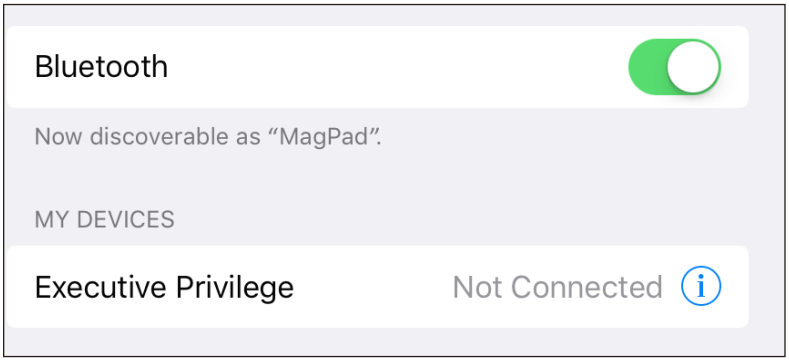


Figure 21: *The Personal Hotspot appears in the My Devices list; here, it’s “Executive Privilege.”*

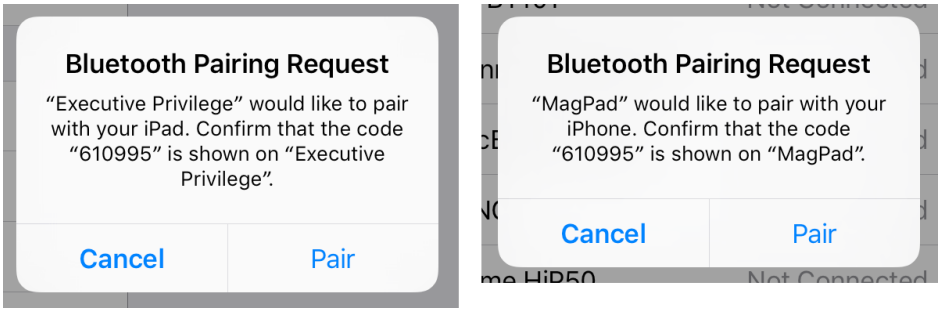


Figure 22: *Tap Pair on both devices to proceed.*

4. If the codes match, tap Pair on both devices.

   The iOS device is now connected over Bluetooth, and a chain icon appears at the left of the status bar instead of the normal Wi-Fi icon.

   To disconnect from the Personal Hotspot, you can do either of the following:

- **On the connected device:** Slide Bluetooth’s switch to Off.
- **On the hotspot device:** Turn off the Personal Hotspot feature or turn off Bluetooth.

  To reconnect, open Settings > Bluetooth and then tap the name of the Personal Hotspot in the Devices list.

  You might want to discard a stored Bluetooth pairing from the Devices list if, for instance, you’re using a friend’s device or you don’t want

someone else using your iOS device with the paired connection. To remove the pairing, tap the info ⓘ button next to the device name and then tap Forget This Device.

Use Bluetooth Tethering from iOS to a Laptop

A side benefit of the capability to tether over Bluetooth is that you can also use your iOS devices to grab Internet access from a laptop. For instance, if you're in a hotel or other location in which you have to pay for each device you connect to a Wi-Fi network, you were previously out of luck in relaying an Internet connection from a laptop to an iPhone, iPod touch, or iPad. Now you can.

Under Mac OS X, use the Sharing system preference pane's Internet Sharing option to share the Wi-Fi connection via Bluetooth PAN. Choose Wi-Fi from the Share Your Connection From pop-up menu, and check the Bluetooth PAN box in the To Computers Using list (**Figure 23**). Then check the box next to Internet Sharing in the Service list at left.

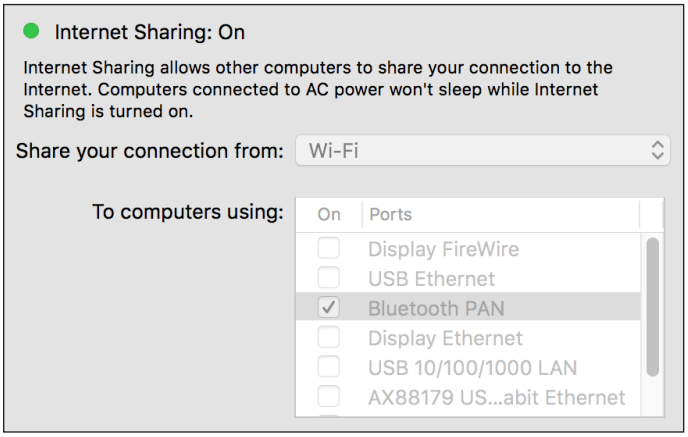


Figure 23: *Via the Bluetooth PAN connection, you can share your Wi-Fi connection with iOS devices.*

If you don't see Bluetooth PAN in the To Computers Using list, open the Network preference pane. Click the plus + button at the bottom of the adapters list, and choose Bluetooth PAN from the Interface pop-up menu. Click Create, then click Apply. When you return to the Internet Sharing option in the Sharing preference pane, the Bluetooth PAN will be there.

Choose to Use Cellular Data or Wi-Fi

There are plenty of good reasons to pay attention to whether a cellular iOS device is accessing the Internet via a Wi-Fi network or mobile broadband. You may need greater bandwidth than the cellular network can provide, be budgeting data on a low-bandwidth plan, or be away from your home carrier territory and want to keep usage low.

Whatever the reason, you can determine which network you're on and set the type of network to which your device connects. In iOS 10, you can also enable a hybrid mode that taps into cellular data when Wi-Fi is flaky.

Which Network Are You On?

iOS has an indicator in the status bar (near the upper left) that shows which network connection is active (**Table 1**). The range of bandwidth is huge (such as 30 to 300 Mbps as the top rate), because iOS 10 runs on devices that span generations of cellular and Wi-Fi equipment. And each iOS device supports many rates for each standard while also offering backward-compatible support for older networks.

Select Which Service to Use

You can force a cellular device to use either cellular or Wi-Fi service instead of letting it automatically switch depending on whether or not a suitable Wi-Fi network is available. Because iOS doesn't offer network profiles as in Mac OS X, which would make it easy to switch, you must use the Settings app to enable or disable a service.

Table 1: *Deciphering Indicator Icons*

Indicator	Explanation	Bandwidth
No service	Can't connect to any network. You may also see five underscores.	None.
	Connected to a Wi-Fi network. The number of white waves, from one (shown as a dot) to three, indicates signal strength from weakest to strongest.	Rates as high as 30–300 Mbps, but limited by the broadband service to which a Wi-Fi router connects.
Wi-Fi	Wi-Fi Calling is enabled, but this doesn't affect cellular data usage.	N/A
LTE	Connected via LTE.	From 5–100 Mbps downstream, 2–25 Mbps upstream.
4G	Connected via 4G (GSM only).	Downstream up to 6 Mbps and upstream up to 1.9 Mbps.
3G	Connected via 3G.	GSM: Down 1.7–4 Mbps; up 384 Kbps–1.9 Mbps. CDMA: Down, 600 Kbps–1.4 Mbps; up, 500–800 Kbps.
E	Connected via EDGE, a 2.5G standard (GSM only).	Roughly 200 Kbps downstream (all GSM iOS devices); 40–50 Kbps upstream
GPRS	Connected via 2G using either GPRS (GSM) or 1xRTT (CDMA).	Roughly 40–50 Kbps.
	Connected via tethering; see **Make a Mobile Hotspot**.	

To enable or disable cellular data service:

- To use a cellular connection solely and avoid Wi-Fi, perhaps to keep a continuous VPN connection or for security reasons, either:
  - Swipe up to show the Control Center; tap the Wi-Fi icon to disable it.
  - Tap Settings > Wi-Fi, and then set the Wi-Fi switch to Off.
- To rely only on Wi-Fi, accepting that you may have times during which you have no Internet connectivity, tap Settings > Cellular Data (iPad) or Settings > Cellular (iPhone), and then set Cellular Data to Off. (In the case of an iPad, this disables all features related to using the mobile network; however, for an iPhone, voice calling, voicemail, and messaging remain available.)

> ***WARNING!*** *There's one odd situation to look out for. When you're using Personal Hotspot, you can connect from an iOS device to a Wi-Fi network while also sharing via Bluetooth or USB to a computer. However, though the iOS device connects to the Wi-Fi network, the shared Internet connection relies on cellular data, even though your iPhone or iPad shows a Wi-Fi icon.*

If a Wi-Fi network is acting flaky, you can avoid the problem in one of three ways, including a new option:

- Use Wi-Fi Assist, introduced in iOS 9 (**Figure 24**). This option, set in Settings > Cellular (iPhone) or Cellular Data (iPad), taps mobile broadband when Wi-Fi connectivity is too poor to use. Without it, so long as there's an active Wi-Fi connection, even if its Internet link is dead, cellular data isn't used.

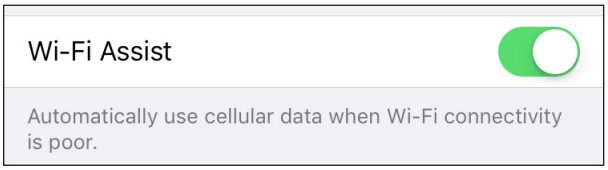


Figure 24: *Wi-Fi Assist swaps to cellular as needed.*

- Switch off Wi-Fi, and force the use of cellular data.
- Use the method noted in **Forget This Network** to disconnect the Wi-Fi network. Wi-Fi is still enabled, but not used when it has no network connection.

Manage Cell Data Usage

When Apple introduced the iPhone, it also managed to first get AT&T and then other carriers to offer unlimited data plans in the United States and in a few other countries. That didn't last as networks became congested with heavy data use.

There are still millions of people grandfathered into old plans that allow unlimited data use. But carriers have recently largely switched back most of their plans to unlimited with a twist: you get data transfer up to a certain point each month, after which you're throttled to 128 Kbps for the remainder of the monthly billing period or you're given the lowest priority for data throughput in congested areas. Overage fees are largely a thing of the past.

This chapter offers a variety of advice on keeping your usage down.

Carriers Shift to Throttling

By mid-2016, all four major cellular carriers shifted phone and shared-data plans, which can include tablets, to the throttling model. You avoid paying overage fees, which were substantial—often $10 to $15 per 1 GB. Here are the details of major plans in October 2016, *certain* to change:

- **AT&T:** Mobile Share Advantage plans vary by monthly included data, and throttle to 128 Kbps after that monthly total is exhausted, including unused data rolled over from the previous month. Switch plan levels for more data. Includes tethering.
- **Sprint:** Unlimited Freedom includes "unlimited" LTE data for everything, although video, audio, and game streaming are throttled to lower rates unless you pay for a Premium option. Sprint "deprioritizes" data after 23 GB of usage in congested areas (read: cities). Doesn't include tethering.

- **T-Mobile:** T-Mobile One includes "unlimited" LTE for on-phone use, allows 512 Kbps for tethering, and throttles video to 480p (standard definition). For a higher monthly fee, service can include LTE rates for tethering and allows high-definition video. T-Mobile "deprioritizes" data after 26 GB of usage in congested areas.
- **Verizon:** The Verizon Plan works almost exactly like AT&T's: it charges varying rates for bandwidth bucket size, rolls over unused data for a month, and throttles to 128 Kbps after data is exhausted. Tethering is included.

Keep Usage Restrained

You can have full-speed mobile access when you need it without breaking your limits if you ration usage. What you need is a strategy.

Tracking Cellular Usage on an iPhone

An iPhone shows your locally tracked consumption of cellular data via Settings > Cellular > Cellular Data Usage. This number has two problems:

- It's not guaranteed to be accurate. Your carrier's records are definitive (**Figure 25**). In practice, it's pretty close.

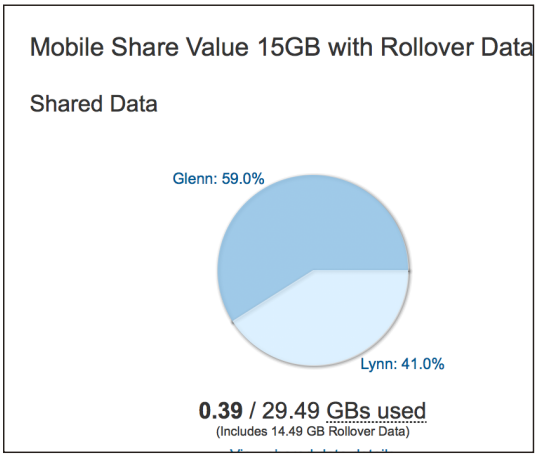


Figure 25: *AT&T's online data statement is the only one you can rely on for billing.*

- It isn't aligned with your billing period. Rather, it's a total of all data consumed since the last time you tapped Reset Statistics at the very bottom of the Cellular or Cellular Data view.

  You can, of course, visit your carrier's web site and get usage information that's typically accurate to within 24 hours, sometimes much less.

  If you'd like this number to be more useful, set yourself a reminder in your calendar for the first of each month (or the start of your billing period if it's another increment) to visit Settings > Cellular and tap Reset Statistics (**Figure 26**).

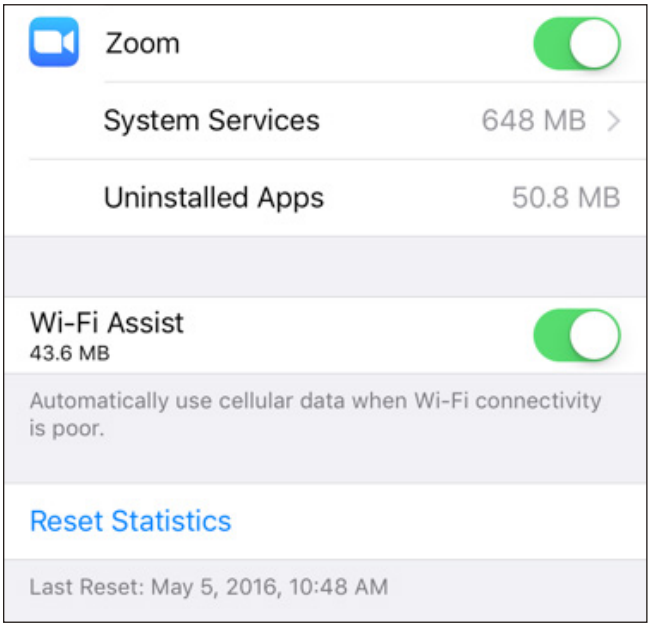


Figure 26: *Tap Reset Statistics to zero out your current cellular data numbers.*

Check Usage in Settings

You can find out how much data you've used just via Personal Hotspot in the Cellular/Cellular Data view. Tap System Services at the bottom, and all the iOS uses, including Personal Hotspot, are displayed (**Figure 27**).

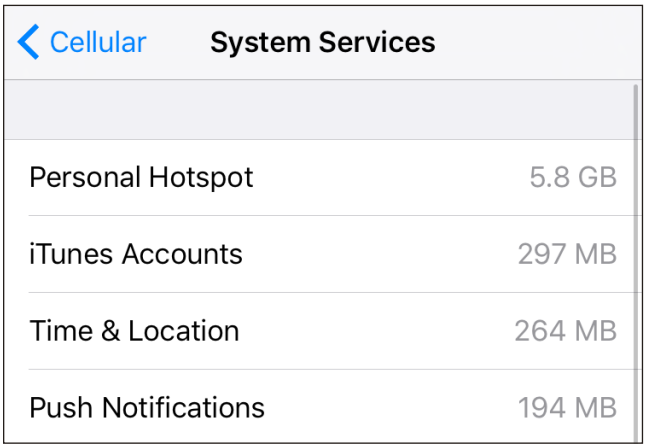


Figure 27: *You can discover Personal Hotspot's portion of overall cellular data.*

Check Cellular Usage on an iPad

A Wi-Fi + Cellular iPad has an additional way to track usage via the Settings > Cellular Data > View Account screen, which shows details from the carrier, including the billing period, how much data is included, and the data consumed so far in that period (**Figure 28**).

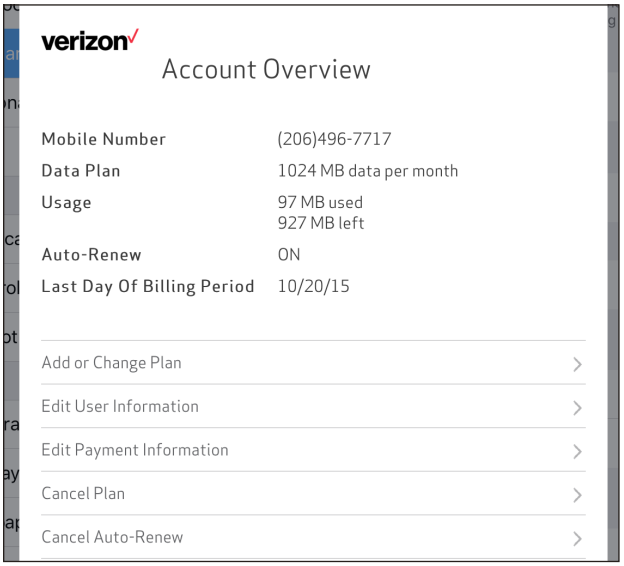


Figure 28: *A Wi-Fi + Cellular iPad can show usage details for the current billing plan period via Settings > Cellular Data > View Account.*

Turn Cellular Data On Only When You Need It

There are times when you'd prefer not to have an active cellular connection or cellular data link on an iPhone or cellular iPad, notably when you're close to the maximum of your monthly service plan or traveling outside an area included in your data plan (out of the country or in certain remote areas, typically). You can change how the cellular radio interacts with a network in two ways:

- To turn off data only, in Settings > Cellular Data (iPad) or Settings > Cellular (iPhone), set the Cellular Data switch to Off (**Figure 29**). This disables the data link only. On an iPad, that's the entire link to a mobile broadband network; for an iPhone, you can still place and receive voice calls and send and receive SMS/MMS text messages.

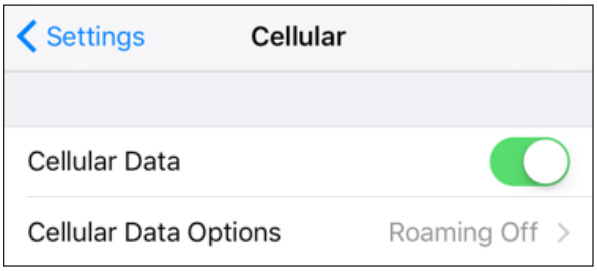


Figure 29: *The Cellular Data switch lets you turn all mobile broadband access on or off. Data Roaming affects use outside your home service area.*

- To shut off the entire cellular connection, set Airplane Mode to On in the upper left of the main Settings screen, or tap the Airplane Mode button in the Control Center. Airplane Mode turns off Bluetooth, Wi-Fi, and cellular radios, although you can re-enable Bluetooth and Wi-Fi separately. See **Airplane Mode** for details. It also dramatically extends your battery life in most cases.

  You can also control other cellular data parameters:

- Setting Cellular Data Options > Enable LTE to Off will eliminate use of 4G LTE networks and rely on slower 2G and 3G networks (**Figure 30**). This is useful when LTE networks near you are spotty and you're having trouble staying connected as your device swaps back and forth between 2G/3G and 4G LTE. This can also reduce battery consumption in some cases.

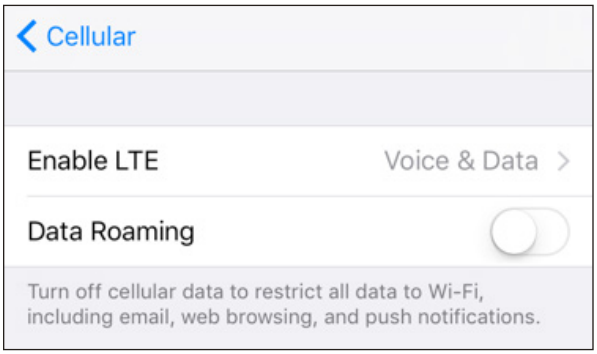


Figure 30: *Disabling LTE helps if nearby LTE networks are erratic. Data Roaming affects use outside your home service area.*

- In some markets, the Enable LTE option may read Voice & Data, and let you pick 2G, 3G, or LTE as network options.
- Data Roaming can ensure that you don't consume cell bytes while you're outside the home area for your carrier. In some cases, you might have limits; in others, you might be charged. For instance, Sprint and Verizon allow roaming across their networks in areas they don't serve, but limit use to no more than 300 MB per month.

Limit Your Activities on the Cell Network

Unless you are connected with Wi-Fi, limit your Internet-related activities to those that don't use much data, such as checking email or viewing web pages.

Various items in Settings let you limit whether cellular data can be used for an app or activity, including:

- Use the options in Cellular Data (iPad) or Cellular (iPhone) to prevent excessive use of certain services from consuming a lot of your data allocation. You can turn on and off specific apps, and see their data consumption (see **Figure 31**).
- In the Safari settings, you can disable syncing the reading list, which is relatively low bandwidth depending on how you use it.
- In iCloud > iCloud Drive, swipe to the bottom and you can disable syncing all items in the list over cellular.

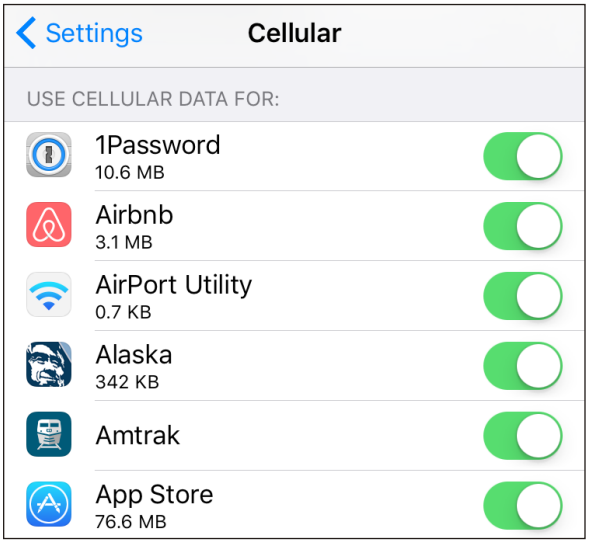


Figure 31: *Opt out of using cellular data for certain iPhone apps.*

- In the iTunes & App Stores, you can choose whether or not to use cellular data for automatic downloads (four different options for things you've purchased and updates).
- In Music, turn off the Use Cellular Data option for playback and downloads of the Apple Music or iTunes Match service, if you subscribe to either one.
- Cache data you need. Plan ahead and download for offline use from cloud or other services. For instance:
  - Use Google Maps offline. While it doesn't burn up lots of data while online, its offline mode lets you consult interactive maps when there's no network connection or when you're roaming on an international network. Enter a place name, tap the name at the bottom, then tap the three stacked dots at upper right. Next, tap Save Offline Map.
  - Use the Music or Videos apps, find items you want, and tap the cloud icon to download them locally. (This is a good time to consider iTunes USB or Wi-Fi syncing for larger files.)
  - Amazon Prime users can download certain movies and TV shows via the Amazon Instant Video app for offline playback.
- You can also enable or disable cellular use via settings within certain apps. For instance, the podcast app Overcast has a cellular data switch

in its Downloads area to let you grab a specific episode or download any available episode via cellular whenever it's available (**Figure 32**).

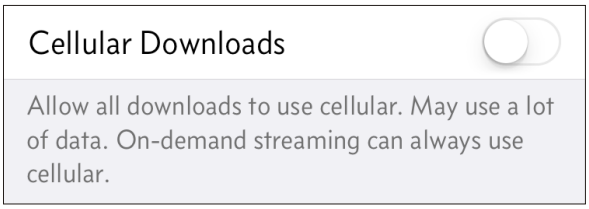


Figure 32: *Overcast is blunt about what might happen.*

> **Note:** The Maps app used to consume lots of data because Apple loaded image data from Google to power its software, even after Google switched to offering *vector* data for plain maps. Vector data uses scale-independent points and arcs and straight lines between them to represent maps, consuming vastly less data. Apple's own Maps app and the revised Google Maps app now both use vector data. In looking at heavy usage of Google Maps in a recent year, my iPhone showed only 382 MB of cellular use.

More generally, you should avoid using or disable the cellular use in Settings for:

- Audio-streaming apps, such as those used by radio stations and networks. Usage is generally small, but it can add up.
- Video-streaming apps like Hulu Plus, YouTube, Netflix, and Vimeo. It's easy to run through a gigabyte or more in an hour, depending on your device and connection.
- Photo-browsing apps like Flickr. Depending on the app, even swiping past a photo might download a megabyte or more.

> **Note:** Your cellular iOS device will warn you if you start running out of data or start to near your current plan limit during a billing cycle.

Place Calls via Wi-Fi

Cellular phone calls are just data. The stream of audio data that composes them, however, can be routed in different ways depending on the generations of cellular technology that a phone supports and on how carriers choose to configure their networks. Wi-Fi Calling effectively extends cellular calling to home and office Wi-Fi networks. It's seamless once enabled except for a tiny Wi-Fi label in the status bar.

Wi-Fi Calling is great when a good cell signal isn't available, often inside a building or house. Carriers that offered similar features used to provide incentives for using Wi-Fi, like unlimited domestic calling. But now they just extend your voice plan to Wi-Fi, whether it's unlimited or otherwise.

While all four major U.S. carriers support Wi-Fi Calling, it's not available with many smaller U.S. and many non-U.S. providers.

Note: Wi-Fi Calling is distinct from Voice over LTE (VoLTE), a method of routing voice calls over the 4G LTE cellular data network. I discuss that in the Personal Hotspot chapter, in the section "**You Can't Always Use Cell Data while Talking**."

Turn On Wi-Fi Calling

Apple doesn't turn on Wi-Fi Calling by default. Instead, you have to enable it, and then walk through a variety of steps that vary by carrier.

Note: Wi-Fi Calling on some carriers works with an iPhone 5c or later. However, others restrict it to phones that also offer HD Voice, which has a later cutoff date: all iPhones released starting with the iPhone 6/6 Plus in 2014.

Enable Wi-Fi Calling on Your Main Device

You start in Settings > Phone > Wi-Fi Calling (**Figure 33**). Once you tap the switch, you're prompted to enable Wi-Fi Calling.

Figure 33: *You have to tap the switch and then agree to enable Wi-Fi Calling.*

Tip: If you know your carrier offers Wi-Fi Calling, but its switch is dimmed out, Apple suggests restarting the phone. If that doesn't work, try resetting your iPhone's network settings by going to Settings > General > Reset and tapping Reset Network Settings.

If all goes well, you have to proceed through a set of steps to opt in that warn you about emergency calls placed when Wi-Fi Calling is enabled, and have you fill out the address at which you typically use the phone with Wi-Fi Calling (**Figure 34**).

It's relatively easy for 911 service to pinpoint you on a cellular-connected call, because your phone has to connect to a nearby tower. For a Wi-Fi-based call, location can be provided by GPS and other factors, but it's not as neat a process. Hence the fill-out form.

When you place an emergency call with Wi-Fi Calling active, Apple says the iPhone will first try to reach a cellular network. If a cell network can't be used, the address you enter for Wi-Fi Calling may be the one that's sent as a fallback to responders.

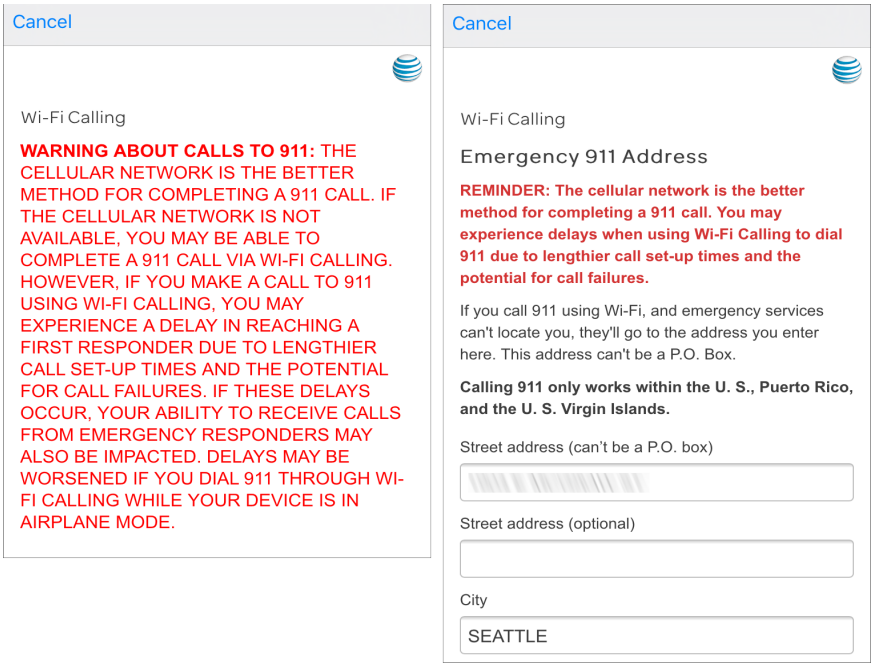


Figure 34: *Carriers have to make sure you understand that Wi-Fi Calling doesn't offer the same guarantees about finding your current address.*

When you've entered your address and tapped Verify Address, the carrier checks to make sure the information you entered matches a legitimate address. If not, you're prompted to correct it. Otherwise, you tap Use This Address, and are rewarded by being told that Wi-Fi Calling will be available in a few minutes; tap OK. Whenever it's active, the word "Wi-Fi" appears following the carrier's name in the status bar.

Once Wi-Fi Calling is active, you can enable and disable it at will by tapping its switch (**Figure 35**). This may be necessary if you wind up on a Wi-Fi network with inconsistent quality.

Enable Wi-Fi Calling on Other Devices

Apple's Continuity feature, introduced a couple OS releases ago, allows you to make cellular calls from iPads, iPod touches, and macOS devices on the same Wi-Fi network as your iPhone. Wi-Fi Calling extends that, letting you call even when your iPhone isn't nearby! (However, you can't use other iPhones!)

Figure 35: *Once Wi-Fi Calling is enabled, you can disable it with a tap or update the stored emergency address.*

An iPad or iPod touch has to be running iOS 9 or later; an Apple Watch needs watchOS 2 or later; and a Mac has to have El Capitan or later installed, and be a model released in 2012 or later, except the 2012 Mac Pro.

In Settings > Phone > Calls on Other Devices, tap Allow Calls on Other Devices (**Figure 36**). You may already have this enabled if you were previously using Continuity for cell calls.

Figure 36: *You can share Wi-Fi Calling among all your iCloud-linked devices.*

Note: Not all carriers have iCloud-connected calling available, even when they offer Wi-Fi Calling. Verizon doesn't.

Now tap Add Wi-Fi Calling for Other Devices. It may take a moment for this to become active. On each iOS device and macOS computer logged into the same, you can now use Wi-Fi Calling. You may get alerted on every device with a Do You Want to Upgrade to Wi-Fi Calls on This [Device]; you can click Turn On or Not Now.

If you don't see that dialog, or you click Not Now, you can upgrade at will. In iOS, go to Settings > Phone > Calls from iPhone, and tap Upgrade to Wi-Fi Calling. In macOS, launch FaceTime, and then select FaceTime > Preferences > Settings, check Calls From iPhone, and click Upgrade to Wi-Fi Calling. You'll be asked to confirm on both platforms.

On devices on which you've never previously used Wi-Fi Calling, you should see a six-digit code appear, which you then enter in a dialog that likewise shows up on your iPhone (**Figure 37**). Tap Allow, and Wi-Fi Calling will now be available. You can update your emergency address on any linked device, or disable cellular-linked calls, too.

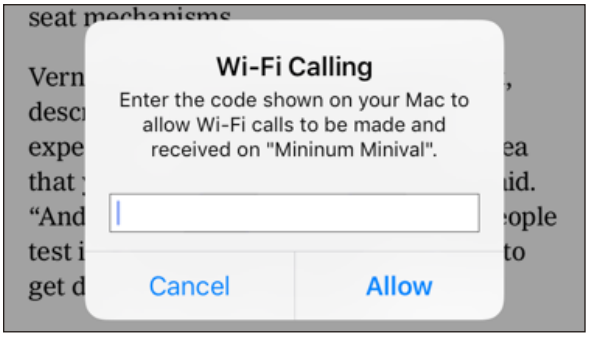


Figure 37: *The first time you use another device with Wi-Fi Calling, it shows a six-digit code that you have to enter on your iPhone to authorize it.*

You get one final warning, however: "Your location will now be used to make emergency calls." Click or tap OK.

Airplane Mode

Before you're flying so high with some guy in the sky, you need to disable radio communications on your mobile device. The Airplane Mode switch makes this simple.

Until recently, the FAA enforced a kind of commercial urban myth: that the cellular radios in cell phones as well as the circuitry in personal electronics like an ebook reader could cause interference with the avionics (electronic flight systems) on commercial aircraft.

This was out of an abundance of caution even years after it was clearly proven that there was no such risk—and after it was shown that cell phones are routinely left on, or even used, in flight without any adverse effects.

The latest flight rules in the U.S. allow the use of handheld personal electronics below 10,000 feet, even though laptops and other large devices are supposed to be stowed so they don't become projectiles. (1,000-page books are still OK, bizarrely.)

Cellular radios remain banned, and one ostensibly isn't supposed to use Bluetooth at all, and should not turn on Wi-Fi unless in a plane equipped with Wi-Fi service.

What's Airplane Mode?

Airplane Mode in iOS, available to all iOS devices, is a simple way to set your device to a legally required quiet mode during flight. In the Settings app, tap the switch next to Airplane Mode. You see an airplane ✈ icon in the top status bar at the left when the mode is active.

Saves battery life, too: *If you don't need to use any of the radios for network access, peripherals, or location, Airplane Mode is an effective way to extend battery life, too.*

When you turn on Airplane Mode in the Settings app—or by swiping up to show the Control Center and tapping the airplane ✈ icon—iOS turns off three separate radio systems on an iPhone or cellular iPad: cellular, Wi-Fi, and Bluetooth. On a Wi-Fi–only iPad or any iPod touch, Wi-Fi and Bluetooth are disabled.

GPS works in Airplane Mode: *Before iOS 8.3, switching on Airplane Mode disabled the GPS radio, even though it's passively receiving signals from satellites. After years and years of this behavior, it was quietly changed in iOS 8.3. This lets you use GPS positioning even if all networking is off and you're using an app that accesses location, such as the Google Maps offline maps option.*

Sleep doesn't disable radios or activity: *When you push the Sleep/Wake button on the top or side of your iOS device to put it to sleep, you might think the entire device is suspended. But this standby mode is pretty active. Certain background operations continue, and a cellular iPad and any iPhone can receive email and other updates via push over a cellular data connection. iOS also maintains Wi-Fi connections on a minimal continuous level. Sleep is more like lightly daydreaming for an iOS device.*

On flights on which Wi-Fi is available for Internet access, you can separately tap and re-enable Wi-Fi in the Settings app. Some people also use Airplane Mode to reduce battery usage by disabling its radios, and turn Wi-Fi on for local network access.

When you turn Airplane Mode back to Off, all your previous settings for access are flipped back on.

Tip: Airplane Mode can also help avoid international charges, because when an iPhone has its radios off, it cannot receive calls. Also, you can neither inadvertently place a call nor use data.

Turning Radios Off Separately

You can choose to separately turn off both radios in a Wi-Fi–only iPad or any iPod touch and three of the four radios in an iPhone or cellular iPad without engaging Airplane Mode:

- Wi-Fi: Swipe up to reveal the Control Center and tap the Wi-Fi icon; or, in Settings, tap Wi-Fi, and set Wi-Fi to Off.
- Bluetooth: Swipe up to reveal the Control Center and tap the Bluetooth icon; or, in Settings, tap Bluetooth, and set Bluetooth to Off.
- GPS: Tap Settings > Privacy > Location Services, and set Location Services to Off.

> ***Is GPS really off?*** *GPS is a receive-only system; with Location Services off, ostensibly, the GPS receiver isn't powered up and attempting to find data, so it's "off" in that sense.*

> ***WARNING!*** *Disabling Location Services prevents iOS from using GPS, Wi-Fi, and cell-tower based information to provide location data to apps and the operating system.*

There is no way to disable the cellular radio separate from Airplane Mode, however. You can opt to disable various cellular modes, as discussed in **Manage Cell Data Usage**.

Set Up Bluetooth

Bluetooth wireless networking lets you connect peripherals like battery-powered headphones, earpieces, headsets, and keyboards to an iOS device for listening to music and entering text. It's also the glue that binds together devices for Continuity's Handoff features and connects the Apple Watch with an iPhone by default.

Read this chapter to learn how to set up and manage Bluetooth devices.

> ***Tethering:*** *Bluetooth can provide Internet service to an iOS device from another piece of hardware, such as an iPhone with Personal Hotspot enabled, a laptop, or a cellular router with Bluetooth as an option. See the earlier chapter* ***Make a Mobile Hotspot*** *for details.*

Bluetooth Basics

The Bluetooth SIG, a trade group, certifies devices as Bluetooth compliant for particular profiles, which include things like text entry, stereo audio, file transfer, and modem access. Apple's iOS devices work with any device that meets the Bluetooth spec for several profiles, including audio, peer-to-peer transfer, and external keyboards.

> **Note:** Apple documents iOS device compatibility **in a support note**.

When you connect with Bluetooth, the process is known as pairing. Some devices can be paired with several hosts (like computers or mobile devices); others can pair with only one host at a time, and must be repaired to switch. Bluetooth devices are discoverable when they are set to allow a pairing connection.

Bluetooth is handled from the Bluetooth view (Settings > Bluetooth). This view lets you turn Bluetooth on and off and displays a list of Bluetooth peripherals under My Devices and Other Devices. The My Devices list shows any devices that have been previously attached to the device and the current status of such devices. The Other Devices list displays any discoverable devices within range.

Bluetooth 4.0 and Low Energy (LE)

Bluetooth 4 brought a low-power mode called Bluetooth LE (sometimes called Bluetooth Smart) to the mix. It lets devices with tiny batteries that are meant to be changed infrequently communicate in tiny, power-conserving bursts. You could have Smart devices in your home's alarm system, and an iOS app could let you tap to see if any windows are ajar, for instance.

Apple has used Bluetooth LE extensively in later releases of iOS and Mac OS X to enable signaling between devices for AirDrop (see **Exchange Files with AirDrop**) and some of the Continuity features, like Instant Hotspot (see **Turn On via Another Device**).

Bluetooth LE is also used to communicate with the Apple Watch, and is a key part of HomeKit, Apple's home-automation technology. With both the Watch and HomeKit, Wi-Fi is a fallback when Bluetooth signals don't reach, but it consumes much more power on both ends.

Pairing Any Device

To start pairing, follow these general steps (the specifics for particular profiles are given later in this chapter):

1. Tap Settings > Bluetooth.
2. Activate Bluetooth discovery on the other device. Turning on discovery varies by device; check the manual. Typically, you hold down a button (sometimes a special pairing button) for several seconds.

   On your iOS device in the Bluetooth view, the other device appears, naturally enough, in the Other Devices list (**Figure 38**).
3. Tap the desired device. iOS attempts to connect.
4. Depending on the device, iOS will do one of the following:
   - Simply proceed: iOS pairs without requiring a code or confirmation. You'll see this with simple devices.

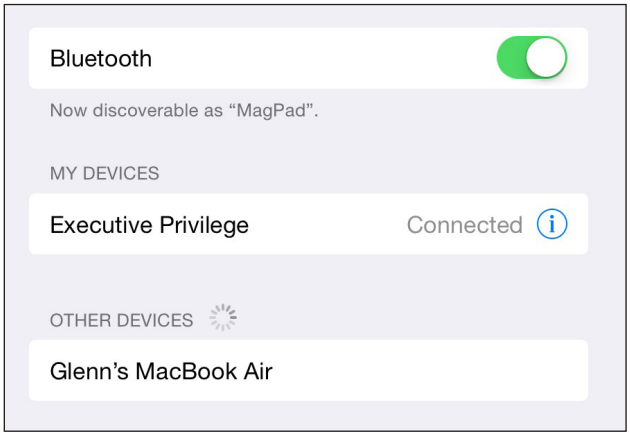


Figure 38: *An unpaired device (my MacBook Air) is discovered.*

- Show a Pair button: In some cases, you don’t need to type a pairing code, but you get a dialog like the one in **Figure 39** on each device. Compare the code, and tap Pair on each to confirm.

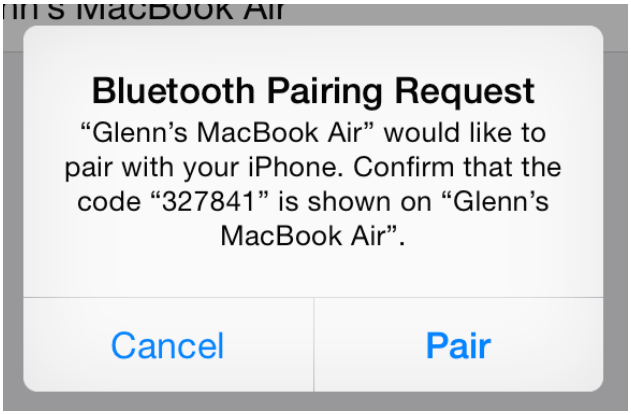


Figure 39: *iOS devices and Macs just ask you to confirm.*

Prevent accidental pairing and attacks: *You’re asked to confirm a code to ensure that it’s the right device and that nobody else is trying to control the two devices trying to pair. The cryptography behind this would prevent both devices from seeing the same code if someone had managed to interpose themselves into the pairing. Sometimes you’ll see a different code if someone else nearby happened to be trying to pair a Bluetooth device at the same time, however!*

- Show a field in which you enter a code: The code will either be provided by the other device or—in the case of a peripheral without a way to choose or display characters—noted in its manual. It's typically `0000`.
- Display a code that you enter on the other device: Your iOS device generates a PIN (called a "passkey" here) to be entered in the pairing device.

The paired device is now shown as Connected in the list.

iOS shows a Connected label for paired devices that are turned on and available, and Not Connected for those that aren't in range or are turned off (**Figure 40**).

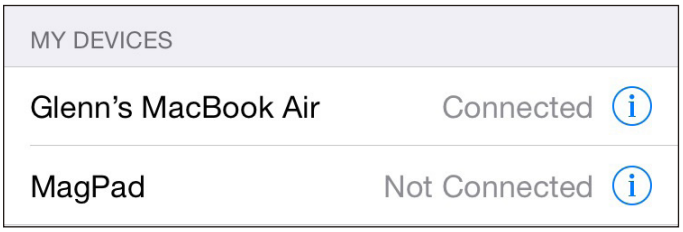


Figure 40: *The MacBook Air is paired and connected; the iPad is paired but not connected.*

Tip: To remove a pairing, select the peripheral in the Devices list, tap the info ⓘ button, and then tap Forget This Device.

WARNING! *If you walk away from a Bluetooth keyboard while it's still on, it can maintain a connection over a long distance. I was mystified as to why I couldn't get an on-screen keyboard to appear on my iPad when two rooms away from an Apple Wireless Keyboard until I recalled I hadn't turned it off.*

Hands-Free Profile

The Hands-Free Profile in Bluetooth lets you have audio conversations using the mic and headphones (or speakers) on a variety of devices, such as over-the-ear or in-ear headsets. You pair a device just as described in Pairing Any Device, earlier.

On an iPhone, you can answer incoming calls by tapping the answer button on the headset. When you place a call, the last chosen mic/headphone is used, but you can pick from the available options, even as the call is underway, by tapping the Audio button. In the example in **Figure 41**, I could choose among the headphones/headset combo I have from Sony, the iPhone's earpiece/mic, or the speakerphone option on the iPhone.

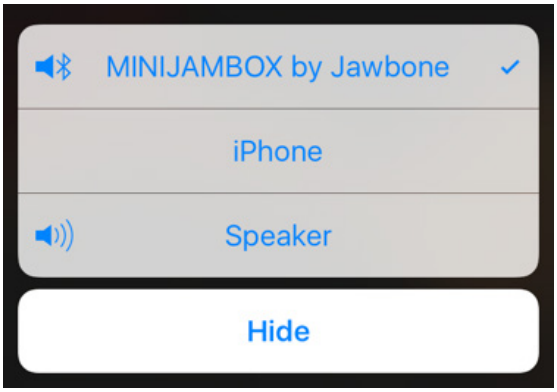


Figure 41: *When placing a call, you can choose a Bluetooth device.*

Picking an audio source also works to let you use a headset for other programs, such as Skype or FaceTime, that don't require a cellular network or an iPhone.

> ***Full support:*** *Apple has supported this profile in all iPhones, in the iPad since the iPad 2, in all iPad minis, and in the iPod touch starting in its 4th generation model.*

Audio Devices

iOS supports two of the three common audio playback profiles for Bluetooth: one for stereo audio playback, and another that allows remote control (pause, play, and stop).

> **Note:** The technical names for these two profiles—useful if you're examining the spec of Bluetooth gear to buy—are the Advanced Audio Distribution Profile (A2DP) and the Audio/Video Remote Control Profile (AVRCP).

Once you've paired stereo headphones, you can use them just as you would headphones plugged into any iOS device. You can tap the start, stop, and other controls in an app playing back audio, or, if your Bluetooth headphones or headset has these controls, you can handle those options remotely.

Apps that allow audio playback should show a special AirPlay icon when multiple audio output options are available. You can also swipe up to reveal the Control Center and change all iOS audio output to another audio device. (See **Stream Music and Video with AirPlay** for more about that technology.)

Tap the icon to pick an audio destination, which includes the device itself (to use its built-in speakers), one or more active Bluetooth headphones, and any Apple TVs or AirPlay speakers connected to your network (**Figure 42**).

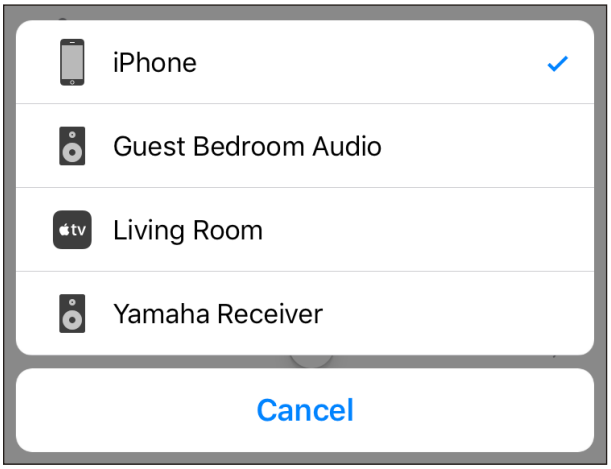


Figure 42: *Tap the AirPlay button in the audio playback controls to choose among available audio output destinations.*

Only one output source may be selected from the list at a time. Tap a device to choose it. Audio continues to play throughout and seamlessly switches whenever you tap.

You can stop using Bluetooth headphones with one of three methods:

- Turn off the Bluetooth headphones using the power button.

- In Settings > Bluetooth, in the entry for the headphones, tap the info ⓘ button, tap Forget This Device, and then tap OK.
- Move the iOS device and the Bluetooth headphones out of range of each other. I like this option least, because Bluetooth can work over a long range. If you leave your headphones at home and take your mobile device with you, then this option makes sense.

  In all cases, audio output reverts to the speakers automatically.

Exchange Files with AirDrop

AirDrop was introduced in Mac OS X 10.7 Lion to let you trade files, URLs, contact cards, and a few other kinds of things among Macs on the same Wi-Fi network. It was later added to iOS 7 to swap among iOS devices. Starting with iOS 8 and Mac OS X 10.10 Yosemite, Apple upgraded to allow both intra- and inter-platform AirDrop support.

WARNING! *Macs as far back as 2009 can use AirDrop with other Macs. However, to use AirDrop between OS X (Yosemite or later) and iOS (8 or later), a Mac has to meet the same requirements for the Handoff feature in Continuity. (See* ***Make a Mobile Hotspot*** *for details about Handoff.)*

Configure AirDrop

AirDrop is one of the simplest pieces of iOS technology. There's only one set of choices to make (**Figure 43**).

1. Swipe up to show the Control Center; swipe right if the first screen isn't showing.
2. Tap the AirDrop area in the bottom left.
3. Tap one of the options (**Figure 44**):
   - Receiving Off disables AirDrop.
   - Contacts Only shows your device only to people whose email address is in your Contacts. This is the default option.
   - Everyone lets anyone on the local network see that you're available to receive files.

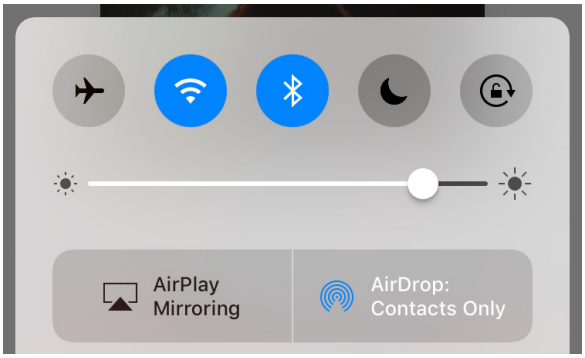


Figure 43: *Control Center is where you set AirDrop access.*

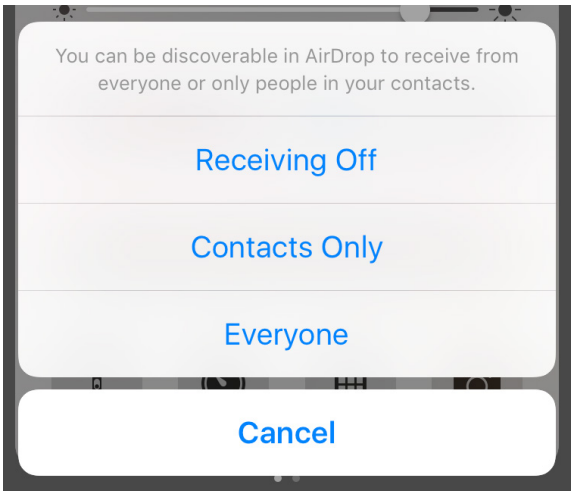


Figure 44: *You can pick how AirDrop advertises itself on a network.*

WARNING! *Some reports that people have received unwanted images, including obscene ones, in public places with AirDrop set to Everyone. My advice is to leave it set to Contacts Only.*

Share with AirDrop

AirDrop is available in any Share sheet in iOS and OS X: you can send URLs, files, photos, contacts, and other items. When you tap the Share icon in iOS, AirDrop will appear at the top, whether or not you've turned off discovery in Control Center; in OS X, it's an option you can select.

You'll see a list of all users on the local network who make themselves discoverable to everyone, or who have you in their Contacts (**Figure 45**).

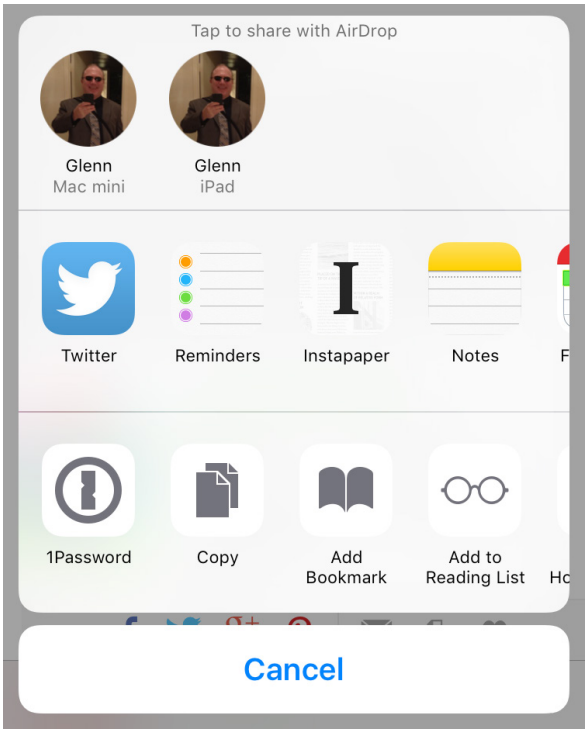


Figure 45: *The Share sheet shows all available AirDrop users.*

Share via iOS

To share over AirDrop, tap the Share icon and then select the user. The recipient will either automatically receive or tap or click to accept or reject the file, as described below.

When a file or other item is accepted or received, the label Sent appears on the icon for the person to whom you transmitted the item (**Figure 46**).

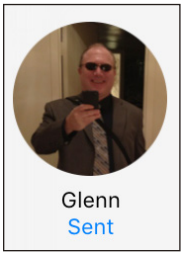


Figure 46: *The Sent label appears to confirm delivery.*

Receive an Item in iOS

In iOS 8, you were always prompted whether to accept the AirDrop transfer (**Figure 47**), even if you were sending something between two of your own devices logged in to the same iCloud account. If you click Accept, the items is received.

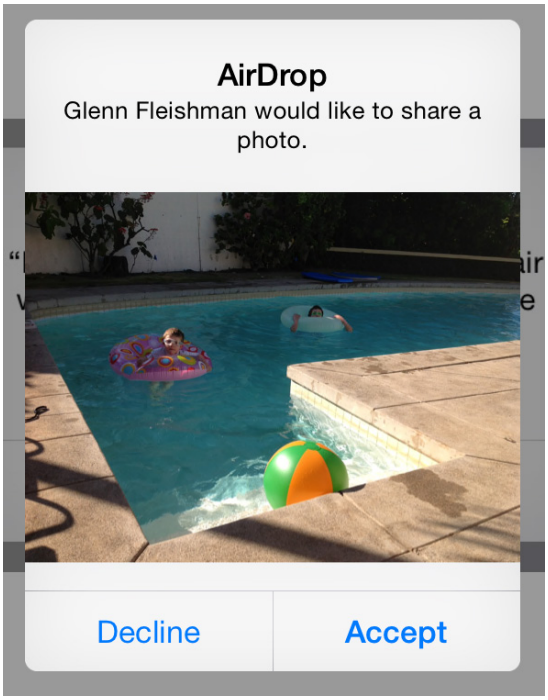


Figure 47: *You're prompted to accept incoming files in iOS 8 or from a device that isn't logged in to the same iCloud account.*

In iOS 10, however, logged in with the same iCloud account, there's no prompt. Instead, you see an unusual overlay notification, and then the appropriate app is opened for the item received (**Figure 48**).

Figure 48: *iOS 10 accepts items without a prompt when the same iCloud account is used on both the sending and receiving sides.*

Incoming items are handled differently by type:

- Image files are added to your Photos collection, the Photos app is launched, and the image is opened.
- URLs are opened in Safari.
- Other files are opened by the appropriate app, if it's installed. For instance, a Soulver file from OS X opens in Soulver for iOS on my devices.
- If no appropriate app is found, an Open With menu appears from which you can select a program that can handle the generic data or that manages generic files, like GoodReader and Transmit (**Figure 49**).

AirDrop and OS X

OS X can share any Finder item via AirDrop:

1. In the Finder, choose Go > AirDrop (Command-Shift-R) or click the AirDrop item in a Finder sidebar window. The AirDrop window shows available recipients (**Figure 50**). (On Macs with Handoff support, it also has the same pop-up menu for configuring how your system is discoverable.)

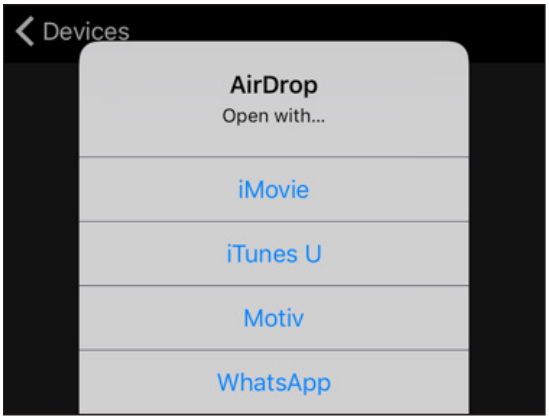


Figure 49: *If there's no app that matches the incoming item, iOS prompts you for possibilities.*

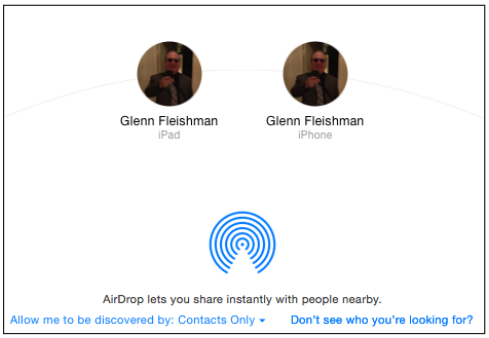


Figure 50: *A list of recipients is shown in the AirDrop window.*

2. Drag a file, folder, or set of items onto a recipient's icon.
3. With the same logged-in iCloud account and a recipient using iOS 9 or 10 or OS X, the item is received. In all other cases, the recipient is prompted to agree to Save, Decline, or Save and Open.

   In apps with a Share button, click it and choose AirDrop, and you can pick a recipient for a URL, an image, or another item (**Figure 51**). The same conditions apply as in step 3 as to whether a recipient is prompted.

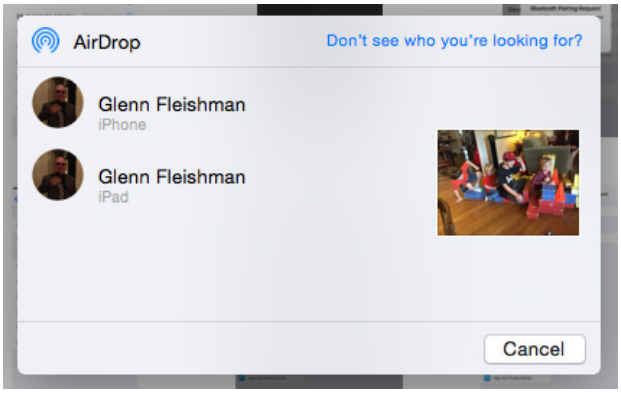


Figure 51: *You can AirDrop an item within an OS X app, too. Here, I'm sending an image from Photos for OS X.*

Stream Music and Video via AirPlay

Apple's AirPlay technology lets you stream audio and video from Apple equipment to a variety of other hardware, including stereo receivers, computers, the Apple TV, the AirPort Express base station, and more.

What's just as good is that Apple licenses the specification so that other companies can extend AirPlay to be more useful. In this chapter, you'll learn how to set up AirPlay, but also how to use it more broadly than with Apple's software and hardware.

Every iOS device that can install iOS 8 or later can use AirPlay.

Select AirPlay Devices

This chapter has to start a little backwards, because before you can use AirPlay, you need a destination. But it's easier to walk through how you can configure your iOS device to point to an AirPlay receiver, and then look at the many kinds of uses.

To select any AirPlay-compatible device on the same Wi-Fi network as your iOS device, follow these steps:

1. Swipe up to reveal the Control Center; swipe left if you're not on the audio control screen.
2. Tap the AirPlay area at the bottom. (If no AirPlay destinations are available—or powered on—the AirPlay area doesn't appear.)
3. Select the device you want to use as a destination (**Figure 52**).

- Your device is shown at the top with a checkmark.
- Bluetooth-capable audio devices are shown with an audio Bluetooth icon.
- Other audio-capable devices are shown with a stereo speaker icon.
- Video-capable devices are shown with an Apple TV icon, whether or not they are actually an Apple TV.

4. Tap Done.

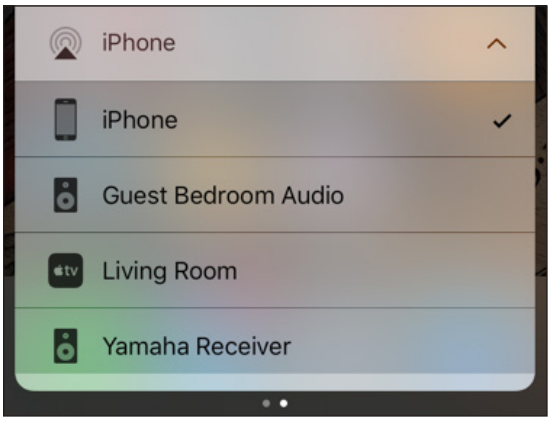


Figure 52: *Available AirPlay destinations are identified by type.*

Connecting with a Passcode or Password

An AirPlay device can be locked with either a four-digit passcode or a password.

- For code access, the device to which you're connecting will display the four digits, and those must be entered in the iOS device to connect.
- With a password, the destination device has a password set through whatever means (such as AirPort Utility with an AirPort Express), and then you enter that password in iOS.

Within individual apps, like the Overcast podcast player, you might have the option to select an AirPlay device as well. The same options appear, only in the form of a popover (iPad) or pop-up (iPhone) with the option to select an item or tap Cancel (**Figure 53**).

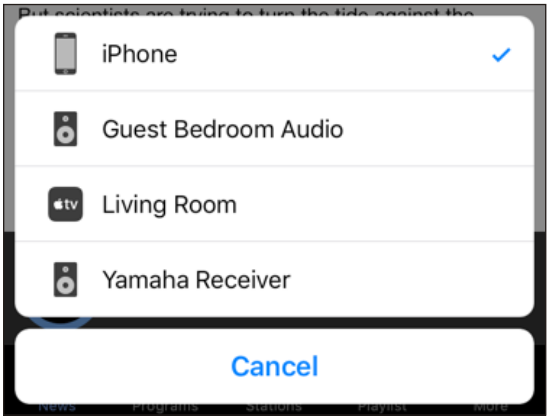


Figure 53: *The popup (or popover) menu in an app doesn't have a Done button.*

Your iOS device retains media control, so you can use volume up/down buttons and on-screen controls such as pause and rewind.

With that out of the way, let's look into uses of AirPlay.

Ways to Use AirPlay

The point of AirPlay is to shunt audio or video around your local network, and there are a number of ways this is useful. I walk through the most common or useful scenarios next:

- Send audio to an AirPort Express.
- Send audio or video to an Apple TV.
- Send audio to another computer or mobile using Airfoil, or receive it using Airfoil Touch.
- Mirror the display to a Mac using Reflector, a third-party app.

> **Tip:** You can send AirPlay audio and video to any device that shows up in the list. For example, I have a Yamaha receiver with an AirPlay mode. On my local network, I select the Yamaha, which automatically turns on and selects its AirPlay mode for input. Unfortunately, you can't turn it off via AirPlay; Yamaha offers a truly terrible iOS app that can be used, but I prefer to press the power button on the unit itself.

Configure AirPlay for an AirPort Express

Apple's own hardware lets you stream AirPlay. In fact, in its original form as AirTunes, it worked only with the AirPort Express. The AirPort Express oddly remains the only Wi-Fi base station with streaming audio support; the Apple TV offers both audio and video output.

An AirPort Express has a combined analog/digital audio port. You can use any standard 1/8-inch stereo plug, or a special digital fiber optic connection that has Toslink (an audio standard) on one end and a special compatible 1/8-inch plug on the other.

Setting up AirPlay is quite simple, and accomplished through AirPort Utility:

1. Launch AirPort Utility, either via iOS or in Applications/Utilities in OS X.
2. Select the AirPort Express base station. Enter the password if prompted.
3. Click the Edit button.
4. Navigate to AirPlay settings:
   - In OS X, click the AirPlay tab.
   - In iOS, tap the AirPlay item.
5. Turn on the Enable AirPlay checkbox (OS X) or switch (iOS).
6. Enter a name for the AirPort Express that will appear in AirPlay lists (**Figure 54**). You can optionally set a password, which must be entered twice identically. Click Done.
7. Click or tap Update in the Update Settings dialog that appears. The AirPort Express restarts with the new settings applied.

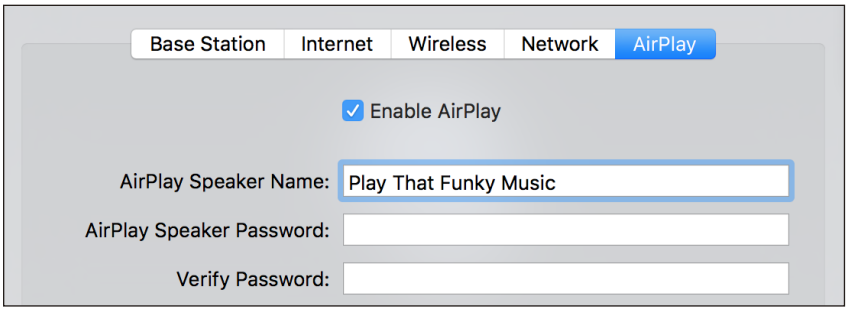


Figure 54: *AirPort Utility in OS X allows AirPlay configuration for an AirPort Express.*

Configure an Apple TV for Audio and Video

Bring up your Apple TV's display on a TV set and use either its dedicated remote or the Remote app for iOS. Navigate to Settings and then select AirPlay (**Figure 55**). You can now:

- Select AirPlay to toggle it on or off.
- Select Apple TV Name to set the device's identifier in the AirPlay list used by other hardware and software on the network.
- Tap Security and set a password.

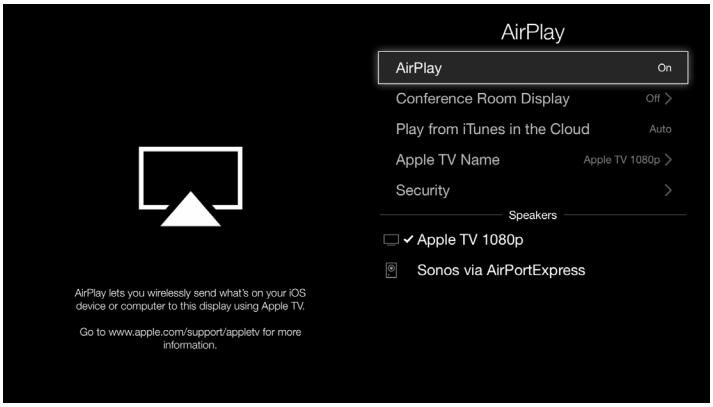


Figure 55: *Apple TV lets you set AirPlay's name and whether security is active.*

Send Audio with Airfoil

Rogue Amoeba makes **Airfoil**, a remarkably straightforward software package for Mac OS X and Windows that lets you send audio from a computer to elsewhere. Airfoil lets you pick a piece of software as its input and one or more destinations to stream audio, and set the individual volume levels for each (**Figure 56**).

But Rogue Amoeba also offers complementary and complimentary (free) software that lets you use iOS more effectively.

First is Airfoil Satellite, available for Mac OS X and Windows. It turns a computer into an AirPlay destination, so you can stream audio from an iOS device or a Mac. Systems running Airfoil Satellite appear in the AirPlay list in iOS.

Second is **Airfoil Satellite for iOS** (free), which acts as a remote control for Airfoil for Mac or Windows, and lets you stream audio using a proprietary protocol from Airfoil to your iOS device.

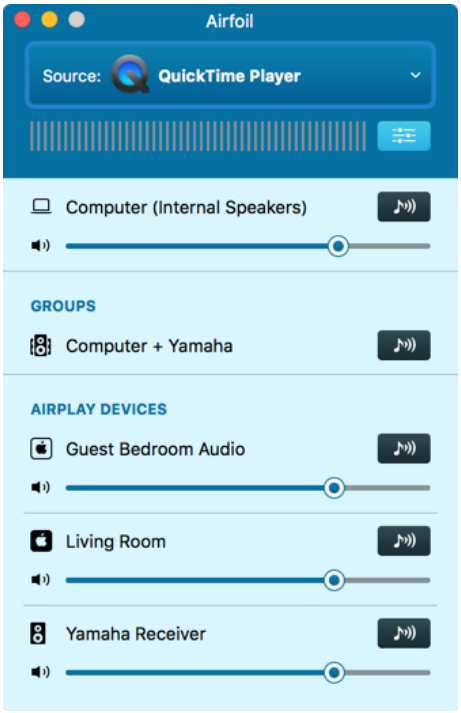


Figure 56: *Airfoil lets you stream audio from any app or the system to one or more AirPlay or proprietary Airfoil destinations.*

Note: Airfoil can stream to any AirPlay device, including Airfoil Satellite for Mac OS X and Windows. It can also stream to Airfoil Satellite for iOS, Android, and Linux, which use its proprietary standard and don't appear as AirPlay devices.

Mirror an iOS Screen

AirPlay is often used for audio or to push video playback to another device. But it can also be used to stream your active iOS display, whatever you're doing it with it, to a computer or other system.

Reflector from **AirSquirrels** ($14.99) acts as an AirPlay video target. Select it as a destination in your iOS AirPlay menu, and the iOS display—

minus any indication of taps—appears in a window on your Mac. You can set passcode or password access.

Being able to stream your full iOS experience is useful for demonstrations and for recording movies of what you're doing to show other people later.

Tip: You can also record or show your iOS screen in Yosemite or later using QuickTime Player without invoking AirPlay. With an iOS device connected to your computer via USB, launch QuickTime Player and then select File > New Screen Recording. From the wee tiny downward-facing arrow, select the iOS device. The window now shows an active preview of your mobile device, and you can then click the big red button to record. This feature also works inside **ScreenFlow** ($99), a screencast capture and edit program, to let you bring in iOS "video" directly.

PRIVACY

The online world is a tough place to keep your personal and financial details private. Even companies we should be able to trust often push at the limits of reasonable and ethical use of our information — especially in tracking us and aggregating our online profile from a thousand little shards into one complete picture.

Our privacy encompasses our personal information (our name, address, phone number, height, weight, and eye color), our financial information (bank accounts, credit cards, purchases, credit score, and much more), and data about us, like our current location, our browsing habits, and our typical travel patterns.

Privacy and security are complementary concepts. In this section, you'll learn how to use controls and filters to limit the ability of Apple and third parties to track you and to retain data to which you give them access. The next section, Security, addresses keeping information intended to be secret away from the prying eyes of others.

Privacy Leaks

What information, either owned by you or about you, should you be concerned about other people getting their hands on? In this chapter, I take a brief walk through a few different ways to slice that question so that you know in the coming chapters precisely what you want to allow, monitor, and block.

The difference here between privacy and security is that to constitute an invasion of privacy it doesn't necessarily require that a malicious party or malware obtain the information discussed below. Where it tips into security issues, discussed in the last section of the book, is when you're explicitly preventing unwanted intrusion that is malicious, criminal, or on behalf of government agencies.

Where Data Lives

Data is a monolithic term, but when we talk about your data being accessible to other parties, or leaking, we should define where it comes from:

Stored data on your device. iOS, apps, and remote systems may be able to access, with or without permission, information you have stored on your mobile hardware. This can include contacts, photos, and emails.

Device hardware. iOS offers highly granular permission control for every kind of hardware element, whether a microphone or an activity sensor. This information can be extremely private. An app that can record you speaking or that can shoot video without your knowledge and stream or upload it later would be terrifying.

Data in transit. Information traveling between your iOS device and a legitimate destination could be intercepted or tampered with.

Information stored at a web site. Any interaction with a site can lead to it storing information about you, whether associated with an account and willingly provided or tracked and associated with a unique ID.

Cloud-stored data. Many services we use rely on data stored in the cloud, a collection of servers without a specific location, as information can be fluidly stored among whatever servers are available for primary storage and redundancy. Clouds may diffuse storage within a data center, among servers across a country, and even at locations around the globe.

What Kinds of Data

Beyond where data is located, you should also consider the kinds of information that you store on your iPhone and iPad and how it might be used. Just the way in which you use the Internet could provide fodder for legitimate and illegitimate purposes.

Behavior

Whatever you do can be tracked, although Apple makes it hard for some of this information to leak or be requested by anyone other than itself. Almost all of the following requires permission from a user (discussed in the next chapter) unless a malicious app was installed, which is unlikely.

Differential Privacy Improves Anonymity

Starting in iOS 10 and macOS Sierra, Apple has added *differential privacy*, a technique of acquiring data that, if implemented and operated well, strongly resists tracking back a particular behavior or response to any individual user. It accomplishes this by adding random noise to all data before it's sent out of your hardware.

The technique dates back decades to something called *randomized response*, which was developed to get honest answers to questions that could be risky to answer. If an American survey subject were asked in the 1950s whether or not they were a member of the Communist Party, the safe answer was always "no," even if the interviewers assured them of privacy.

But there's a way around this. Give the subject a coin, and have them flip it. Heads, they always say "yes." Tails, they always give an honest answer. With a small number of people, the

results remain poor. With a large enough number, however, the statistical noise of the coin flip can be reversed out without knowing which subjects answered honestly.

Differential privacy uses the equivalent of hundreds of random coin flips, and destroys information as it creates an answer to send to Apple, so there are no intermediate steps can be recovered and analyzed, either.

Apple is using this method for a few kinds of information it's collecting initially, and has suggested third-party developers start using it via built-in libraries. iOS 10 will collect QuickType and emoji suggestions, Spotlight deep link suggestions, and Lookup Hints in Notes. Google has used this approach for years to collect usage statistics within Chrome.

Apps

The OS can track which apps you install and which of them you launch. A developer in 2011 created a framework for other developers that relied on listing all app-registered schemas—the app-specific part of a URL—to get a partial sense of all apps installed. (For example, `fb://friends` comprises `fb`, the schema for Facebook's app, and `friends`, a destination the app interprets and then opens as the Friends list.) That framework, as well as a proof-of-concept app, has since been effectively banned.

Apps themselves can also track precisely what you do inside them. While this seems obvious, what the app does with that information is always a question. Is it sent anonymously in some form to troubleshoot and improve the program? Is it aggregated anonymously to change how the app behaves? Does it use differential privacy to randomize data so that there's no chance your individual actions can be figured out later? Is all your information sent to servers to be processed—and is it retained or deleted, and if so, how does the app maker ensure this?

Where iOS is concerned, Apple offers extensive privacy policies that explain how your data is tracked, transferred, stored, retained, and deleted. I go into this in depth in iOS Privacy Settings.

***WARNING**: It's also possible for someone to use AirPlay to capture everything appearing on your screen and mirror it on a device that's recording your actions. However, AirPlay sessions are hard to maintain and have to be set up through a few taps on the device.*

The web and web searching

It's of interest to others how you surf: what you are looking for, which search results you click on, where you wind up, which web sites you have bookmarked, and what pages you view on them—even how long you spend on any page or how you move a cursor on that page. And, of course, when you purchase things.

Because you're using search engines and web sites, the destination where you wind up and what you do there is captured by wherever you visit. What those sites do with your information is a matter of the privacy policy on each site.

> **Tip:** Content-blocking Safari extensions can help in iOS 9 and later to block unwanted tracking and targeting; there's a whole chapter on them coming up.

However, iOS also sends various information to Google, Bing, and other search engines in different places—sometimes in Safari, sometimes in Spotlight, sometimes elsewhere. I cover how to control what information is sent in iOS Privacy Settings. The Duck Duck Go search engine is specifically designed not to retain information about you between searches, and it can be set as your default Safari search engine.

In the past, some clever hacks have let web sites trigger a browser into sending some or all of its browsing history. While the last of those was fixed a few years ago and mobile Safari doesn't have any known weaknesses, it's worth considering how often you want to wipe your browser history to prevent tracking.

Metadata

In the era after Edward Snowden's revelation, most people know what metadata is: it's information that describes other information, like the destination of an email message rather than the contents of the message. iOS lets you send instant messages through iMessage and SMS/MMS as well as via third-party apps; use cellular and Wi-Fi calling via Phone; and use Skype and other VoIP programs for audio/video calls, chatting, and file transfer.

All of those activities involve recipients, locations of where you and they are at a given time, and the frequency and duration of contacts without revealing any of what you send back and forth.

Sensors and receivers

I noted hardware as a category above, but the more specific elements that can be tracked include:

- What you're saying (via the microphone) or doing (via the front-facing or back-facing camera). Apple displays a red bar below the status bar (which it also changes to red) and lists the program currently accessing the mic (**Figure 57**).

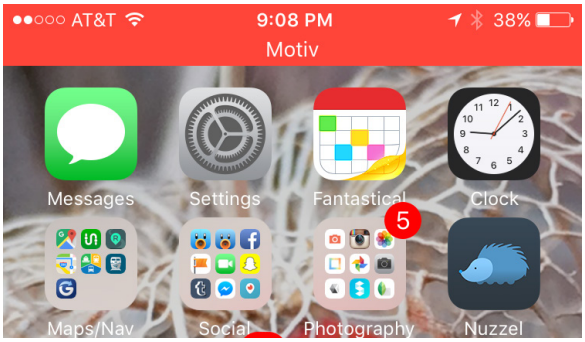


Figure 57: *While iOS is recording, it puts a red banner at top to let you know.*

- Where you are using GPS, cellular, and Bluetooth. If your location is currently being accessed, Apple puts a location icon in the status bar, unless you've disabled it. (See **Location**.)
- Your speed, heading, and altitude, via a GPS, barometer, magnetometer, and accelerometer.

Data

Finally, we should review the kind of information that could be extracted so you can consider what you opt to store:

Your fingerprints. Although Apple locks all this away in a one-way Secure Enclave portion of a chip, the fact that one or more fingertips unlocks a device can be a giveaway: it proves you own or have access to it, which can be evidence in a trial or otherwise used against you.

Contacts. All the emails, phone numbers, and personal data you've stored.

Email. Not just the email on your device, but if you've configured it typically, all the email also stored on your email provider's servers.

Messages. iOS stores your messages locally and indefinitely.

Historical sensor data. HealthKit, iOS, and various apps can store a history of information about you gathered from hardware sensors.

Photos. With iCloud Photo Library, Google Photos, or other cloud-based photo services, you're storing not just pictures and video taken by the device, but also any available from the cloud.

Where you've been and where you're going. Your current location and related position information can be obtained, and some apps retain where you've been, including things as disparate as which cellular towers your phone has recently checked in with. With travel apps and mapping apps, itineraries and destinations may also be available.

iOS Privacy Settings

Apple states repeatedly that it's committed to keeping its customers' data private, and it does seem to do a better job than other companies because it's primarily interested in selling us stuff — hardware, software, and services — rather than pushing advertising at us. (Its iAds business is very small compared to everything else it does.) However, there are both centralized and scattered settings that let you control on a large scale and in small ways all sorts of data that leaks from your iOS device to Apple and beyond.

Setup without Much Sharing

It's a privacy conundrum: Apple encourages you to enter personal or private details and connect your iOS device to its services before it lets you choose how you want to share data. You can work around this a bit with a new device or when you erase one to start from scratch.

Start setup. On the third setup screen, Choose a Wi-Fi Network, Apple won't let you proceed until you either select a Wi-Fi Network or, on a device with an active mobile data plan, tap Use Cellular Connection (**Figure 58, left**). The moment you do this, some information about your activities starts transmitting immediately — although not much.

On the fourth screen, Location Services, choosing Disable Location Services ensures nothing related to your position is sent (**Figure 58, right**). (If cellular service is available, even if you chose Wi-Fi in the previous step, your device's pings to cell towers are recorded, however—that's unavoidable.)

On the seventh screen, Apps & Data, don't enter an iCloud account's information, but instead pick Set Up as New iPhone (**Figure 59**). On the Apple ID screen, click Don't Have Apple ID or Forgot It?, then confirm you wan tto skip. You can connect your Apple ID and iCloud account later.

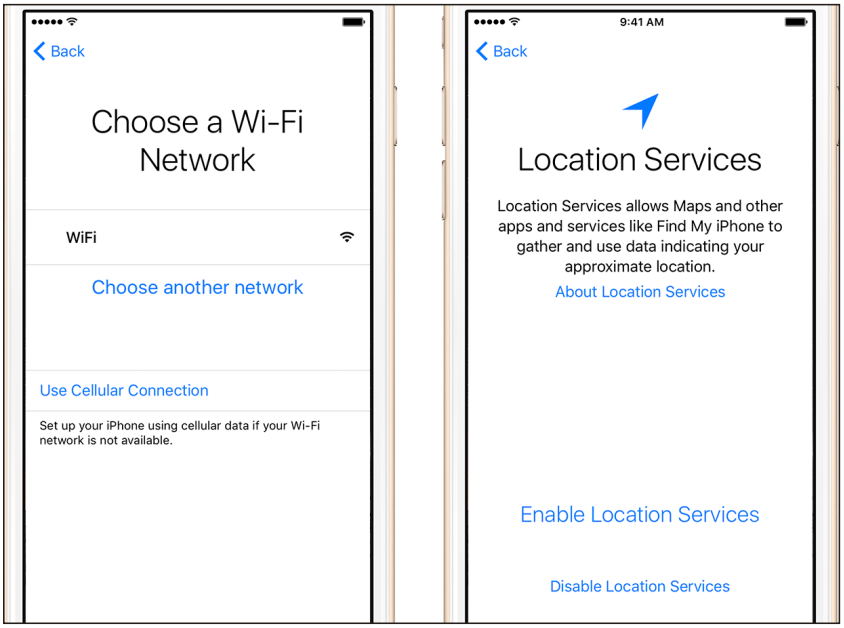


Figure 58: *You have to pick some network (left), but you can disable Location Services.*

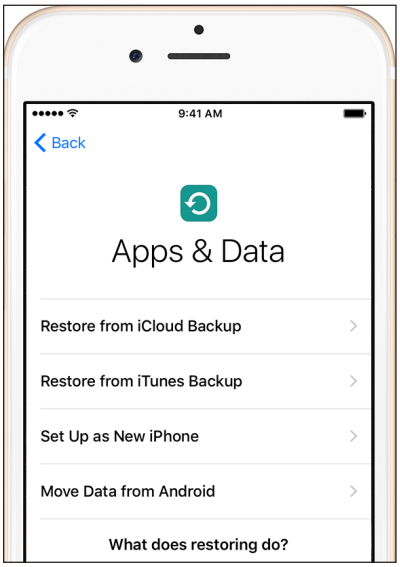


Figure 59: *Don't restore a backup, but start from scratch.*

Continue to the Siri screen, where you should select Don't Use Siri (**Figure 60**). On the Diagnostics screen, choose Don't Send. The device should now be set up.

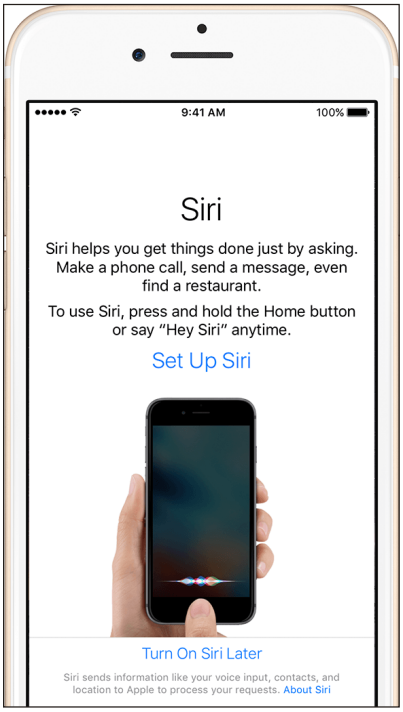


Figure 60: *Siri can leak certain data; don't use it till you can choose which associated options to allow.*

Now you can read through this chapter and decide which features to enable, whether related to privacy or to the way in which your information is synchronized to the iOS device.

Controlling System Privacy

Much of the information iOS captures about you and sends to Apple's servers is used to improve your "experience." For example, Siri can't work without sending your voice off to central processing, and it learns more about you over time as you correct its dictation and travel. But you can also reset Siri at any point, and it forgets forever the connection between any interaction and your device.

Apple typically tries to capture the least amount of information it needs, and when it needs to make a connection between you and that data, it associates your information with a tag that isn't connected permanently

to your identity. You can disassociate from that tag and forget most or all of that information with a click.

In this chapter, I examine the many places in iOS where you control what you allow Apple to know about you, and how you either prevent sharing details (such as your location) or cause Apple to delete your data.

Note: The Settings > General > Restrictions options let you lock all privacy settings in whatever state you like in a separate privacy section.

Note: Apple's full privacy policy spells out in great detail how it promises to handle your personal data and information about you.

Disabling Information for Ads

Apple scatters its settings related to how it gathers information from you to better target ads by interest and location. There are two settings you can disable:

- Privacy > Advertising: set Limit Ad Tracking to On
- Privacy > Location Services > System Services: set Location-Based iAds to Off

You can also reset an identifier that's tied to your Apple ID account and used to associated targeting information in Privacy > Advertising. Tap Reset Advertising Identifier, and the link between you and the data gathered is severed.

Siri

iOS's voice-processing technology mostly lives in Apple's cloud, and thus you need a live network connection to use Siri and Dictation. Siri passes what you say to Apple's servers to produce a response. Apple also sends information about you that you've entered in iOS to make Siri know what you're talking about.

Apple's privacy document for Siri and Dictation explains that it collects the following details:

- Your name and nickname
- Names, nicknames, and people's relationships to you that are stored in your Contacts
- Song names in your collection
- HomeKit-enabled devices
- Names of photo albums
- Your current location (if available)

Apple connects this information to you using an identifier that doesn't contain information about you. You can sever this link whenever you want, by disabling both Siri and Dictation.

To turn off Siri, go to Settings > General > Siri, and set the Siri switch off (**Figure 61**). To turn off Dictation, go to Settings > General > Keyboard, and turn off Enable Dictation. This severs the link between your device and Apple, although on its servers, Apple may retain a fair amount of:

"...audio files and transcripts of what you said, related diagnostic data, such as hardware and operating system specifications and performance statistics, and the approximate location of your device at the time the request was made."

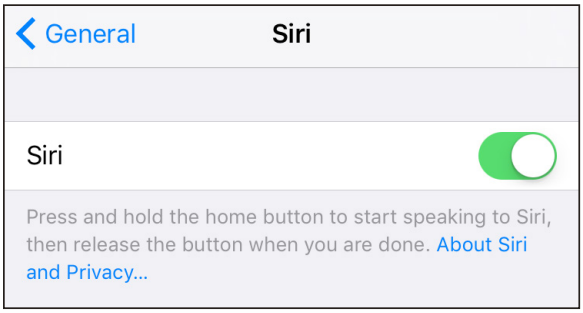


Figure 61*: Disable Siri and the link to your device is tossed, but not all the data collected.*

If you're uncomfortable with any of that ever being sent or retained even in that disassociated form, disable Siri and Dictation and never use them.

You can also selectively disable location hints for Siri and Dictation, so that neither service uses contextual clues, by configuring Settings > Privacy > Location Services > Siri & Dictation to Never.

Safari

When you use a web browser, you're always leaking information about yourself. Use a search engine, and it knows what terms you typed in, what kind of device you're using, and your Internet protocol address or a proxy. When you visit a web site, it knows what pages you request, of course, but may also track mouse movements and other page-based behavior, as well as use tracking IDs to identify you from previous visits and across multiple unrelated sites.

> ***Duck Duck No? Yes!*** *Duck Duck Go is a search engine that promises not to retain or resell personal information. Many people who dislike the tendrils of Google opt to use Duck Duck Go instead. You can set it as your preferred search engine in Settings > Safari > Search Engine.*

iOS has several options to reduce the amount of information leaking about you. iOS 9 and OS X El Capitan introduced content-blocking extensions for Safari as a sophisticated way to block tracking, ads, and creeping privacy leaks. See **Content-Blocking Safari Extensions** for a full rundown on how to use them.

Even innocuous features such as autofilling forms and storing passwords can expose you to some risk if someone gains access to your phone or you visit a malicious site. Fortunately, Apple also has tools that help protect you.

Apple's Suggestions

Apple tries to give you a better answer to whatever you're looking for in Safari, but to do so it sends information about you to a search engine or its own servers. When enabled, the Search Engine Suggestions option at Settings > Safari transmits your query to the search engine you chose and then displays the results it offers. (Preload Top Hit downloads the first match in the background.)

Safari Suggestions displays all sorts of things—search results, apps, movie showtimes, and more—based on the terms you enter, your location, and the music and video subscriptions on your iOS device.

You can disable either or both Suggestions options entirely, or turn off location awareness, via Settings > Privacy > Location Services; swipe down to the bottom (past all the apps that use location data) and tap System Services, where you can disable Location-Based Suggestions.

A Sideways Leak of Searches

There's one oddball search-related setting you won't find in the Safari area. In Settings > General > Spotlight Search, you'll see a list of apps that contribute to Spotlight searches—results from within apps, such as saved 1Password logins, that appear when you perform a search from the Home screen. These matches are drawn entirely from locally stored information in apps—like files you favorite within Dropbox—and Apple says it neither makes a record of them nor uploads that data at all.

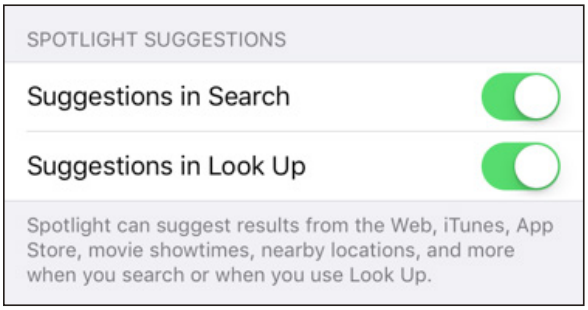


Figure 62: *Spotlight suggestions for search and look up pass information through Bing.*

However, at the top, you'll find Suggestions in Search and Suggestions in Look Up (**Figure 62**, above). Apple passes your keywords to Microsoft's Bing search engine to provide search-based results, and Spotlight Suggestions uses the same contextual clues noted above for Safari. Bing searches are relayed via Apple, which prevents Microsoft from associating a search with you, and Apple says Microsoft further doesn't retain the search terms you use.

Passwords and AutoFill

Although automatically providing or filling in information would seem like a plus—as long as those details remain under your control—you may prefer not to have any such information stored permanently on your iOS device. And with iCloud, some information is synced across all devices with the same Apple ID and settings.

For example, you may not want your information filled in on a form automatically. Some web pages use AJAX, a kind of portmanteau scripting technology for live server interaction. Even if you never click or tap a submit button, that form information is sent. You also may not want someone else with access to your iOS devices—even perfectly legitimate access—to log in or fill in information on sites.

With Settings > Safari > AutoFill > Names and Passwords enabled, whenever you visit a web site and enter account information and passwords for login, Safari will offer to capture and store them (**Figure 63**). A pop-up dialog will present three options: Save Password, Never for This Website (never asked again), or Not Now (asked on next visit).

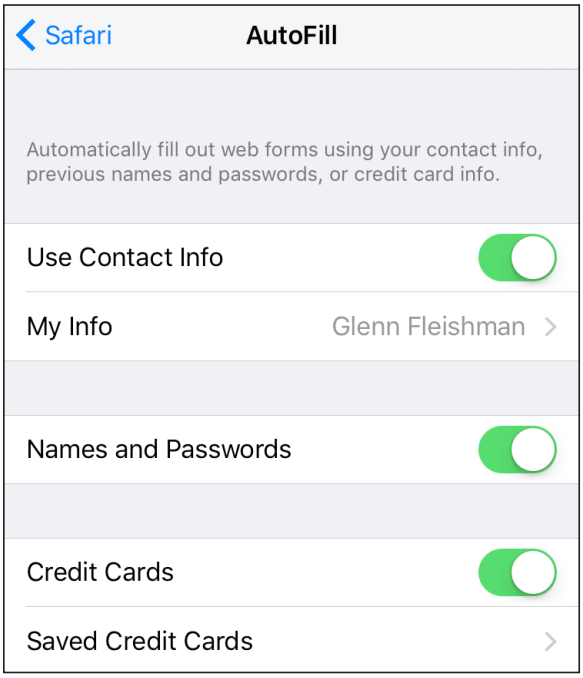


Figure 63*: AutoFill handles a lot of stored information.*

Tap the Passwords item and then enter your passcode or use Touch ID to view and manage passwords. You can swipe left on an entry and tap Delete, or tap the entry to edit or delete it. If Settings > iCloud > Keychain is turned on, then you'll see all your passwords from every Safari interaction on all linked devices, and actions you take on your iOS device ripple outward too.

You can disable Names and Passwords at any point, and all password entries remain intact. There's no good way to get rid of them all at once, however. Tap the Edit button in the Passwords list, and you can select multiple items to delete. But you need Safari on OS X to do a mass delete. (Safari > Preferences, click Passwords, and select ranges or Edit > Select All, then click Remove.)

Safari's preferences for AutoFill also let you enable and disable pre-filling your contact information and credit card details. (That latter option is managed separately from Apple Pay.)

Watching the Watchmen

Beyond content-blocking extensions, which affect what loads in a web page, you can also control several elements of how web sites interact with you.

> ***Nuke all data:*** *While these options control specific kinds of browser/server communication, you can also get rid of all data associated with web site visits by tapping Settings > Safari > Clear History and Website data. If you're signed in to iCloud, it also nukes this information from Safari on every associated computer and iOS device.*

Do Not Track

A well-intentioned effort began a few years ago to let browser users indicate in an affirmative manner their preference about being tracked across one or more web sites. Do Not Track would be a simple preference sent from a browser if the user had checked a box or enabled a switch for Do Not Track. It was that simple.

Unfortunately, advertisers and other parties who track user behavior opposed recognizing that flag. Browser makers also mucked up the clarity of Do Not Track by enabling it by default or proposing that new releases would enable it by default. This takes the user intentionality away if a browser automatically picks the option. Really, there should be three states: not yet decided (send no Do Not Track preference), no (don't track me), and yes (do track me).

Apple opted for a simple switch in Safari preferences. By default, it's set to Off, which corresponds to "no choice"; when it's switched on, you send a feeble signal to sites, who typically ignore it, but you are nonetheless sending a message!

Block Cookies

Browser cookies, discussed at greater length in Safari Content Blocking Extensions, let a server deposit a small bit of text in your browser to keep track of a session, preferences, or other account-related details—as well as for the more irritating purpose of tracking you around the web for marketing.

iOS lets you pick one of four options at Settings > Safari > Block Cookies:

- Always Block never accepts cookies. This can affect your ability to use many web sites.
- Allow from Current Website Only limits Safari to accepting cookies only from the same domain as the page you're viewing. See *warning* below.
- Allow from Websites I Visit will use your browser history to allow cookies more broadly, but still related to your choices.
- Always Allow accepts everything.

> ***WARNING**: I strongly suggest picking Allow from Current Website Only following reports in 2016 of malicious scripts that can make use of non-local cookies to run attacks that can leak information.*

Fraudulent Website Warning

This little switch in Safari preferences apparently protects you against phishing sites: sites that appear to be legitimate but are fraudulent and counterfeit, to which you're often directed by links in email or subverted advertising (**Figure 64**). Apple hasn't provided details for years about how it assembles the list, and I've never been warned in years of using it.

If you encounter a site that's in its blacklist, you'll be warned and asked if you want to proceed. This prevents the page from loading and attempting to fool you or even install malware. (Malware is a slight risk for iOS users, but a risk nonetheless.)

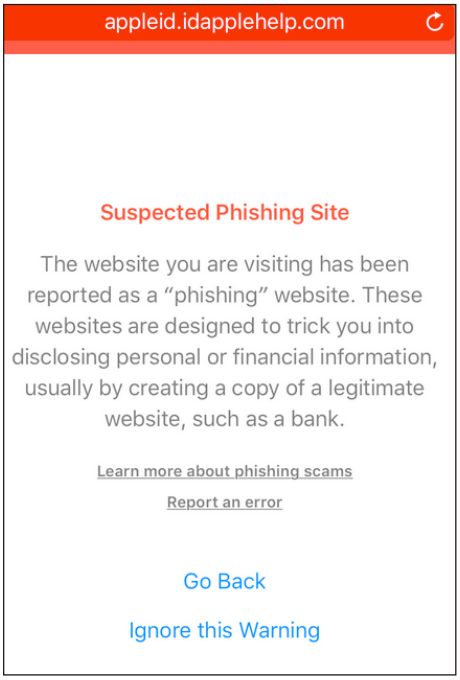


Figure 64: *Sites that are phishy provoke this warning.*

Check for Apple Pay

Starting in iOS 10 and macOS Sierra, you can pay for transactions within a Safari web browser using Apple Pay on an iPhone or other devices. This scheme uses Continuity, Apple’s catchall term for linking Macs and iOS devices together for proximity-based activities, including Handoff, where you can start reading on one device and continue reading on another.

Apple Pay in Safari requires that a web site can detect whether the browser can hand off a transaction. This leaks a tiny bit of information about you, and you can disable this.

Private Browsing

Not a preference but a mode; you can use Safari in a way in which all your normal settings are overridden and nothing is retained from the browser window you use once it’s closed (**Figure 65**). Specifically, your history in that window is forgotten, the tab isn’t synced with Safari on other devices through iCloud, Do Not Track is set to On, cookies aren’t permanently stored, and local storage isn’t accessed.

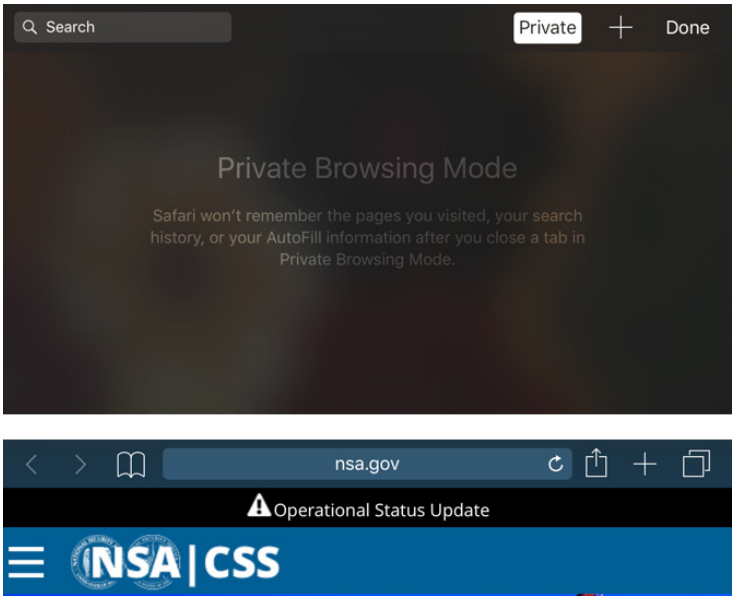


Figure 65*: The Private Browsing mode explains itself (top). A page loaded (bottom) keeps the dark top bar to remind you.*

In Safari, tap the Windows button and then tap Private at the bottom of the screen on an iPhone or iPod touch, or at the top of the screen on an iPad. The color scheme switches from light to dark to remind you that you're browsing privately. To exit the mode, tap the Windows button and tap Private again.

Private sessions are maintained separately unless you close the tabs before switching back to regular Safari use.

Because history isn't retained between private sessions, it's a reliable way to zero out where you've browsed even if someone else were to obtain access to your device.

Website storage

An improvement that was added several years ago to HTML and browsers allows web sites to store information in a database format in a browser. This is especially useful paired with JavaScript: a site can load and the JavaScript code can consult settings or other information stored locally without a round trip to the server, speeding up how a page might display.

In Settings > Safari > Advanced > Website Data, you'll see a list of sites that store information and how much data they're using. A selection of sites that use the most data initially appears; tap Show All Sites to view everything. You can swipe left on a site and tap Delete to remove the associated data, or tap Remove All Website Data to kill all local storage.

Location

iOS's ability to provide a set of coordinates that fairly precisely describes your current location on Earth works amazingly well. So well that you may have reasonable concerns about when, how, and to whom your location is shared. iOS offers a lot, lot, lot of settings and options. While most are centralized, Location comprises a lot of disparate things you have to consider when limiting what sees your coordinates.

The How and Why of Location

Apple uses a combination of four radio systems to produce a set of standard geographical coordinates, sometimes with a margin of error when data isn't precise enough. Relying on GPS is logical. (Since the iPhone 4s, it's actually both the U.S.-operated GPS plus the Russian-operated GLONASS system, for greater accuracy.) Satellite navigation systems can provide location accuracy within meters, or even better with more satellites or when combining multiple systems.

But iOS also uses Assisted GPS, which lets it plot satellite positions more rapidly and accurately, relying in part on data sent via a live Internet connection. It can also use cellular network information (because cellular network transmitters' exact positions are fixed and known), Bluetooth (to communicate with nearby base stations, the locations of which are identified), and Wi-Fi (relying on a worldwide database, which Apple constantly updates, of the broadcast names and signal strengths of Wi-Fi networks).

iOS and apps make use of location for all sorts of purposes. Of course, advertisers want to target you, because they make more money in pushing things at you that relate to where you are. But your position can also be attached to photos (called geotagging), track a stolen iPhone or iPad, help you find a family member, bring up a list of restaurants near you, and tell you the current weather for the micro-climate you're standing in.

Opting In and Opting Out

Apple makes use of location in iOS without prompting for every use for its own purposes, but apps have to request permission. Even after granting permission, iOS will prompt you occasionally for apps that update location in the background to make sure you still want them to do so.

iOS has a comprehensive panel for controlling what gets access to location even after you've authorized that access. In Settings > Privacy > Location Services, you'll see nearly everything associated with system-level and app-specific position permission. Set Location Services to Off, and location information stops being gathered and fed to apps and the system. (The sole exception, Apple says, is to provide your location when someone uses the device to place an emergency call.)

Note: Apple has a full description **in a support document** of how iOS makes use of your location.

Share My Location

The most consensual of all position-providing services, Share My Location lets you send details of where you're at to people you know, either on a one-time basis (as a map) or on a dynamic basis as your current position for a period of time or indefinitely. You can use the Messages app, Find My Friends, and Family Sharing to send your location or control who sees where you are (**Figure 66**).

Because the feature is exclusively opt in, you can't accidentally share your spot with people you didn't choose to. However, you can suspend sharing by setting Share My Location to Off, and then no one with whom you're connected can track you; when you re-enable the setting, the connection to them resumes as before.

You can also remove people from the Friends list (and Family list with Family Sharing enabled). Tap the name, and then tap Stop Sharing My Location.

With Messages, you can opt to share your location with people over iMessage or SMS in one of two ways. Begin by starting a conversation

with someone or, if you have a conversation in the Messages list, by tapping their name. Then tap the Details button. You can either tap Send My Current Location, which sends an image of a map slice and a pin for your current spot on the map, or tap Share My Location, which lets you pick one hour, till the end of the day, or indefinitely (**Figure 67**). You can then manage that connection from the Share My Location settings.

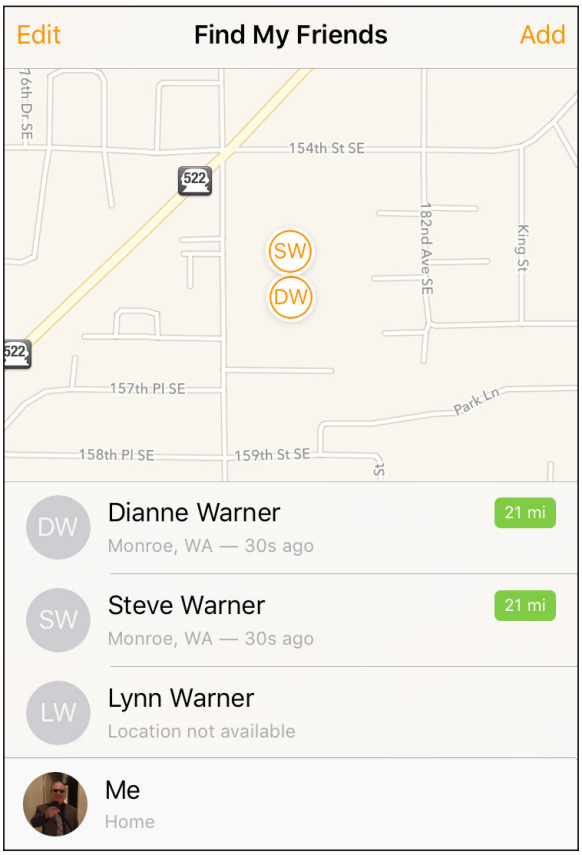


Figure 66*: In the Find My Friends app, you can see the current position of everyone who has shared their location with you and currently has that sharing enabled.*

Note: Find My iPhone is an incredibly powerful feature, but once you have it enabled, all someone needs to track your motions is access to your iCloud account and password (unless you've got two-factor authentication enabled). It's useful to consider leaving the feature off if you have any concerns about having total access to your account credentials.

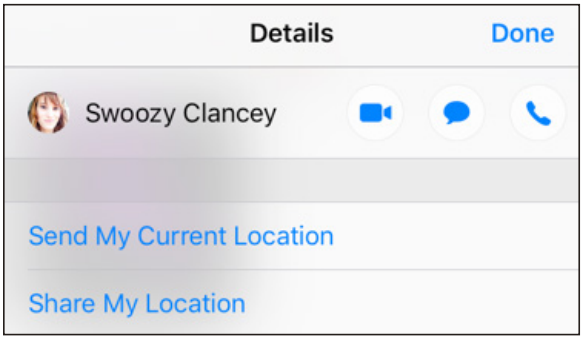


Figure 67: *You can share your location as a static map of where you are, or as a constantly updated position for a short or long period of time.*

Tip: You can access Share My Location's settings from Settings > Privacy > Location Services, or just the iCloud settings in the Advanced section.

Location Privacy Settings

Location privacy is split into apps and services. iOS marks each app or service with a location symbol (**Figure 68**):

- Purple, when in use or recently used
- Gray, when used within the last 24 hours
- An outline, for an app that supports geofencing, which monitors when you leave a defined location or area

Figure 68: *The arrow colors indicate how location services were recently used.*

At the top, a list of both Apple and third-party apps appears alphabetically with a notice about how the app is currently allowed to access your position. The options are Always, While Using the App, and Never. Many

apps include either Always or While Using the App, but not both; all include Never. Some apps offer text explaining precisely what they're using location information for. You can change an app's access at any time.

System Services, listed at the bottom, contains a host of very specific permissions for how iOS makes use of location. Some of them allow the hardware to function more accurately, such as Compass Calibration. Some are useful, like setting your time zone automatically based on location. Let's go through the list for clarity's sake:

- Cell Network Search, Compass Calibration, and Motion Calibration & Distance help hardware function more effectively.
- Find My iPhone/iPad/iPod touch is covered in **When Your Device Goes Missing**. It requires entering your iCloud password to disable.
- Location-Based Alerts enable geofencing.
- Location-Based iAds is discussed earlier in **Disabling Information for Ads**.
- Location-Based Suggestions is covered above in **Safari**.
- Setting Time Zone...sets your time zone.
- Share My Location is covered earlier in **Share My Location**.
- Wi-Fi Networking continuously sends snapshots about Wi-Fi networks that can be picked up from your location to improve Apple's Wi-Fi positioning database.
- Frequent Locations tracks your regular haunts, and Apple says the data is stored only locally, to help with "predictive traffic routing" and other services.

Tracking You in Maps

Apple says it goes to great lengths to prevent information about your whereabouts and trips from being connected with you and your devices. Its Maps app (as distinct from the Google Maps app) doesn't require a login to use, and relies on what Apple describes as a frequently reset random identifier to tie your current use with its servers—think of it like a browser cookie that's regularly deleted. Apple also says it doesn't collect trip segments.

The one exception to this is the Location Services > System Services > Improve Maps setting. When enabled, it lets Apple connect the address stored with your Apple ID with GPS data,

albeit in an anonymous form. That is, it's trying to improve the accuracy of your address's coordinates, but it doesn't associate you with that data. Disable that behavior by setting the switch to Off.

Privacy Settings and Allowing Access

There's one more section to talk about, which is the main Settings > Privacy screen, where you manage disabling access to apps that you've previously given permission to.

Apple controls access to many kinds of personal data and device hardware by prompting you the first time an app wants to use either data or hardware, letting you confirm or reject it. This came about after apps would access your contacts list and upload it to their server for processing, including inviting other people to use the app or their service!

If you confirm access, iOS creates an entry in the Privacy settings in the appropriate category. You can visit any category and disable access on a per-app basis. You can't delete the app from the list except by uninstalling the app.

When you've disabled access for an app, the next time you use that app and try to employ a feature that requires one of these iOS caches of data or a hardware element, you'll be told that the app currently lacks access. You're directed back to Privacy to change the setting so it will be re-enabled in the app.

Note: The categories include Twitter, Facebook, Flickr, and Vimeo if you've entered your login information for one (or more) accounts in Settings for those services.

Keeping Creeps Away

The Internet can be an unfortunately vile and random place at times. Many communications tools, like iMessage, are designed to be open by default. In this chapter, I look at how to clamp down on who can reach you and how to stop those you don't want to hear from.

Blocking Contacts by Phone, IM, and Video

When iMessage first appeared, it was a great addition to instant-messaging offerings built by other companies, such as AOL. AOL Instant Messenger (AIM) was the basis of IM for OS X in iChat; Apple registered one's .Mac, MobileMe, and iCloud account with AOL automatically. Over time, iChat added Google Chat and other options. But with the introduction of Messages in iOS and then in OS X, Apple offered its own, in-house unified mobile and desktop IM.

But there was a problem. iMessage allows us to use any phone number connected to an iPhone (even if we have multiple iPhones) and any email address. This meant, however, that not only could acquaintances who knew any of those email addresses or phone numbers reach you, but anyone could.

The same problem existed for phone calls, of course, as well as FaceTime audio and video. Yet people's concerns seemed to center on iMessage, because a phone number can be harder to obtain, and people engaged in forms of harassment don't typically want video evidence of it, either, which is easy to gather within FaceTime.

And until iOS 7, there wasn't anything you could do to stop them, which was truly horrible for those being harassed, stalked, or just subject to boring unwanted attention. The only options were to stop using iMessage or disconnect your known email addresses, and even change your phone number.

Note: Caller ID is used to block phone calls, but unfortunately it's not a secure method of identification. A harasser can turn off Caller ID or, with third-party services, change the number that appears.

iOS 7 added blocking, which extends to calls, iMessage, and FaceTime. iOS 8.3 added yet one more feature: the ability to sort incoming messages in iMessage by those in your Contacts and others.

How Does Blocking Appear to Blocked People?

When a blocked phone number's owner places a call, the line rings once, they hear a generic message about the person being unavailable, and they are dumped into voicemail. If they leave a message, it's listed separately at the bottom of the Phone > Voicemail list. The recipient isn't notified of the call.

Messages are shown to the sender as Delivered, but are dropped into the memory hole: the recipient doesn't see and isn't informed of them. Regular SMS and MMS text messages are likewise swallowed up without the sender knowing otherwise.

With FaceTime, a placed call rings indefinitely without the recipient being notified.

Blocking Phone Numbers and Email Addresses

You can block phone numbers and email addresses in multiple places:

- In Phone, you can select any number and tap the info ⓘ button (or select any contact) and then tap Block This Caller.
- In Messages, tap Details, tap the info ⓘ button, tap the phone number or name (not the icons next to it), and tap Block This Caller.
- In FaceTime, tap the info ⓘ button next to any Video or Audio entry, and tap Block This Caller.

  Once you tap and confirm with Block Contact, all associated information is added to the block list (**Figure 69**). The list of blocked phone numbers and addresses appears the same whether accessed from Settings > Phone, FaceTime, or Messages. You can tap an entry to view all associated details, or swipe left and tap Unblock to allow them access to you again.

Figure 69*: The Blocked list shows all banned emails and phone numbers.*

Starting in iOS 10, you can also use third-party apps to block calls and provide Caller ID lookup as a call comes. You control which are active via Settings > Phone > Call Blocking & Identification. They don't block jerks you know, but they can identify likely fraud and spam callers, and even auto-block them.

Sort iMessages by Whether in Contacts

Messages offers a subtle way to segregate incoming messages between people in your Contacts and those who are not. Enable it in Settings > Messages > Filter Unknown Senders.

Incoming iMessages that match any phone number or email address in Contacts appear in a Contacts & SMS tab, as well as any SMS/MMS messages, which are unfiltered. Conversations already underway appear in that tab, even if they're not in your Contacts.

Any future incoming iMessage messages that don't match a contact go into Unknown Senders. Such messages don't trigger your usual notifications flags, and you have to remember to review it occasionally to see if you've missed anything.

Tap Report Junk from an unknown sender to send details to Apple.

Content-Blocking Safari Extensions

In iOS 9, Apple added a powerful tool for web browsing: content-blocking extensions. Developers can create custom add-ins that monitor and block Safari-based connections for items on web pages. You will find a huge array of options available, from simple to absolutely baroque.

Why block content? To reduce the time it takes to load a page that's otherwise laden with advertising and trackers, to decrease bandwidth consumed over cellular connections, and to suppress advertising and prevent easy tracking of your activities.

It's not all about ads and behavior, though. Specialized blockers, and settings within more sophisticated blockers, can remove the display of comments on sites by blocking major content systems, keep popover boxes from obscuring your screen, remove social-network-related widgets and buttons, or blacklist entire categories of sites (such as those that show adult-oriented imagery).

How Content Blockers Work

Starting in iOS 9 (and in El Capitan), Apple lets developers create apps that can block content from particular URLs or from patterns that match URLs. The app provides the interface, if any is required; some are just a set of filters you can't manipulate, while others have extensive options and customization.

> **Note:** In iOS 9, content blocking only worked within the Safari browser. In iOS 10, Apple extended it to WebKit: any embedded web page that uses Apple's default browser display system will also process content through active blockers.

Content blockers don't analyze what is on a web page, nor do they examine other media and files referenced by a web page, such as Cascading Style Sheets (CSS) documents, images, video, JavaScript, and the like.

Rather, a blocker has a list of filters, which comprise these elements:

- A specific URL or a pattern that can match a range of URLs.
- A behavior: block the item entirely, block just associated browser cookies from being set, or block specific CSS selectors, which I'll explain in a moment.
- An optional kind of content to match. The list of types are document (which is generic), image, style sheet (for CSS), font (as fonts can be quite large), raw (anything not specified), SVG document (a vector image format that's rendered in a browser), media (for images, audio, and video), and pop-up windows.
- An option to block only if it's fed from the "first party" (the web site you're visiting) or only from a third party, typically used with ad and tracking networks.

> **Note:** You can find the full technical details about how content-blocking extensions work at the **Surfin' Safari blog**, a site maintained by Apple's WebKit browser-engine team.

Filters are set by the app, and then compiled by iOS every time they're changed, so that they are handled very quickly in Safari. Apple created these as opposed to allowing JavaScript-based extensions, which are available in Safari for OS X, because JavaScript imposes a much heavier load per page, delaying viewing pages and burning battery life.

As noted in the list above, blocking behavior doesn't have to keep an item from loading entirely: there are two alternatives.

Browser cookies are one way to feed to a browser a unique identifier that's stored locally. Every time a browser makes a web-based request

for a page or other item that matches the same domain, it also packages and includes the cookie as part of the set of headers sent to that web server. Cookies are often used to plop a long-term or per-session identifier into a browser after a login or during an otherwise anonymous visit.

These identifiers can be shared across networks and persist, so that everything you do among sites that use the same tracking or advertising service is associated. Blocking cookies can prevent many kinds of tracking by companies that comply with industry rules, government regulations, and ethical standards. Some content-blocking apps will include cookie filters.

> ***Block that tracker:*** *There are also a lot of other ways to bypass the limitations of regular browser cookies by using evercookies and supercookies. Blocking browser cookies won't prevent determined tracking networks from seeding other kinds of IDs. Apple could expand the filters to disallow access to some HTML5-based features that are used to keep a cookie persistent when it shouldn't be set in the first place or after it was intentionally deleted.*

The other kind of page-specific blocking allows a filter to suppress CSS. This might sound a bit obscure if you don't design or develop web pages, but it's straightforward. HTML defines the bones of a page, like the girders of a skyscraper, and contains the innards—text and images and other stuff — just as an office contains workers and furniture and printers.

CSS is the glass and metal panels covering the skyscraper, while also painting the outside and creating the walls and cubicle barriers: it defines how things appear, including the dimensions and placement of both fixed layout areas and boxes that can seemingly float above the page.

A CSS "selector" defines the scope of what style definitions apply to. They can be used to attach to an HTML element (a tag), reused for multiple parts of a page (a class), or define a specific structure (an identifier or ID), which is used for those floating boxes among many other purposes. By allowing a blocking filter to strip out specific selectors, it can suppress advertising overlays or other annoying or intrusive behavior.

Blockers in Action

Apple allows any combination of content-blocking extensions to be enabled at once via Settings > Safari > Content Blockers (**Figure 70**). And you can override all content filters by holding down the reload button for a few seconds and choosing Reload Without Content Blockers. Instead of a simple reload, it becomes a "reload without filtering." Some blockers provide even better bypass options.

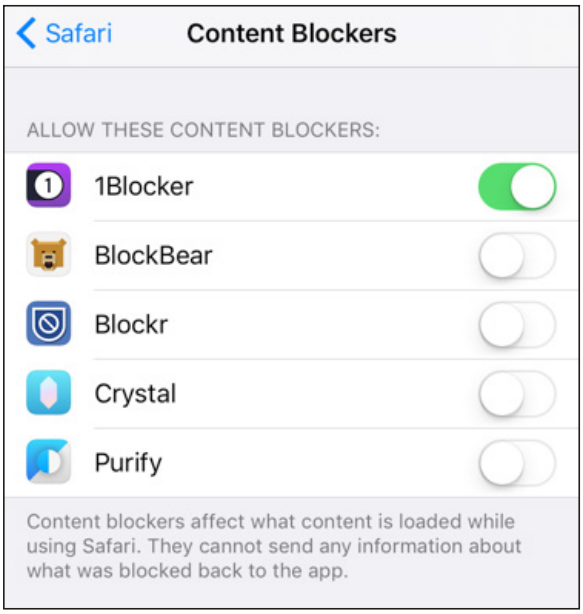


Figure 70: *You can enable and disable any combination of content blockers.*

> **Note:** Apple's notes on these filters indicate that if they take too long to process, Safari may ignore them. In practice, this should apply only to URL patterns that are complicated and require too much processing time to find matches.

Content-blocking apps come in several forms:

- Simple. The app will have no controls, and you'll rely on rules, set by the developer, that can be updated in the background or through app updates.
- Selectable. Many apps will offer an interface to select among the kind of content you want to block and how you want to block it, but provide little information about what's in the filters beyond that.

- Customizable. Some apps will be entirely devoted to seeing everything that they're blocking and will let you create your own rules; some of the selectable apps will also include limited customization.

Because there are so many content blockers, you'll need to rely on reviews and recommendations to find the ones that fit you. Instead of going through everything that's available, let me show you good early examples of each kind: simple, selectable, and customizable apps.

Simple: Crystal

Crystal uses a customized version of the **Adblock Plus EasyList**. There's no way to change what's used, but you can suggest sites to add to the blocklist (**Figure 71**). The app developer pushes regular updates to the list in the background.

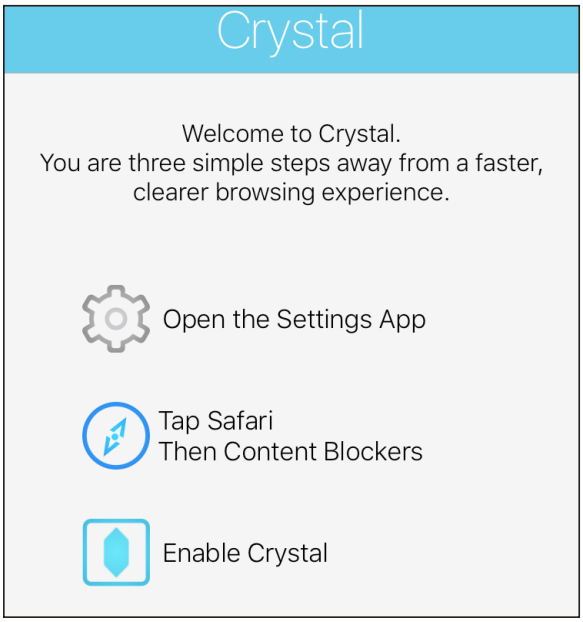


Figure 71: *Crystal has no configuration options.*

WARNING! *In a sign of how complicated these issues are, Crystal's maker said he'll participate in a whitelist program in which a third party that is paying him will provide an opt-out list of sites that meet good advertising guidelines, and Crystal won't block those.*

Selectable: Blockr

Blockr offers three categories of blocking: ads, media, and privacy (**Figure 72**). It doesn't provide any information about the source of these lists. You can tap Advanced for each category to whitelist specific URLs. You can also suppress "cookie warning" messages at sites that are obliged under European Union rules to let you know about cookies.

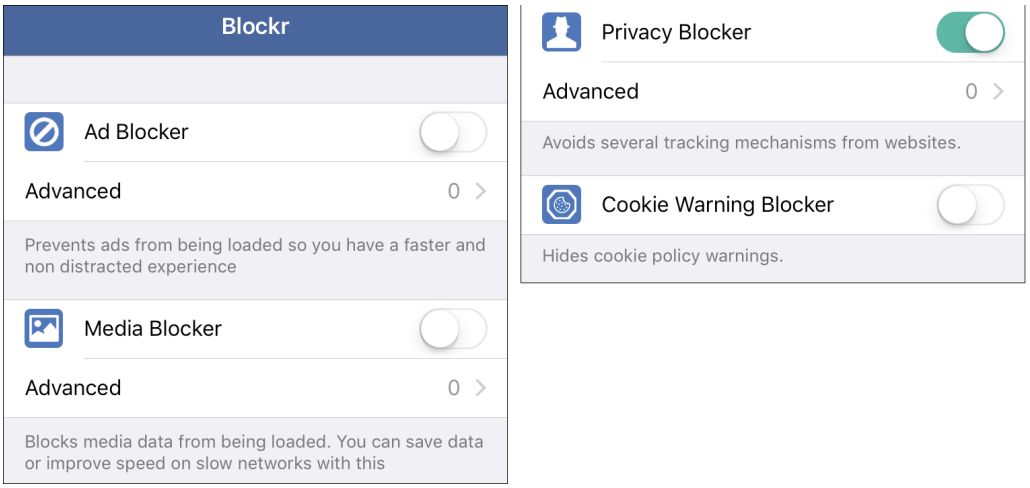


Figure 72: *Blockr has limited options you can set, plus whitelisting.*

Customizable: 1Blocker

1Blocker has a remarkably customizable interface. For each of several categories for which the app offers control, you can not only enable and disable blocking (**Figure 73**), but also tap the category name and see every item in the list (**Figure 74**). You can then opt to disable specific items.

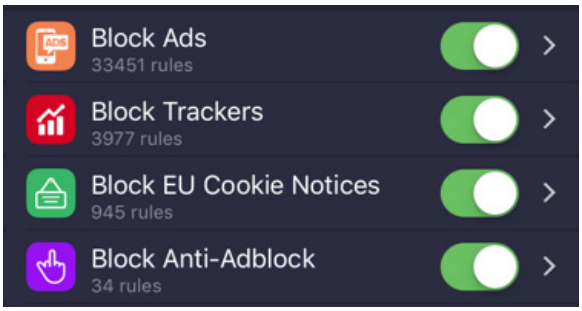


Figure 73: *1Blocker offers a lot of separate settings for kinds of things to block.*

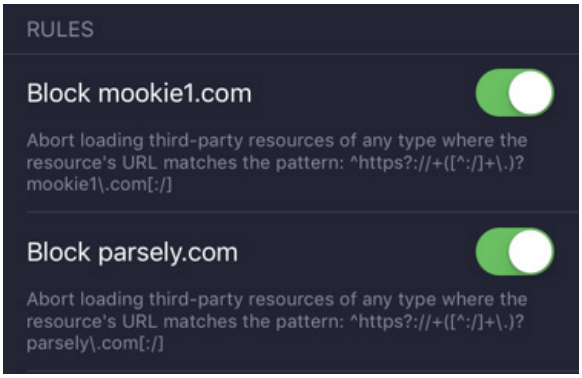


Figure 74*: You can see individual filters and disable them in 1Blocker.*

The app also lets you specify blocking parameters for URLs, cookies, and CSS elements (**Figure 75**). I configured one for CSS that prevents the *Washington Post*'s site from popping up a remaining articles warning (**Figure 76**).

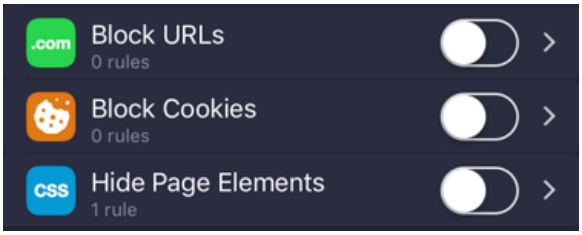


Figure 75*: You can dive deeper and create your own filters within the app.*

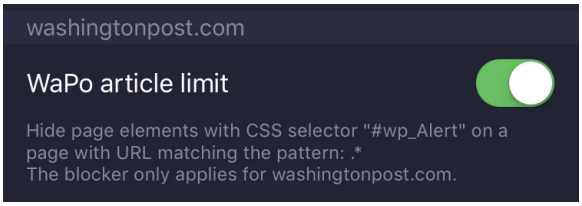


Figure 76*: As an example, I block a subscription pop-up on the* Washington Post*'s site.*

And 1Blocker even offers an advanced configuration option from its web site, letting you create filter items that draw from every possible option Apple offers, which you can then transfer to your installed copy of the app in iOS.

SECURITY

Security encompasses many forms: How do you deal with a device being stolen? How do you protect its contents when it's out of your control? How do you prevent people from snooping on your network sessions? In this half of the book, you'll get answers that will make you feel better when using a device in all situations.

Connect to a Secure Wi-Fi Network

Most home networks are now secured, and nearly all businesses networks employ some way of keeping outsiders out. Connecting to these secured networks is often as easy as entering a password, but not always. This chapter helps you handle any difficult security situations that you might encounter.

Also, if you're setting up Wi-Fi security for a network, this chapter discusses what sort of security to set up and how users with iOS devices will connect to it.

Wi-Fi security divides into three main types: methods used for small networks, methods for large ones, and outdated methods that still exist but that you should avoid.

Note: Cellular networks have their own security methods, which are partly based on the Subscriber Identity Module (SIM) for GSM networks and on a unique set of identifiers for CDMA networks.

WARNING! *Public hotspots, whether free or fee, typically have no security; if they do, it's a shared password that provides no protection from other people on the network. When you connect, I recommend using only secured services or a virtual private network (VPN) connection. Read* ***Transfer Data Securely*** *for details.*

Connect to a Small Network

Nearly all home and small-office networks that have wireless security enabled require the entry of a short password or passphrase. Enter the password when prompted, tap Join, and, if entered correctly, you're done.

The password is stored for the next time you're near the same network, and it's automatically supplied by iOS. If you don't want to join the network automatically the next time you're nearby, or don't want to store the password on your device, launch Settings, tap Wi-Fi, tap the info ⓘ button next to the network, and tap Forget This Network. (This only works while you're connected to the network, however.)

If you have **iCloud Keychain** enabled, entering a Wi-Fi network password into any synchronized device means that you won't have to enter it again. Thus, you might connect to a network via iOS that you've already connected to in OS X and not be prompted, and vice versa. (iCloud Keychain requires iOS 7.0.3 or later or Mac OS X 10.9 Mavericks or later.)

What's Behind Simple Wireless Security

The latest and best security method for connecting to a Wi-Fi network in a home or office is Wi-Fi Protected Access 2 (WPA2). Nearly all computer hardware with Wi-Fi sold starting in 2003 supports WPA2, including the iPad, iPhone, and iPod touch.

> ***Et 2?*** *The original WPA (no number) was a backward-compatible, temporary solution that you may still see in use with older networks or when networks weren't upgraded. All Apple hardware sold since 2003 can use WPA2, and the same is true for that made by almost every other company.*

WPA2 comes in two forms: personal and enterprise. (I talk about enterprise just after this section.) The personal part refers to protecting the network with a password—sometimes called a passphrase since it can comprise multiple words. It can be up to 63 characters long and include punctuation, letters, and numbers. The passphrase is run through mathematical churns to produce something stronger.

A base station's administrator sets the passphrase and then provides it to anyone who needs to connect to the network. If you've set up the network yourself, you're the person who picks the passphrase.

Security on a Base Station

If you're setting up a base station, pick a good passphrase. The best WPA2 passphrases are at least 12 characters long; 20 is better. Choosing something memorable (like a song lyric) is fine so long as you insert a random character like `#` or `!` as well.

By the way, using a short password and obscuring it through substitution—plugging in an `@` for `a` or a `0` for an `o`—isn't effective. Crackers who try to break passwords try all common swaps as well as the real letters.

You should consider enabling only WPA2, even if there's a choice for mixed old-style WPA and new WPA2 encryption, unless some hardware that needs to use the network is too old for WPA2, such as a pre-2003 Apple iBook.

Connect to a Corporate or Academic Network

There are stronger ways to secure a network, and if you use an iOS device in corporate or academic settings, you will likely encounter WPA2 Enterprise. This flavor puts up a wall that lets you interact only in a limited fashion with the network to provide login details before your device is granted full access to the network and, typically, the Internet beyond.

> **Note:** WPA2 Enterprise is an instance of "802.1X port-based authentication," which can be used with Ethernet and older Wi-Fi standards, too. It's a mouthful! But it's a mainstay of corporate network security.

WPA2 Enterprise networks are most frequently secured by a username and a password. However, a digital certificate (described below) can also be used for login. iOS supports these and other types of WPA2 Enterprise. Let's look at each option in more detail.

Username and password login

In the simplest setup, you must enter a username and a password provided by the network administrator or IT department to connect your device to a WPA2 Enterprise network. Often, these are the same credentials you use for file service, email, and other network resource access, such as your email mailbox name (the part to the left of the @) or full address (`user@domain.com`) for that network.

To connect to a WPA2 Enterprise network of this sort, select the network, enter your username and password, and tap Join. It's that easy. If you get an error, check your entries. If they are correct, then contact network support: you won't be able to troubleshoot this any further, because there are no settings to tweak in iOS.

> ***WARNING!*** *Some networks may have policies that limit these sorts of logins to specific days and times, among other parameters. That's rare outside of high-security corporate networks, though.*

Certificate-based login

Some networks rely on digital certificates to handle logins. A digital certificate combines an encryption key with information that helps to validate the identity and integrity of that key. That is, the certificate lets a system make sure that the key hasn't been tampered with, and that it was created by the party that the certificate says created it. Digital certificates are used to provide a verified identity for server software, like a mail server, or for an individual.

In the case of WPA2 Enterprise, a certificate is used as an alternative to a username and login because the certificate can't be written down on a sticky note or extracted in some fashion.

Typically, an IT worker creates and provides you with a certificate and installs it for you. However, an iOS device can receive a certificate via email, and install it when you tap it as an attachment.

Outdated Methods

Wired Equivalent Privacy (WEP) was the first Wi-Fi security method, born in the same standard that unleashed Wi-Fi on the world (as 802.11b in 1999). But the standard had severe security compromises that were exploited by white hats (researchers who try to find flaws to fix them) and black hats (thieves, villains, and exploiters) alike.

As a result, since 2003, WEP hasn't been a reliable way to secure a network. It's useful as a flag that the network isn't meant for access by outsiders—breaking a WEP key to gain network access has been used as the basis of successful criminal prosecution in some places.

Apple has slowly phased out the ability to use WEP from iOS, in OS X, and in its base stations. It's unlikely you'd only be able to connect to a base station via WEP, although iOS devices can technically work with WEP.

Some base stations can be configured to accept a mixture of WEP and WPA (original flavor), but it's mostly disappeared.

Plain WPA (not WPA2) replaced WEP, allowing hardware made as long ago as 1999 to upgrade one step, and some base stations are configured to handle older WPA and newer WPA2 at the same time.

Viewing an Apple Base Station's Stored Passwords

If you've configured an Apple base station and can't recall or find the wireless password you set up, Apple's AirPort Utility software can reveal these in plain text so long as you have the administrative password that allows configuring the base station.

In iOS

1. Launch AirPort Utility. (It's a free app, if you don't already have it installed.)
2. Tap the base station in the graphical view.
3. If this is the first time you've used the app, or you opted on a previous use to not save the password and it's been a few minutes since the last

time you entered it, the Enter Password link appears. Tap it, enter the password, and then tap OK.

4. Tap the Edit button and then go to Advanced > Show Passwords. The Show Passwords view displays the network password at top and then the base station password (which you had to know to get this far).

> **Note:** If you tap the network password, the WPA Pre-Shared Key is revealed. Wait...the what?. It's the full underlying hexadecimal encryption key that your passphrase is converted into. I've never, ever had to enter this 64-character string into anything, but there's always a first time.

In Mac OS X

1. Launch AirPort Utility (found in Applications/Utilities).
2. Select your base station and click Edit.

   An edit dialog appears in the main window.
3. From the Base Station menu, choose Show Passwords.
4. From the dialog that appears, write down or copy the text for the WPA Password (**Figure 77**).

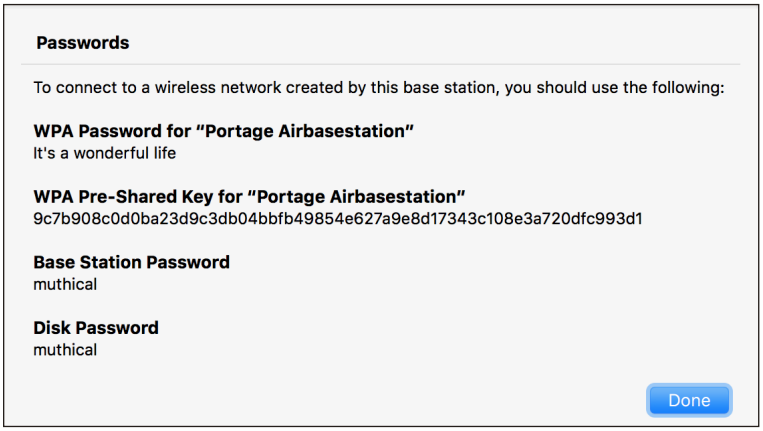


Figure 77: *The Equivalent Network Passwords dialog gives you the hex key value of a text network key.*

Now that you have the password, you can enter it on your iOS device in order to join the Wi-Fi network. Email or text the password to your iOS devices so you can copy it and then paste it instead of retyping it.

Use Two-Factor Authentication

Apple's two-factor authentication for Apple ID lets you secure access to your accounts with a password plus something extra that you have under your control. In this chapter, you learn how to set up two-factor authentication, how to secure your extra pieces against discovery or loss, and how to reset an account.

Dancing a Two-Step

Apple lets you tie in an Apple ID for several purposes in iOS: for iCloud synchronization, iCloud Drive, iTunes purchases, iMessage, and more. However, without making an extra effort, an Apple ID is protected only by the password you set, and can be reset and potentially hijacked in a number of ways should someone gain access to your email or know your security questions for resetting a password.

The way around this is to use what Apple calls two-factor authentication (2FA). A factor is a bit of proof that you are who you say you are. Requiring two factors of different sorts makes it more likely that you are the legitimate owner of an account or have authorized access for a service.

A two-factor system generally employs something you know, such as a memorized password, coupled with something you have or possess physically—such as a phone, a smartcard, or other hardware—or something *you are*, like a fingerprint or personal characteristic. Usually there's an emergency backup, too: a one-time-use code or set of codes that can be used in a pinch, or a process to prove your identity.

In Apple's implementation, when you enable two-factor authentication, you keep your existing password on your Apple ID, and add at least one phone number that can receive SMS (text) messages or voice calls, and one or more trusted iOS devices or Macs.

> ***WARNING!*** *Once you turn on 2FA, if you can't recall your password* or *lose access to your phone number and all your trusted devices, you have to go through a recovery process with Apple to regain access to your account, which can take up to a week. If you can't prove to Apple you're the legitimate owner, you have to create a new Apple ID, which makes you lose access to any associated purchases, unsynced items, backups, and the like.*

Factor in Apple's Security Changes

Apple had a previous two-factor approach that it called "two-step verification," which was stapled on top of existing software and systems. Some Apple-controlled sites would let you log in using an Apple ID that should be protected with a second factor using just the password. OS X didn't support it directly, which led to awkward interactions and round-trips through web sites to complete some tasks.

Starting in iOS 9 and El Capitan, Apple engineered support deeply into both operating systems, while removing two elements that were problematic in practice, simplifying both logging in and account recovery.

If you've used a two-step protected Apple ID before, here's what's changed:

- A backup phone number can receive a code either by SMS or by voice, using an automated system that speaks the numbers to you.
- Before seeing a code on a trusted device, you're shown an approximate map and location from which the request has been made, and you have to click Allow to proceed.
- You no longer pick a phone number or trusted device at which to receive a code: all trusted devices get the code.
- A Mac can be a trusted device, not just iOS equipment.
- The Recovery Key, a linchpin of keeping account access, is gone, replaced by a human-interaction recovery process.

Turn On Two-Factor Authentication

You enable two-factor setup on your account through iOS or OS X by logging in using an account that's been approved for 2FA; by tapping an opt-in button through Settings > iCloud in iOS; or by clicking an opt-in button in OS X's iCloud preference pane in Account Details > Security.

Enable Two-Factor

1. Go to Settings > iCloud > *account name* > Password & Security. You may be prompted to enter your password when you tap *account name*.
2. Tap Two-Factor Authentication and then tap Enable.
3. The Two-Factor Authentication screen provides a brief explanation and then offers a Continue button to tap (**Figure 78**).

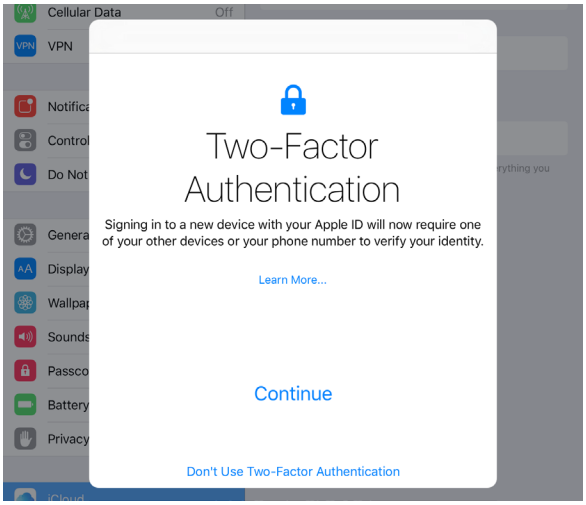


Figure 78: *The first screen lets you opt in or, in fine print at the bottom, opt out.*

4. You start by entering a phone number at which you can receive a text message or voice call; you can choose which (**Figure 79**).

   Select your country, enter your number, pick Text Message or Voice Call (to get an automated call speaking the code number), and tap Next. A code arrives. (If no code shows up, tap Didn't Get a Verification Code?, which lets you re-send it.)

Tip: You can add additional trusted phone numbers later.

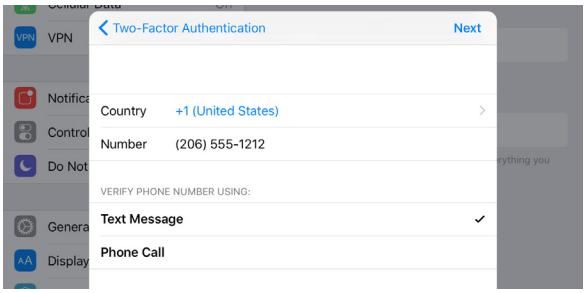


Figure 79: *The process starts with entering a phone number.*

5. Enter the verification code. When you enter the last digit correctly, setup is complete.

   The Password & Security settings now show two-factor authentication set to On, and list your Trusted Phone Number (**Figure 80**). As you add phone numbers and devices, they appear here, as well as at the Apple ID web site. You can also remove trusted devices and phone numbers.

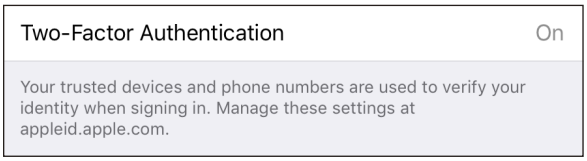


Figure 80: *iCloud settings show that two-factor authentication has been enabled.*

Disable Two-Factor

You can easily turn off two-factor authentication if you find it doesn't work for you, or you need to work with other iOS devices and Macs that don't support it.

From the **Apple ID site**, log in and then click Turn Off Two-Factor Authentication. Choose new security questions, and then click Continue. You'll be asked to confirm one last time, and then you're back to normal password-only account protection.

Log In with Two-Factor Authentication

When you log in to iCloud in iOS or OS X, log in via a web browser, or attempt to purchase an item via iTunes, iBooks, or the App Store from a device that hasn't previously been used, you'll be prompted to validate your password-based login with a code sent to a trusted device.

When logging in via Settings > iCloud or the iCloud system preference pane, you're also simultaneously turning that iOS device or OS X computer into a trusted device. For a web browser and iCloud.com, you can opt to trust the browser from then on (**Figure 81**).

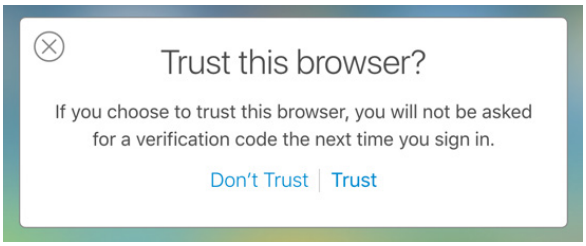


Figure 81: *Browsers can be trusted just like iOS devices and Macs.*

Note: Because OS X has separate user accounts, trusted device status is set for each user account individually. Each OS X user can be logged in to a different iCloud account.

Two-factor authentication presents itself in different ways in different places. In practice, you typically enter an account name (if not already filled in) and password, and then receive the code at all your trusted devices, which you then enter where prompted.

Let's say you're adding a Mac as a trusted device.

1. Open the iCloud system preference pane, and click Log In.
2. Enter your user name and password.
3. At all your other devices, you're prompted with an Apple ID Sign In alert, which shows the account name, the nearest city, and a zoomed-out map, along with Don't Allow and Allow buttons (**Figure 82**). Click Allow to proceed.

WARNING! *If you click Don't Allow, the remote login can't proceed, as no verification code is generated. However, from what I've tested, there's also no alert generated anywhere about an attempt to log in that you apparently didn't authorize!*

Figure 82: *To avoid unwanted logins, you're shown a geographic alert.*

4. On the device from which you clicked Allow, a Verification Code alert appears. Enter the verification code on the requesting device. If entered correctly, access is approved—in this case, the Mac is now trusted.
5. Tap OK or click Done on the trusted device on which you clicked Allow.

If you don't have access to a trusted device at the time at which you want to log in, you can use a trusted phone. Follow these steps instead:

1. Open the iCloud system preference pane, and click Log In.
2. Enter your user name and password.
3. On the requesting device or browser, click Don't Have Access to Trusted Devices.
4. From the Verify Your Identity dialog, select a phone number if you have more than one, then choose Text Message or Phone Call, before clicking Continue (**Figure 83**).
5. Enter the number you receive via text or by automated voice call into the requesting device or software, and you're done.

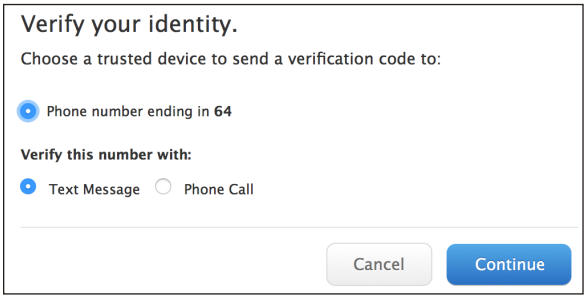


Figure 83: *You can opt to use a phone number instead of a trusted device.*

Add a Trusted Phone Number

Trusted phone numbers can be added via iOS, OS X, or the Apple ID site.

- OS X: Open the iCloud system preference pane, click Account Details, click the Security tab, and click the + (**Figure 84**).

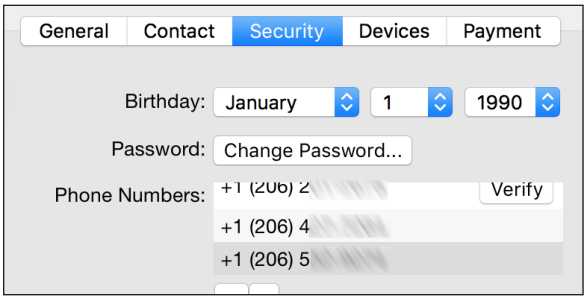


Figure 84: *Trusted phone numbers can be managed in several places, including OS X.*

- iOS: Go to Settings > iCloud > *account name* > Passwords & Security, enter a phone number, and click Continue. Tap Add Trusted Phone Number.
- Apple ID site: In the Security section, click Edit at the far right, then click Add Trusted Phone Number.

  In each location, you enter a phone number, choose whether to send a text message or receive a voice call, and then enter the verification code.

  If you don't get the verification code immediately, you can go to any of the above configuration locations and click Verify to try again.

WARNING! *SMS Forwarding is a feature that first appeared in iOS 8.1 and Yosemite as part of Continuity. Because it forwards text messages, it can allow security codes to be received on your Mac. If you have any concerns about someone having access to your Mac when you're not around, disable SMS Forwarding.*

WARNING! *An SMS code can be seen on the lock screen of an iOS device unless you've disabled notifications on the lock screen.*

Manage Your Notification Email

In addition to the email associated with an Apple ID, you can have a notification email that's used for critical messages, and that will aid you if you need to unlock or recover a two-factor account.

You have to use the **Apple ID site** to change this address or remove it. After logging in to your account:

1. In the Account section, click the Edit button at far right.
2. Under Notification Email, click Change Email Address.
3. Enter an email address and click Continue.
4. Apple will send you an email with the six-digit verification code. Check your email, and then enter that code and click Verify.

   You can later remove this address by returning to the same location, clicking Edit, and clicking the X next to the address.

Logins at Other Sites

Because calendaring (over CalDAV), contacts, and email can be used with non-Apple software, you can generate up to 25 app-specific passwords for use with this software via the **Apple ID site**.

WARNING! *App-specific passwords bypass two-factor protections and, if recovered, could be used to access contacts, calendars, and email.*

1. Click Manage Your Apple ID.
2. Enter your Apple ID and password, and click Sign In.
3. Enter the verification code that appears on other devices and click Continue.
4. In the Security section, click Edit at far right.
5. Under App-Specific Passwords, click Generate Password.
6. For each password you need to create (**Figure 85**),
   a. Enter a label that helps you remember for what purpose you created the password and click Create.
   b. Copy the password that appears and paste it into the software with which you need to use it.
   c. Click Done.

Figure 85: *App-specific passwords work with non-Apple software for a few specific services, like email and contacts.*

If you ever want to revoke an app-specific password, return to the Security section, and click Edit, then click View History. If you've lost track of which passwords are used for which services (even with your labels), the date and time created appear next to each. You can click an X next to each one to revoke it, or you can click Revoke All to start over.

Tip: These app-specific passwords can't be recovered. If you can't recall one, just generate a new one and revoke the old one.

Remove a Trusted Device or Phone Number

When your device is sold, given away, lost, or stolen, you need to uncouple it from your account. The same is true when you stop using a given phone number or lose access to it.

Remove a Trusted Device

You can remove a trusted device via iOS, OS X, or the Apple ID site. Here are the instructions for iOS:

1. Tap Settings > iCloud > *account name* > Devices (**Figure 86**).
2. Tap a device.
3. Tap Remove From Account.
4. At the prompt, tap Remove to complete.

You can add a device back by logging in to iCloud on that device. It will then rejoin the set of trusted devices.

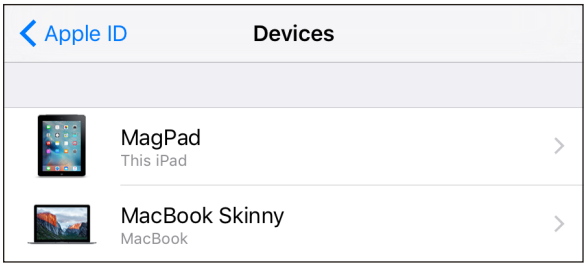


Figure 86: *All trusted devices are listed wherever you can log in to examine the details of your Apple ID account.*

Remove a Trusted Phone Number

Trusted phone numbers can be removed from iOS, OS X, or the Apple ID site. In Mac OS X:

1. Open the iCloud system preference pane.
2. Click Account Details.

3. Click the Security tab. (Enter your password if requested, and you may have to repeat steps 2 and 3.)
4. From the phone number list, select one and click the – button.

Recovering Account Factors and Access

So you need two factors to log in: a password and a verification code. But what happens if you forget your password, your account is locked, or you lose access to your trusted phone numbers and devices? Apple has responses for each.

Lost or Forgot Your Password

Visit **the iForgot site** and follow these steps:

1. Enter your Apple ID and click Next.
2. Confirm your trusted phone number by entering the entire set of digits; Apple displays just the last two (**Figure 87**).

Figure 87: *You have to confirm a phone number by entering it to reset your password.*

> ***Can't remember the number?*** *Click Don't Know the Phone Number and proceed to* ***Lost Everything! Recovery****, below.*

3. Click Continue.
4. A notification is sent to your trusted devices. Follow that link.

5. If you don't have access to trusted devices, click Don't Have Access to *Device Name*, and then click Reset with Verification Code (**Figure 88**).

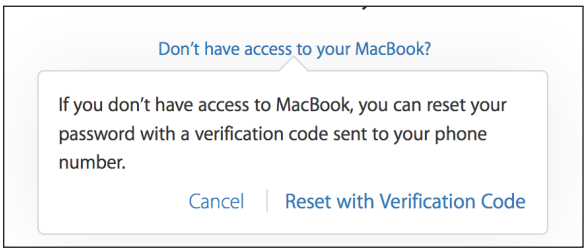


Figure 88: *If you don't have access to one or more trusted devices, you have to reset by receiving and entering a verification code.*

6. A code will be sent to your trusted devices, which isn't much use, but you can then tap Don't Have Access to Trusted Devices? and have the code sent to one of your phone numbers. Enter that code.

   If you don't have access to your trusted phone numbers, read on.

Lost One, but Not All, of Your Trusted Devices

You can manage your trusted devices as noted earlier via iOS, OS X, and the Apple ID site. If you lose a device, remove it from the account.

> ***WARNING!*** *I'd heavily suggest adding new devices before removing old ones to avoid being locked out of your account if something goes wrong before you've tested the new setup.*

Lost a Phone Number

A phone number, not an actual phone, typically travels with an account; the phone contains a SIM (most global networks) or a similar module that is associated in your carrier account with your number.

If you lose your phone, you can get the number associated with a new one. Call your carrier and it will work through the details with you.

If you somehow manage to lose your phone number—such as giving up an old number and getting a new phone—there may be no way to recover it. It's vitally important to migrate all your records with Apple and any

other company after changing your phone number, preferably before losing access to the previous number.

In iOS, in OS X, and at the Apple ID web site, you can add other trusted phone numbers and then delete one or more that's out of date.

Lost Everything! Recovery

Failing everything—the loss of access to all numbers and the loss of all your trusted devices—at step 6 above, keep going:

7. Click Don't Have Access to Any of These Numbers? and you can choose Try Again Later or Continue without Code (**Figure 89**).

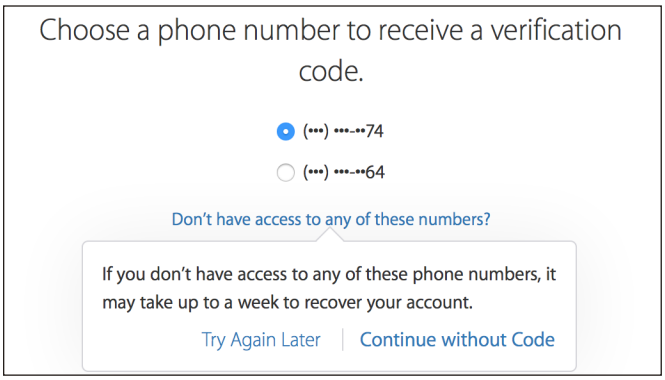


Figure 89: *If no trusted number is available, you can move towards account recovery.*

8. If you need to pick the latter option, click it and you finally see a Request Account Recovery? dialog (**Figure 90**).

> ***WARNING!*** *It might take a week to recover access to your account. This is intentional, to make it hard for those who might have some of your personal details to access your account.*

9. Click Continue, and you start a new process, which may begin with you confirming credit-card billing information and other details. Apple hasn't disclosed all of what happens next, presumably for security.

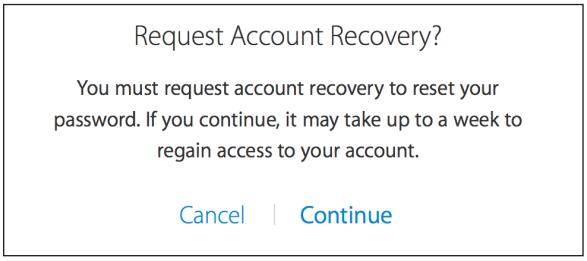


Figure 90: *Your last-ditch effort, after all other avenues are exhausted, is to request account recovery.*

Account Locked

In some cases, Apple will apparently lock your account when, based on factors that it doesn't disclose, it appears that your account is not under your control. In the past, this could happen when an outside party made a concerted effort to break into your account, however futile.

When your account is locked, you have to go through the same procedure as for a regular recovery, and it can take days. However, as long as you have most or all of your factors in hand, and all of your account-registration information (like your credit card number and the like), you should have an easier time of getting the account re-enabled.

Transfer Data Securely

The data that travels to and from your iOS device isn't secure even when you're connected to a Wi-Fi network with a strong password. Any data you send that's not encrypted could be sniffed by anyone else on that network.

The same is true for any point between you and your data's destination or wherever you're running an active session, whether you're using a protected Wi-Fi network, an open one, or a cellular data connection: any party in between, for unencrypted services, can see exactly what you're doing.

But you can avoid this problem with secure services or a comprehensive solution called a virtual private network. I explain both in this chapter.

Why Encrypt?

When the previous edition of this book came out a few years ago, it was still necessary to explain the value of security and encryption. After dozens of corporate breaches, network attacks, and the disclosures of government snooping around the world (in democracies and dictatorships alike), the value is clear.

Encrypting our data in transit enables us to make decisions about how our data is being used and who sees it, preventing criminals, relatives, and government agencies from overstepping our rights.

Protect Particular Services

Nearly every kind of service you can think of offers an encrypted option, and, fortunately, most modern services employ some kind of encryption by default. Here's a laundry list of what you should consider:

- Always use TLS email connections (Transport Layer Security). There's no good reason not to employ TLS. If your mail host doesn't provide secured email for your incoming email (POP or IMAP; almost always IMAP in iOS) and for your outgoing email (SMTP), find a new host. Without security, email programs may send passwords in the clear or with weak encryption, and likely send all data in the clear. iOS will always attempt to configure your mail settings securely.

  Note: TLS is a successor to SSL (Secure Sockets Layer), and both older and newer protocols were used side by side, so you'd see SSL/TLS or TLS/SSL as a label for these kinds of session protections. However, SSL is now considered definitively broken from an encryption standpoint, so it's important to look for TLS only. (And to be pedantic, only TLS versions 1.2 and later are considered secure as of September 2015.)

- Secure access to web sites. You can usually make a secure connection to a web site.
  - Most web sites, including social networks like Facebook and Twitter, have switched from using plain-text http connections to secured TLS (https) connections. You log in securely (which is true on almost all sites), but then remain securely connected at all times.
  - If you're not sure, look in the security settings for a web site where it notes something like "Always use https" or "Always use secure connection" and check that box. (A login is almost always secure, so your account name and password is rarely at risk.)
  - For other web sites, try to always use the secured flavor by typing in or bookmarking `https` instead of `http` as the start of the URL. Many sites offer TLS sessions as an option reachable just by entering the URL in this fashion.
- Transfer files securely. When making an FTP connection, use only a secured alternative to plain FTP, such as the SSH-based SFTP or one of several TLS-protected methods. FTP programs otherwise send passwords and data in the clear. **Transmit for iOS** is the app of choice for secure file transfer ($7.99).

  Tip: On a Mac, enable Remote Login and File Sharing in the Sharing preference pane to allow SFTP over a local network or via the remote Back to My Mac service.

What's protected without any extra effort?

- iMessage and FaceTime. Apple builds in end-to-end encryption in such a way that even the company can't decipher your messages. In fact, it's so secure, governments around the world—including both the U.S. and China—aren't happy about it.
- Other instant-messaging and audio/video chat services have various levels of protection. The Electronic Frontier Foundation has a **continuously updated report card** you can consult.
- Most file-transfer, sync, and backup services with iOS apps (like Dropbox and CrashPlan) use TLS—or an even stronger industry-vetted method—to handle your login and to transfer data back and forth. Check web sites for details.

  Starting in iOS 9, Apple required all apps to use TLS for encrypted transit for all communications by default, although developers can (for now) include exemptions to access services that aren't yet available in encrypted form or that use older security protocols. Apple will likely clamp down on that over time.

Umbrella Protection with a VPN

A virtual private network connection is a nifty way to prevent any sniffing of your local network hookup. A VPN encrypts all the data coming and going from a device, such as an iPad or iPhone, creating an encrypted tunnel that extends between the device and a VPN server somewhere else on the Internet, traversing with protection any local network and hubs as well as every node on the Internet between the two points.

For corporations, VPNs can extend the aegis of corporate security to remote devices. For individuals, that's less the case. With a company, the VPN server is within the corporate network and any data leaving that server is protected by company firewalls and intrusion prevention.

But if you're using a VPN just to protect your local link (the connection between your device and the hotspot), data remains encrypted only until it hits the VPN server, usually located in a data center. From that data center to its destination, data is unprotected (unless wrapped in an en-

crypted method, like SSL/TLS on the web, describe earlier), but that's typically just fine. The main locus of risk is the local link.

And because major Internet sites—like Google, Apple, and the rest—have distributed sets of computers and even private links to big data centers, the hop from the VPN server to the destination network may be within the same building or close by.

Before you can set up a device, however, you need to find a VPN service.

Find a VPN Service and Install an App

Several firms offer "VPN for hire," letting you pay for a fixed period of time or a recurring subscription. The connection you make, as noted above, runs from your iOS device through the local Wi-Fi or cellular network, then goes through any intervening local area network routers and higher-level backbone routers, and finally winds up at one of the company's VPN servers located in a data center.

There are many such services to choose among, some of which offer apps and some of which require manual or partly manual configuration. I've had experience with two that I can recommend because:

- I've had personal experience with them, and tested them. (You can read **a Macworld column of mine** about how we trust companies.)
- They offer an app, which is the simplest way to configure and connect in iOS. (They both offer Mac OS X apps, too.)
- They let you subscribe using a single subscription that works across all your iOS devices or across iOS and Mac OS X hardware you own.
- Their software is elegant and works well.
- They offer a "transporter" option that lets you terminate in another country, which allows viewing media or accessing resources that otherwise require being physically present in that country.

> **Note:** I used to recommend VPN-for-hire services that typically required manual configuration. Now, I'd prefer to recommend app-based services, as they require less fuss without any greater cost.

The two services are **Cloak** and **TunnelBear**. Both support older and current releases of iOS and OS X/macOS, while TunnelBear offers apps for Windows and Android as well.

The two services try to remove as much complexity as possible, which means eliminating manual configuration in both iOS and OS X. (OS X is simpler, because Apple doesn't restrict access to the network innards required to set things up.)

Set up a VPN app

To get set up in iOS, you download a service's free app. Neither service has a trial in iOS directly, so visit their web sites to sign up for an account that can be used in the app. TunnelBear offers a 500 MB-per-month free usage tier, while Cloak has a 14-day free trial.

After installing the app, you have to accept an iOS VPN settings bundle that encapsulates all the necessary configuration details. This is nice because you don't need to deal with the fiddly bits described in the manual setup section below. And if the profile needs to be updated because the service's details change, they can push a fresh one through their update, rather than asking you to reconfigure by hand.

In earlier versions of iOS, you had a multi-step process with lots of redundancy. The process was securely streamlined in later versions:

1. Launch the app, which will detect that no profile is available and request to install it (**Figure 91**).
2. Tap Allow.
3. Enter your passcode or use Touch ID when prompted.

   The profile is installed and you're returned to the app.

After installing a profile, you can use the Settings > VPN view to start or end a connection. A VPN label will appear in the status whenever the connection is active. You can find more information about these options in **Make a VPN Connection**.

TunnelBear also has an option to disable the connection in the app, which features bears.

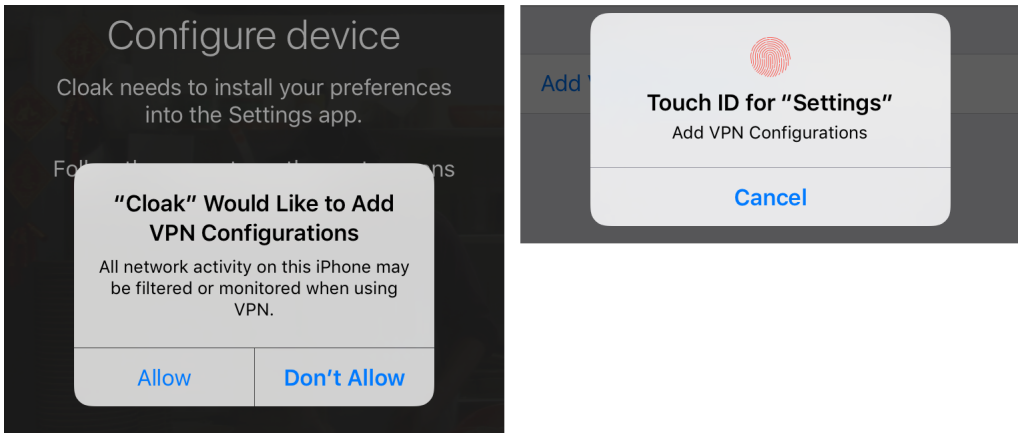


Figure 91: *Launch the app, and you're prompted to add a VPN configuration (left); on devices with Touch ID, you touch to approve.*

Both services can initiate a VPN connection "on demand," too, when you reach out to the Internet (and both can disable it during idle times). Opt in via either app's configuration options.

Cloak also lets you set its VPN service to connect automatically when you join Wi-Fi networks, as well as pick trusted Wi-Fi networks to bypass.

Country-hopping with a VPN

There's one more trick up the sleeve of VPNs: they can let you seem to be accessing a service from a country other than the one that you currently occupy. This is useful to evade certain per-country licensing limitations on free and subscription online streaming and other services. For instance, BBC iPlayer works only in the United Kingdom.

Simply select a destination country in TunnelBear or Cloak, and when you connect, your VPN connects to a server at a data center in one of those lands (**Figure 92**). This can substantially slow down your throughput, because traffic has a longer topographical path from you to another country to the service in question and back. It can also bypass content-distribution networks (CDNs), which push media to you with the fewest possible Internet hops.

The ethics of such workarounds can be problematic. BBC, for instance, gets its funding primarily from a TV license paid by every household in the United Kingdom in which at least one person watches TV (any broad-

cast network, as well as satellite) or streams BBC programs via its iPlayer app. Residents are required by law to pay this license fee. Using a VPN to "watch" remotely is taking a service that you're not paying for. Many BBC programs are carried by foreign services, such as BBC America, that pay licensing or other fees, and many of its programs can also be purchased on DVD or as digital downloads.

Figure 92: *The bear says, "What ho, guv'ner."*

Netflix and other services that you can pay for, but that are limited to certain countries, are another matter. They rely on licensing agreements that restrict access to specific countries, but your Netflix subscription still goes to pay the license holders.

Eventually, all national licensing barriers will have to fall because of such absurdities, but consult your internal ethical compass.

Pricing options for VPN apps

Every VPN service is paying not just for servers and the overhead of staff and the like, but for the bandwidth you consume as well: every gigabyte you send through a VPN is one gigabyte inbound (which is often cheap or free) and one gigabyte outbound (about 5 to 10 cents per GB). Some users will consume 50 GB a month, others a trickle.

As a result, plans may seem expensive, but they're typically priced very reasonably relative to both the value and the hard costs the company has to pay to keep its software and security up to date.

The deciding factor between these two services might be your particular number of devices, data usage, and interest in—or fear of—bears.

Cloak

Cloak sells time-limited passes as iOS in-app purchases, and passes and recurring subscriptions from its web site. Every account may be used with an unlimited number of devices by a single person across iOS and Mac OS X.

The fees range from $3.99 for a week to $99.99 per year for passes that don't automatically renew, all with unlimited data. A monthly subscription costs $2.99 with 5 GB of data included; unlimited monthly and yearly plans are $9.99 and $99.99, respectively.

TunnelBear

TunnelBear has a slightly different approach. In iOS, you can purchase recurring subscriptions and one-time passes, both with unlimited data. These start at $3.99 for a pass on a single device for one month or the same price for a subscription for all iOS devices attached to your account. Other plans range up to $49.99 depending on duration and devices included.

Via the web site, you can sign up for a free plan that includes 500 MB per month, or for unlimited data across up to five devices (computers or mobile) for $7.99 per month (recurring) or $49.99 per year (recurring).

Configure a VPN Manually

There are several kinds of VPN protocols, and iOS supports the most popular: IKEv2, L2TP/IPsec (listed as L2TP), PPTP, and Cisco IPsec (listed as IPsec). The first three are generic, widely used standards. The last is a Cisco VPN flavor proprietary to its systems. (Apple, like many companies, spells IPsec with a capital S, even though that's the wrong capitalization.)

Note: Two VPN types that use SSL/TLS, one by Cisco and one by Juniper, are also available (see **Apple support note**). Both require the use of special Apple enterprise deployment software.

Almost any server operating system that offers VPN software at all can support one of these protocols, including Mac OS X Server and Microsoft Windows Server.

Set up a VPN profile

Start by making sure you have all the server settings provided by your VPN host or network administrator at hand, since you'll need to enter several pieces of data.

To set up a VPN profile, follow these steps:

1. Launch the Settings app, and tap General > VPN. (If you've configured a VPN before, it may show up in the top level of Settings.)
2. Tap Add VPN Configuration. The Add Configuration view appears (**Figure 93**).
3. In the Add Configuration view, tap Type if the default IKEv2 isn't what you want. L2TP, PPTP, and IPsec are also available. The choice here affects which options appear for configuration.
4. Then, fill in the settings:
   - The description appears in the VPN view after you create the configuration; enter something short and expository.
   - Server (all), and Account and Password (all but IKEv2) tell iOS which Internet host to connect to using which credentials.
   - Remote ID is exclusive to IKEv2 and required; Local ID is also part of IKEv2, but not required.
   - RSA SecurID (L2TP and PPTP) should always be off unless your employer provided you with a physical key fob.
   - Secret (L2TP and IPsec) is a shared bit of text that's used as an extra level of security.
   - Use Certificate (IPsec only) is enabled when you have a stored certificate to validate your identity.

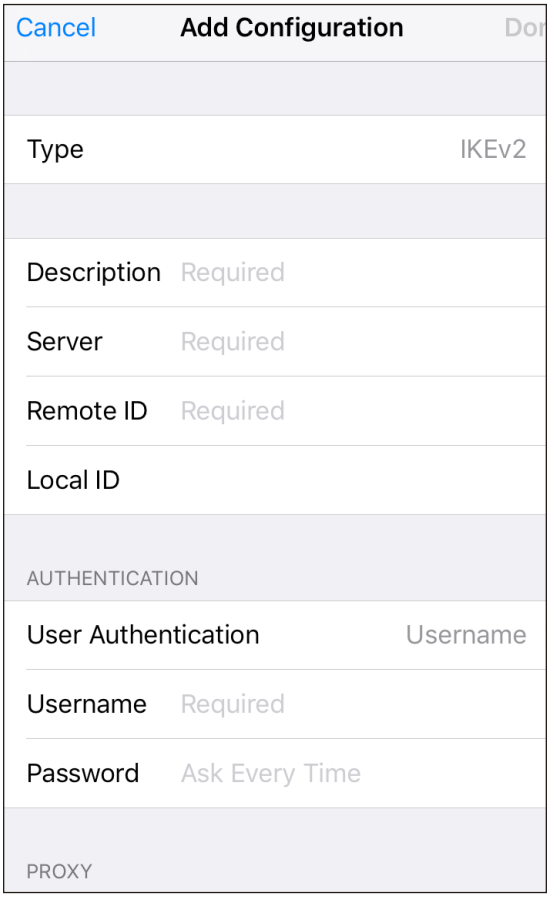


Figure 93: *Enter the details provided by a for-hire service or a network administrator.*

- User Authentication (IKEv2 only) can be set to Username, in which case Username and Password appear; or to Certificate, and then a certificate needs to be selected.
- Group Name (IPsec only) is set if a network admin provides a group.
- Encryption Level (PPTP only) is typically left set to Auto.
- Send All Traffic (L2TP and PPTP) is typically left on. If it is off, you can filter which traffic is not encrypted and which is.
- A Proxy option can be ignored unless you've been told otherwise.

5. Tap Save.

You now have a configuration profile that you can use.

Make a VPN Connection

In the Settings app, in the VPN (top level) or General > VPN view, set VPN to On, and iOS will connect using the profile; if there's more than one VPN profile, the one that's used will have a checkmark next to it. (In some cases, you may see VPN Configurations and Personal VPN as separate lists, each of which will have a separate switch for enabling and disabling.) Corporate-style VPN apps will also let you enable the connection in the app.

You can tell that a VPN connection is active in two ways:

- A VPN indicator appears in the status bar.
- A Status entry appears in the Settings app's main view that reads Connected (**Figure 94**).

Figure 94: *The Settings main screen shows that the VPN is connected.*

WARNING! *VPNs are typically disrupted when you move between networks. If this happens to you, flip the VPN switch to Off and back to On to reset the connection.*

To get more information about the status of your VPN connection, tap the info ⓘ button to the right of the currently active VPN configuration profile in Settings > VPN (**Figure 95**). This provides a variety of technical details (**Figure 96**). The Server IP Address field provides a clue to the facility at which your VPN terminates. You can also switch on or off Connect On Demand in this view.

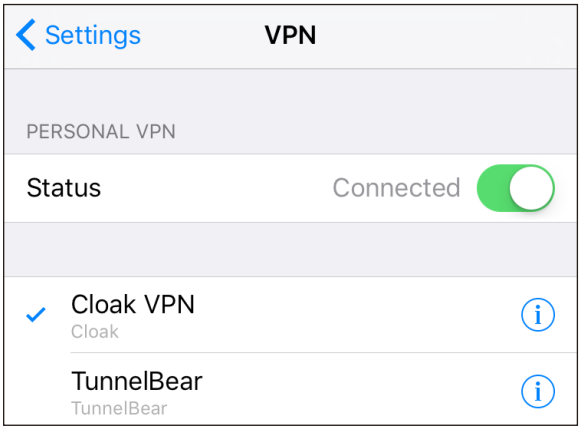


Figure 95: *The selected profile and a switch appear in VPN settings.*

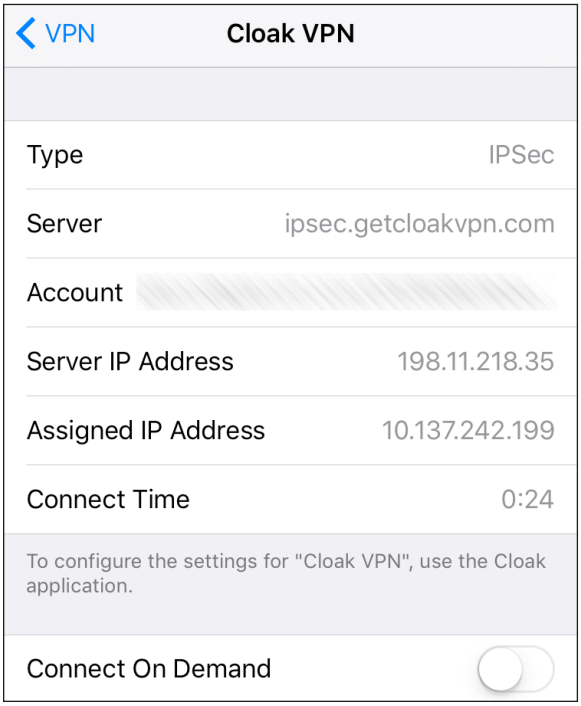


Figure 96: *Connection details reveal where the VPN terminates.*

You can cancel a VPN connection in process (before the connection is completed) by tapping the Cancel VPN Connection button that appears in the VPN view. To disable a VPN connection, set VPN to Off in Settings > VPN; or use the app, when that's an option.

Protect Your Device

Now that you know how to keep your data from being intercepted in transit, how can you prevent your stored data—on an iOS device—from being rifled if your device is out of your control?

Apple has two robust ways to secure a device: with a passcode and, for newer hardware, its Touch ID fingerprint-recognition system.

All devices that support iOS 8 and later include robust hardware encryption. When a device is on and locked, its data is inaccessible until a passcode is entered or Touch ID accepted, which unlocks the encryption keys needed to read stored information.

WARNING: *If you lose the passcode and Touch ID isn't available (such as after a reboot), your data is lost forever.*

Set a Passcode

Your best single protection against anyone unauthorized having access to data is enabling the passcode lock. This allows you to set a four-digit code required to wake and gain access to the device.

To set the passcode lock, follow these steps:

1. In Settings, tap Passcode. On Touch ID-equipped devices, the option reads Touch ID & Passcode.
2. Tap Turn Passcode On.
3. If you want to use the minimum, a four-digit passcode, tap it in and re-enter it when prompted.

You can also opt to tap Passcode Options and pick a six-digit code, a custom-length numeric code, or an alphanumeric password of letters, punctuation, and numbers (**Figure 97**).

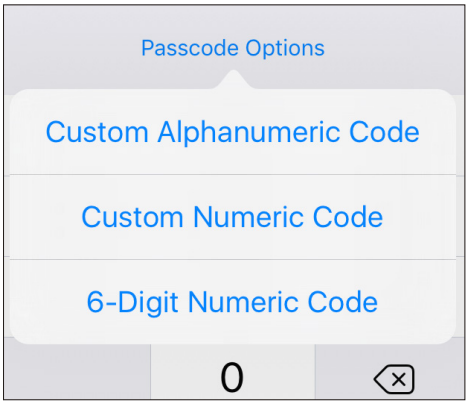


Figure 97: *You can opt for a longer or more complicated passcode.*

> ***WARNING:*** *Many iOS security gurus say not only is four digits too few to resist cracking, but six isn't enough, either. They recommend picking a memorable short phrase that's easy to enter but impossible to guess.*

You can also enable the passcode lock remotely if you have an active iCloud account and Find My iPhone enabled on the device. See **When Your Device Goes Missing**, ahead.

The Passcode Lock screen offers a few additional security options (**Figure 98**). You can set the time after which you must enter a passcode at intervals from Immediately to After 4 Hours:

- Immediately means you're asked for the passcode any time the device wakes up. You can put your handheld to sleep manually, of course, by pressing the Sleep/Wake switch, but you can also set it to sleep automatically, with the Settings > General > Auto-Lock.
- Longer intervals let the device be unlocked without a passcode for up to the time duration you've chosen from the list.

You can also set which services are available when your device is locked in this view, which is a good way to prevent leakage of information, such as appointments, being able to present barcodes for scanning at stores or an airport, or using Messages to reply.

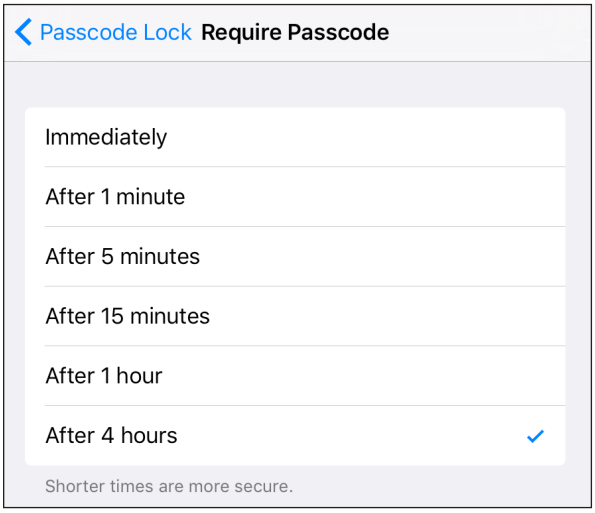


Figure 98: *Choose the duration until you're asked for your passcode again.*

As a nuclear option, you can set your device to self-destruct—destroy its data, at least—if there are more than ten failed attempts to enter the passcode correctly by switching Erase Data to On. What do you lose? Only items created since the last backup and sync; see **Erase Device**.

Use Touch ID

Apple's Touch ID lets you turn to your fingertips to secure your device. Touch ID lets you train several later models of iPhone and iPad to recognize up to five fingerprints. It can be used not only to unlock your phone, but to use Apple Pay (on supported devices) and make iTunes and App Store purchases as well.

> **Tip:** Touch ID in iOS can be used to authenticate third-party software. 1Password and my credit union's app are two I use that allow Touch ID for unlocking.

You select which of the Touch ID associations you want in Settings > Touch ID & Passcode and then tap Add a Fingerprint. iOS guides you through enrolling a fingerprint. When it's finished, it names the entry Finger plus a number. As this isn't descriptive, tap that entry, then name

it with something you remember. In that way, if iOS "forgets" your fingerprint, you can delete the appropriate entry and retrain it.

Touch ID allows fingers from different people, which is convenient, as you and others could all use Touch ID to unlock the same phone or tablet, or you could enroll a partner's fingerprint as an emergency fallback if they need to access your device.

Even with Touch ID enabled for all tasks, you will still be prompted to enter the passcode in a number of circumstances:

- After your iOS device has been powered up or restarted.
- If you haven't unlocked your device in more than 48 hours.
- Once five unsuccessful attempts have been made to unlock your phone or tablet via Touch ID.
- If you've put the device into Lost Mode via Find My iPhone.

There's one more that requires more explanation. It was added quietly in 2015, and it appears designed to make sure you don't forget your passcode! If you've only used Touch ID to unlock your device over a six-day period, an eight-hour timer starts every time you use Touch ID. If you don't unlock with Touch ID within eight hours of the previous attempt, you're prompted for your passcode. You'll most likely see this when you wake up in the morning. This tries to ensure that even constant iOS users have to enter their passcode occasionally.

> **Note:** Matthew Green, a well-known security researcher, **tweeted this cautionary tale** in November 2014: "I woke this morning to find my 7 y/o levering my finger onto the Touch ID sensor of my phone. Maybe time to go back to passwords."

When using Touch ID, it's important to remember that while it increases the relative security of your data while improving the speed and simplicity of use, you also open yourself up to your device being unlocked via coercion. If someone—a government agent, criminal, abusive spouse, or other party—can force your finger onto the sensor, they can gain access to at least some of your information.

When Your Device Goes Missing

Your mobile device is a desirable item for thieves. It's compact, it has a high retained value, and there's a huge market for used models.

Without freaking you out about theft, I want to tell you how you can protect your data when your device has disappeared, make it impossible for a thief to use your device, and find your device if it's stolen or lost.

Find My iPhone (and Other Devices)

Find My iPhone, introduced by Apple in 2009, has a name that belies its utility: it works with every kind of iOS device and, starting with Mac OS X 10.7 Lion, with Macs, too (as Find My Mac in the iCloud preference pane).

You can find the last reported position of any iOS device or Mac by enabling the feature, which requires an iCloud account. You can also play a sound on the device, lock the device or mark it lost, or delete all its data!

Finding a device's current location and taking a remote action can be accomplished via the iCloud web site or the free **Find My iPhone** app.

> ***One name for clarity:*** *For simplicity's sake in the text ahead, I'm calling the service Find My iPhone.*

With Family Sharing turned on, anyone in the family group can see where an iOS device is, unless the owner has disabled letting that person or anyone see his or her current location. With that user's password, all Find My iPhone features are available through other Family Sharing members' accounts.

Note: The four major U.S. phone carriers also offer phone-tracking services, which can work across a family account and different smartphones and dumb phones. Each comes with a separate fee and various enhancements and limitations. If everyone in your family is using an iPhone, there may be no advantage.

How It Works

The feature relies on a device sending Apple's servers a regular update of location information derived from Wi-Fi, cellular, and GPS signals and data. All iOS devices and most Macs (provided they're running 10.7 Lion or later) use the built in Wi-Fi; iPhones and Wi-Fi + Cellular iPads add cellular radios and GPS.

With Find My iPhone active, a device with GPS and cellular regularly sends updates derived from its GPS receiver and from ranging information it has about nearby cell phone towers that allow it to trilaterate.

Note: You may be more familiar with the term *triangulation*, which relies on using known fixed positions and measuring angles. *Trilateration* uses the intersection of geometric areas, such as the radius of signal strength from cell towers.

All iOS (and OS X) devices also scan for nearby Wi-Fi networks and send a snapshot of that information to an online system run by Apple whenever the device has an Internet connection. This system approximates a position based on network details that it knows about from previous scans sent by other devices, including the name and some less-apparent unique hardware identifiers. The position is inferred based on the relative signal strength of the Wi-Fi base stations detected.

That lookup requires an active connection, which is fine for a cellular device with an active cellular data plan. But a Wi-Fi–only device must be connected to a Wi-Fi network to retrieve and send Wi-Fi–based position information, as well as to respond to queries from Apple's servers.

Note: Apple **caches some information** about location on the phone for up to 7 days to avoid frequent network access to look up information, or to use Wi-Fi positioning in an area you've been recently even if you don't have current Internet access.

Enable Find My iPhone

Find My iPhone requires an active Apple ID associated with iCloud. You likely set this up when upgrading or setting up your iOS device or Mac.

To enable Find My iPhone on an iOS device, if you haven't logged in with an Apple ID account yet, go to Settings > iCloud and do so. Once you're logged in, that view shows the Find My iPhone switch, which you can set to On or Off.

> ***WARNING:*** *Since iOS 7, Apple requires that you enter your iCloud password to disable Find My iPhone. This prevents a thief or other unauthorized party who has access to your unlocked phone from using it while also removing it from being tracked.*

> **Note:** To enable Find My Mac, enable the Find My Mac checkbox in the iCloud system preference pane. If your Mac has Wi-Fi turned off with an active Internet connection (such as cabled Ethernet), it can still be contacted to perform actions, but it can't display a location.

View Your Device's Location

To view your device's location, you can choose between two similar tools: the Find My iPhone web app on the iCloud site or the Find My iPhone app on an iOS device. Because the two options have nearly identical interfaces and features, you should use whichever one is easier for you to access.

Find My iPhone on the web

To find your devices via a web browser, follow these steps:

1. Go to **https://icloud.com/#find**.
2. Log in with the correct Apple ID.

> ***Apple is smart about unattended machines:*** *iCloud.com allows you to stay logged in, but prevents unauthorized access to Find My iPhone by asking for a password even when you're already logged in to another part of the site. The Find My iPhone login times out after 15 minutes.*

In the Find My iPhone web app, click the All Devices button at the upper center to reveal all your equipment (**Figure 99**). All Devices is the default selection, revealed in the map at whatever magnification level is required to show all the devices at once.

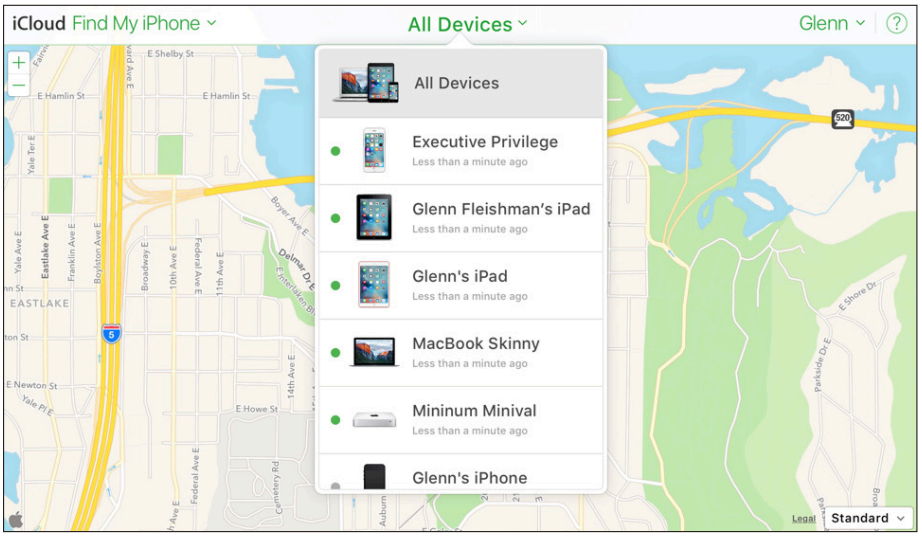


Figure 99: *The Find My iPhone web app shows devices in a drop-down list at center and their locations on a map.*

In the All Devices list, the dot beside each device name indicates the status: gray ● means trying to connect or offline, and green ● means online. It may take Find My iPhone up to 3 minutes to fix a precise location for a device.

3. Select a device in the list to see just its location.

   Find My iPhone shows the location of the device on the map as a green dot. For GPS-enabled devices that have obtained a strong location fix, only the dot is shown.

   When the GPS information isn't good or it's a device without a GPS, the green dot is surrounded by a green outline, the radius of which indicates the amount of confidence in the location (**Figure 100**). With hardware that relies on a GPS signal, the outline may appear briefly while a better fix is being obtained.

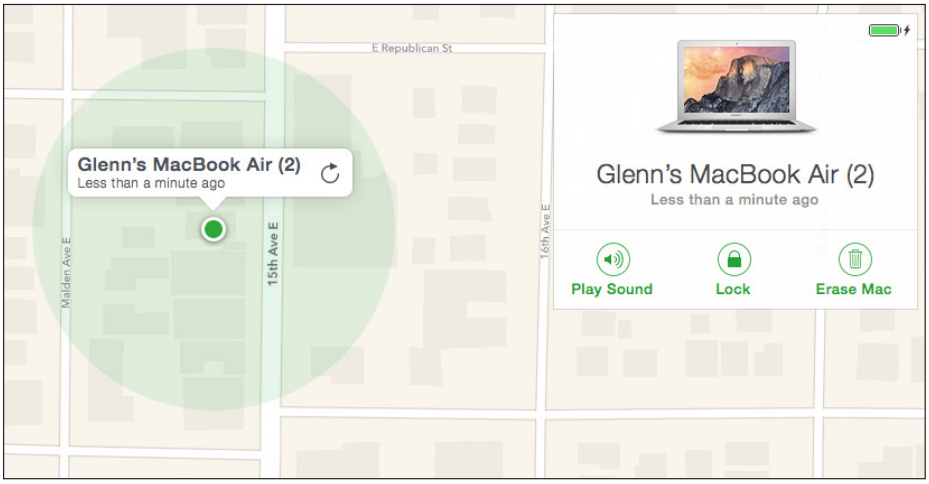


Figure 100: *The shaded green circle shows the degree of confidence. In this case, my MacBook Air might be half a block away (though the green dot is, in fact, accurate).*

With All Devices chosen, click the All Devices label or click anywhere on the map to hide the drop-down, and then click any green dot on the map. A popover menu appears with options for actions, described a few paragraphs ahead, and the last time a fix was made on the location.

If the device was previously found but can't be found now, you may get a message that says, "Your device is no longer locatable." The last-known location of the device should be displayed for 24 hours, along with the time showing the last moment it was known to be located there. Clicking the green dot on the map representing the device brings up a popover with a Refresh button you can click to force another attempt to locate it.

> ***Battery life:*** *The web and iOS app show the battery life remaining on hardware with batteries, including setting the icon green if it's charging.*

Find My iPhone app

You don't have to use a web site to run Find My iPhone. Instead, you can download the free **Find My iPhone** app to an iOS device, launch it, and then enter your account and password. (It's confusingly labeled "Find iPhone" in Spotlight and on the Home screen.) The app works almost identically to the Find My iPhone web app, although its interface layout is a little different when a device is selected.

The default view shows all devices in a list at the bottom (**Figure 101**) and their locations in a map shrunk to fit them all at the top. Tap any device in the list, and it's selected and zoomed in on in the map (**Figure 102, left**). Tap the All button at the upper left to return to the full device list.

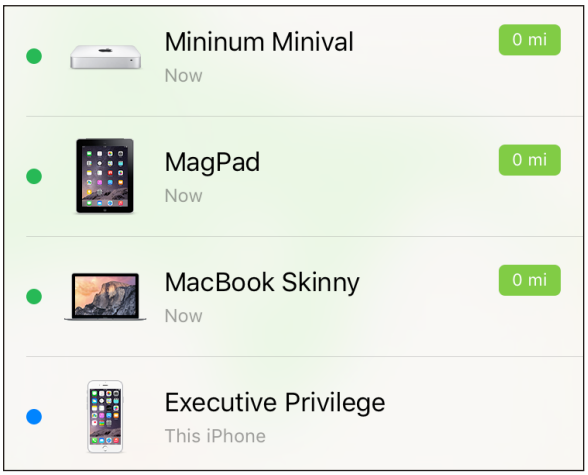


Figure 101: *The Find My iPhone app shows all your connected devices in a list (as well as plotted on a map, not shown).*

Tap the device in its green circle, and three options appear at the bottom:

- A Location icon, which lets you tap to cycle through showing a map with the current device location centered, with your location centered, and with your location centered and oriented by the device's compass.
- An Actions button to reveal actions you can take, discussed next.
- An info ⓘ button lets you choose miles and kilometers for measurements, as well as select a schematic map, a satellite view, or a hybrid.

Tap the Actions button at the bottom and the map pivots to show a close-in view that's canted back to reveal a bit of 3D (**Figure 102, right**).

You can tap the automobile icon at lower right, and the Maps app is launched with the device's location preloaded as a destination.

Next, I'll explore each of the possible actions.

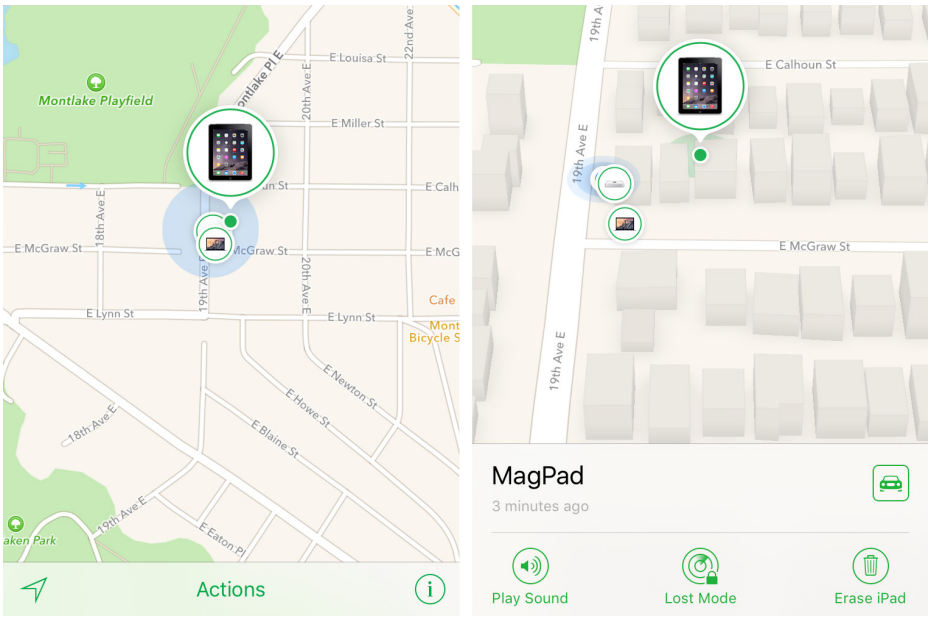


Figure 102: *Tap a device and you see it on a map (left); tap Actions, and the map tilts back for a 3D effect, zooms in, and reveals options.*

> ***Password not stored:*** *The app doesn't save your password, and it caches it for only a short time. If you borrow someone's iOS device to run Find My iPhone, you don't have to worry about that person finding your iOS devices in the future. And, to reverse the situation, if a thief steals your iPad, the thief can't use the app to locate more of your devices—or figure out where you are!*

Take Remote Action

You can now take action on your remote device, with three options that vary in utility based on whether your device has fallen behind a couch cushion, or has been misplaced or stolen (**Figure 103**). Whatever action you take, iCloud sends an email message to your Apple ID address, notifying you.

Tap one of the options and see the section below that corresponds to Play Sound, Lost Mode, and Erase Device. (For Macs and iOS 5 devices, the earliest ones supported, Lost Mode is replaced with Lock.)

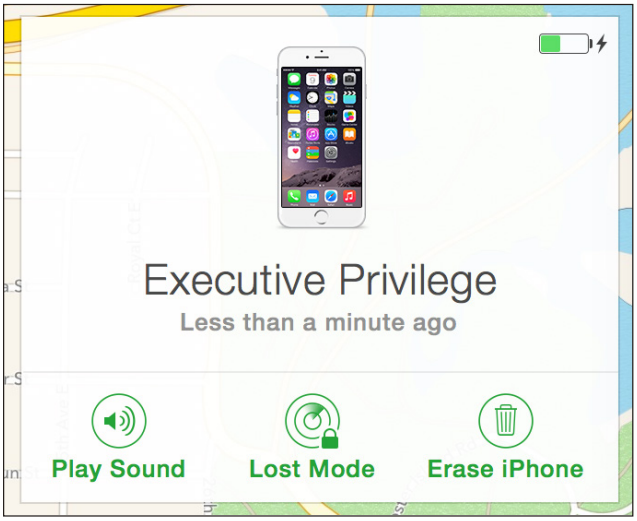


Figure 103: *The three remote actions: Play Sound, Lost Mode (or Lock), and Erase.*

WARNING! *If you know your device was stolen, consider taking location information to the police—call an officer if you have a report already opened—before trying to entice the thief to give it up.*

Even If Offline, It Works When It Comes Online

You can pick any of the below options even if the device is shown as offline, and iCloud will trigger it if the device comes online with Find My iPhone still active. You don't need to keep the web app or iOS app open; if the trigger happens, you'll receive an email message.

Thieves tend to wipe stolen hardware as soon as practical. An iPhone or iPad with an active cellular plan could receive a Find My iPhone action over the cellular data network when it comes back online; any device, if it connected first to Wi-Fi, could receive remote actions.

Notify when back online: *If a device's location can't be quickly determined in the Find My iPhone web app or iOS app, you can select it from the Devices list and then select the Notify When Found box without having to trigger any other actions (**Figure 104**).*

If it ultimately provides its location, you receive an email message, see a banner when you sign in to the Find My iPhone web app, and get a pop-up alert on iOS devices with Find My iPhone installed.

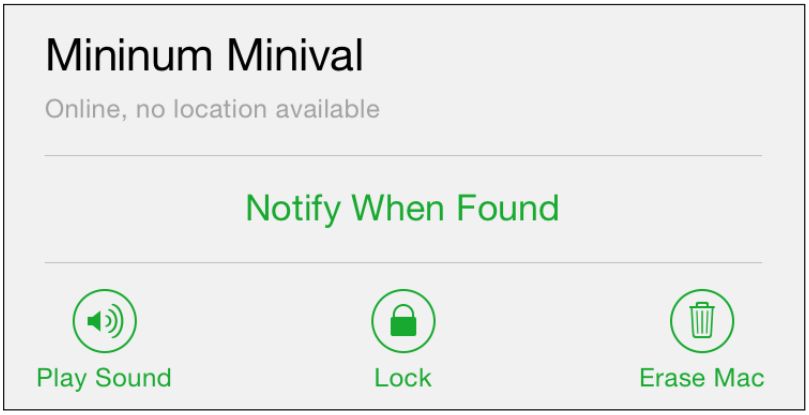


Figure 104: *Devices without a location can trigger alerts when they acquire a location.*

Play Sound

When you can't find a device but think it may be nearby, the Play Sound option should help you locate it. Tap or click Play Sound, and a loud pinging noise will play for 2 minutes on the device, which also displays the message "Find My *Device* Alert" (**Figure 105**).

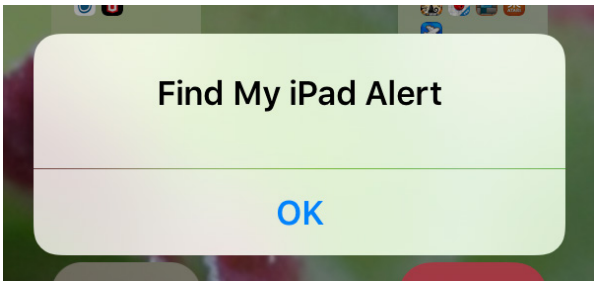


Figure 105: *iOS shows this message when Play Sound is triggered.*

The sound will override any mute settings on the device. The sound can be stopped on the found iOS device by tapping OK if it's unlocked. If the passcode lock is active, enter it to stop the dratted noise.

Lost Mode

This option is designed to help you recover a lost device. You can offer a reward and provide your phone number. It also puts the finder on notice that you know approximately where it is. ("I'm a block away, coming to

pick it up. There's a reward.") Were your hardware stolen, this is a way to tell a thief that you have her location and other data, and advise her to give it up.

> **Note:** Lost Mode immediately disables Apple's side of Apple Pay for devices that are both capable of it and have the feature enabled, even if it's offline. Thus, if your device is lost and someone has the passcode and attempts to unlock the phone when it's not connected to a network to pay for something, Apple will not pass the transaction on for approval. You can log back in to iCloud on the device if it's recovered, and any credit and debits cards are once again available for use.

This Lost Mode option has up to four steps:

1. After tapping or clicking Lost Mode, you have to confirm by tapping Turn On Lost Mode (**Figure 106**). (Click Cancel to back out.)

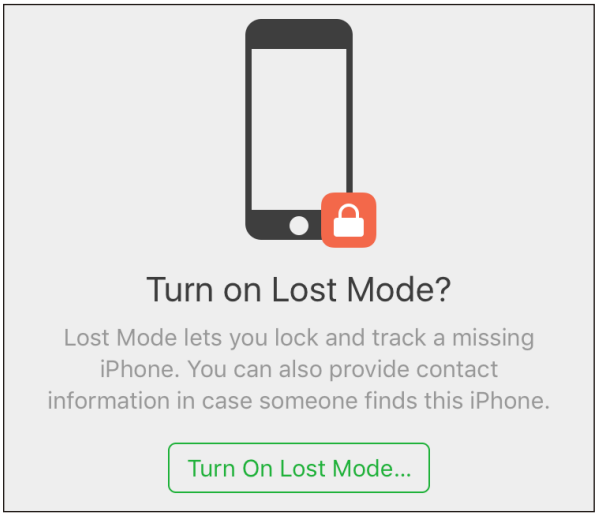


Figure 106: *Lost Mode doesn't involve a mysterious island.*

2. If a device doesn't have a passcode set, you are prompted to enter and verify a passcode (**Figure 107**).
3. Optionally, set a phone number for a call back (**Figure 108**). On an iPhone, the phone may be used to call *only* that number. On other devices, the call-back number is displayed but can't be used.

Figure 107: *If a device doesn't already have a passcode in place, you are prompted to enter one and then verify it in the next step.*

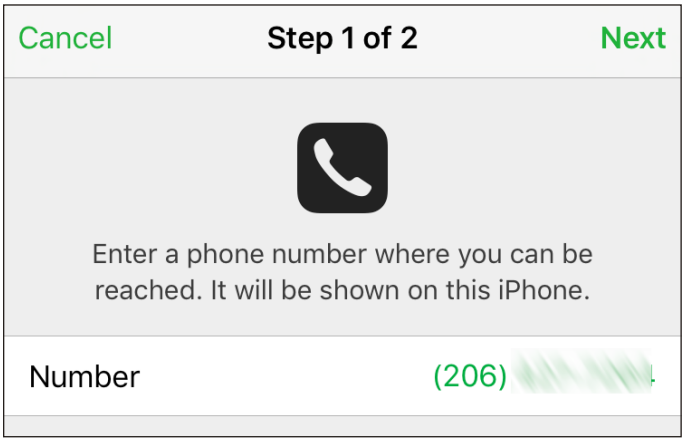


Figure 108: *You can opt to enter a call-back number.*

4. Optionally, enter a message to appear on the device (**Figure 109**). In this step, the dialog shows that a passcode has already been set and will be used to lock the device.

   After you activate Lost Mode, the action is passed to the device, and an email message is sent to the email address for the Apple ID account you're using for Find My iPhone, confirming what you've done.

   Once the action is sent, one of the following behaviors occurs:

- If the device is connected to a wireless network and asleep, the next time it's woken, a passcode must be entered to gain access.

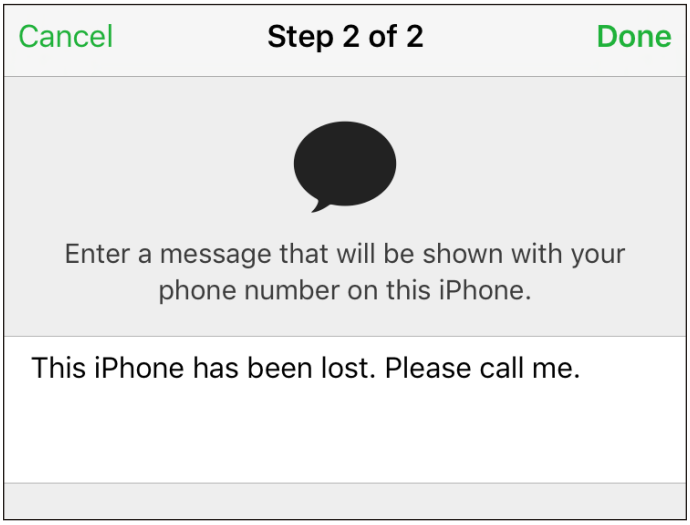


Figure 109: *Choose to add a message.*

- If the device is online and in use, iOS drops the user into the Lock screen where the passcode-entry dialog or keypad is shown.
- If the device is offline, the next time it accesses any network with an Internet connection, the passcode lock is put into place.

  Lost Mode also enables tracking the next time the device is online. A tracked path appears in a map as a dotted red line (**Figure 110**). This lets you see wherever a device has gone—so long as it remains online. Even neater, if Location Services has been turned off, Lost Mode re-enables it so that you can track your device.

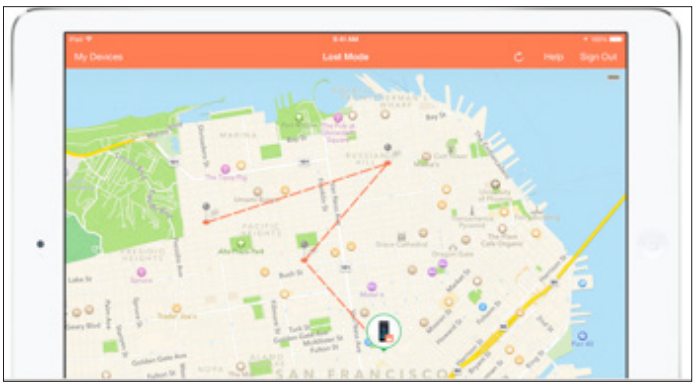


Figure 110: *While Lost Mode is enabled, the path a device takes as long as it has connectivity is recorded and shown as well. (Figure via Apple.)*

Note: The Lock mode for Macs makes a user set a six-digit code to unlock it. If the Mac has a Recovery disk partition installed, Find My Mac causes OS X to shut down immediately, no matter what's happening! Then the computer restarts from the Recovery disk, and will only unlock when that six-digit code is entered (**Figure 111**).

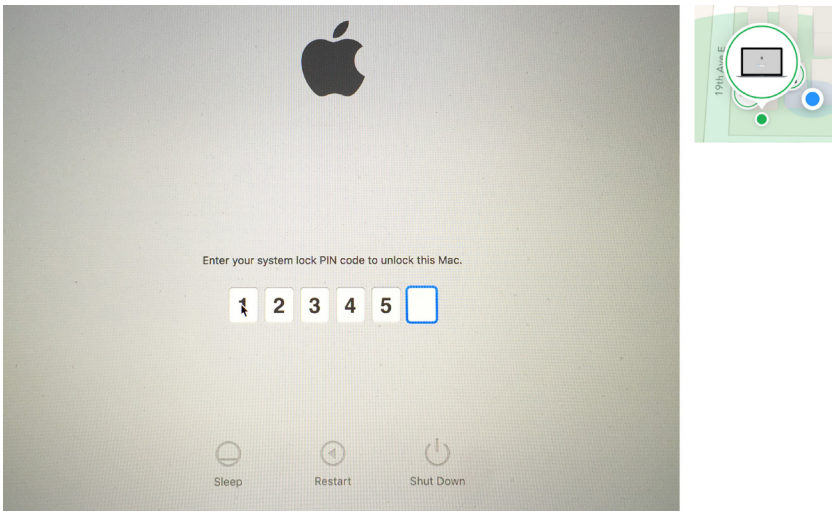


Figure 111: *A Mac reboots into a special locked mode. Find My iPhone even shows a neat "locked Mac" icon to indicate its status.*

Erase Device

The last resort in some cases (or first in others) is a remote wipe, in which all the user data on the iOS device is erased.

Since iOS 7, an erased device that has Find My iPhone enabled before erasure and remains associated with an Apple ID cannot be unlocked without the account password. (This is called Activation Lock.) The Erase Device option lets you provide a phone number and message so that a person who found (or stole) your device can get in touch. The iOS device is essentially useless to them without the password.

WARNING! *After erasing a device, Find My iPhone can no longer provide location information.*

Note: You can remove a device from your Find My iPhone list after erasing it by following Apple's instructions **in a support note**.

It's a multi-step process to prevent accidental erasure:

1. In the web app or the iOS app, tap Erase (web) or Erase *Device* (iOS).
2. You're warned that everything is about to be erased. Tap or click Erase, but there are more steps ahead (**Figure 112**).

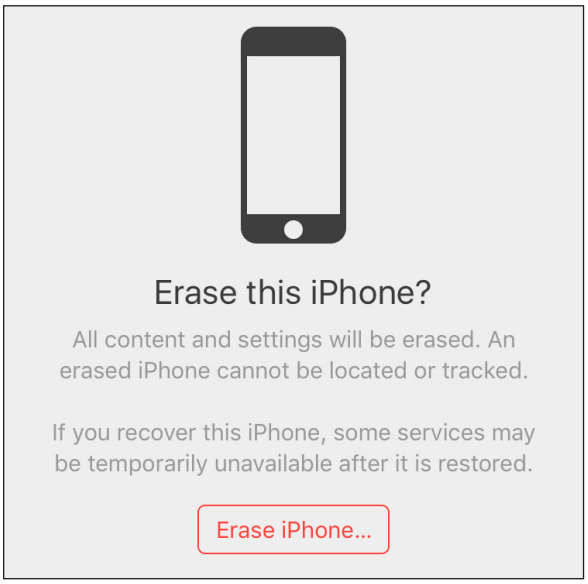


Figure 112: *This step seems like you're about to erase your device immediately, but there are more steps ahead.*

3. Tap Erase.

   If you're using **two-factor authentication**, Find My iPhone reminds you before you proceed that it will be removed from your set of trusted devices (**Figure 113**).
4. Enter your Apple ID password (**Figure 114**). (If this is another member's device, accessible via Family Sharing, enter her or his Apple ID password.)

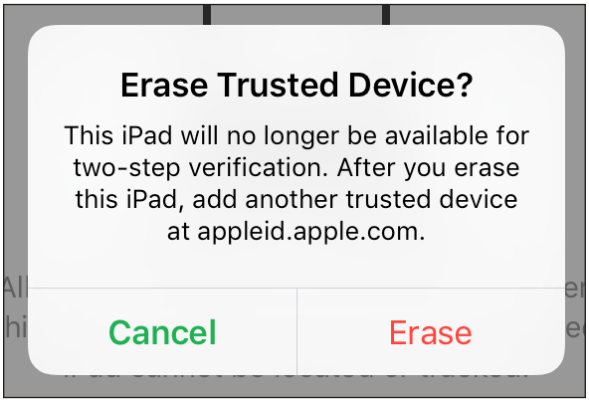


Figure 113: *Trusted devices provide additional information.*

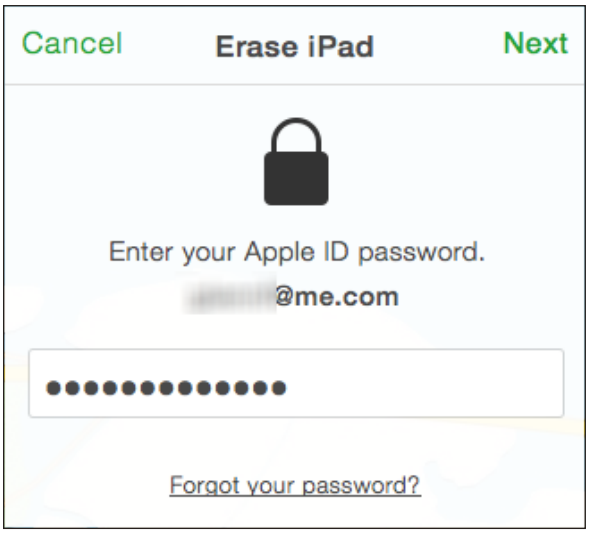


Figure 114: *Enter the appropriate Apple ID password.*

5. Enter a phone number at which you can be reached after it's erased, and tap Next (**Figure 115**).
6. Enter a message you want to appear along with the phone number (**Figure 116**). You'll notice there's a Done button. Tap that, and the remote device is erased—there's no going back!

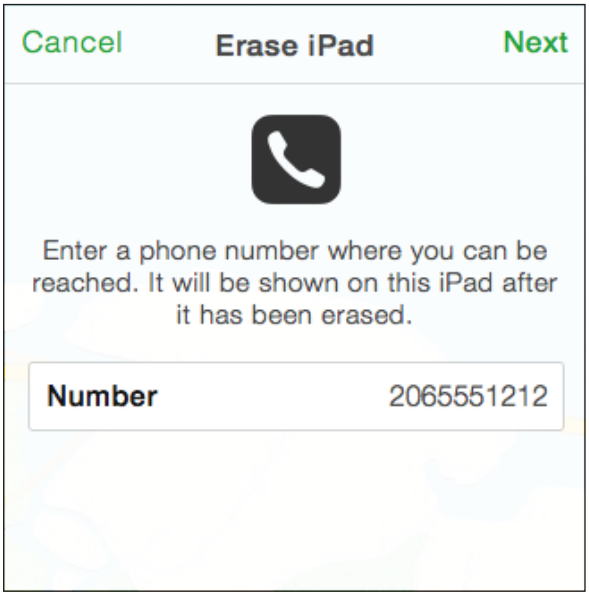


Figure 115: *If you want to provide a number, enter it at this step.*

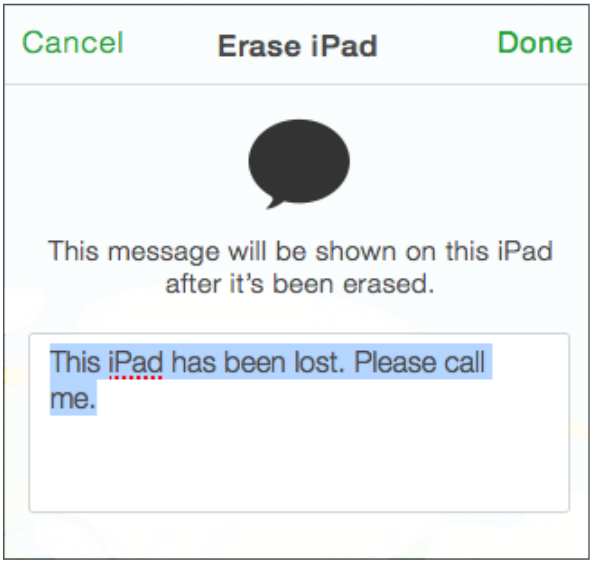


Figure 116: *This message will appear after erasure as well.*

If the device is online, the Erase action immediately wipes all your data off it. If it's offline, the erase begins as soon as it next comes online through any networking method.

Note: Because Find My iPhone works with older versions of iOS, you might see slightly different options if you have iOS 5 or iOS 6 installed on an older piece of hardware.

The erasure happens quickly. Apple includes hardware encryption on all iOS devices that can run iOS 6 or later: all iPads, the iPhone starting with the 3GS, and the iPod touch starting with the 4th-generation model (2010). To "erase" all the device's stored data, the encryption key is thrown away and a few other settings rewritten, and everything is now completely unrecoverable.

Note: Macs with FileVault 2 (starting in 10.7.2 Lion) can similarly have their boot drives rendered unreadable: an encryption key is deleted, making the drive's encrypted contents irretrievable. (The drive can still be erased and a new system installed, however.)

However, wiping your device isn't as bad for your data as it sounds. All iOS devices are set by default to back up the unique data that's stored on them, like settings, passwords, and documents created by or associated with apps. These backups can be either local to iTunes on a particular computer or remote to iCloud.

Tip: You can also make both kinds of backups by manually switching between the options in iTunes when an iOS device is connected. Tap Back Up Now in Settings > iCloud > Backup, then switch in iTunes to make a local backup (or the opposite).

Any media and apps kept on an iOS device are not stored in the backup. Instead, they are stored in some combination of a copy of iTunes (for your own music, videos, ebooks, and purchased movies) and iCloud (all apps or any media that you've bought from Apple, and your own music uploaded or matched using iTunes Match).

If you erase your device, and then either recover it or obtain a new device, you can restore from your most recent backup. If you were syncing any items to your device through iTunes, you can then sync them back to the device. Or, for items stored in iCloud, the restore process downloads them again.

If you were syncing any data wirelessly through iCloud or an Exchange account, such as calendar or contact information, you likely won't have lost any of that data up to the moment the device was lost or disconnected from a cellular or Wi-Fi network. You will lose any changes made on the device between the last sync (push, fetch, or manual) for each account and the remote wipe.

WARNING! *Erase can be used by a ne'er-do-well who obtains your Apple ID and password. That happened to writer Mat Honan in August 2012. His password was obtained by a malicious party who fooled Apple's customer service into bypassing protections on security questions and answers, and then the villain erased the data on Honan's iPhone, iPad, and MacBook.*

A Remote Wipe Makes a Mac Hard to Fence

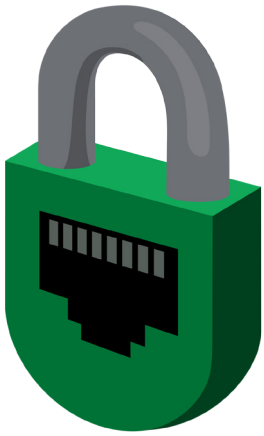
When you send an Erase action to a Mac, you're prompted to set a recovery code and message. Wiping a Mac deletes the data on the main partition that you use to boot your system, but it keeps intact the Recovery disk, a small partition that Apple employs to help with common installation and other problems.

A thief who has a machine that you wiped using Find My iPhone won't be able to easily install a new system—he would require the passcode you set. If he tries to sell the system, whenever it boots, it will display the message you set—ostensibly advising that the machine is lost or stolen and how to contact you.

Acknowledgments

I dedicate this book to my wife, Lynn, and sons, Ben and Rex. They keep me sane and happy, and keep me from spending my entire day thinking about and using digital devices.

Many thanks to longtime collaborators Adam and Tonya Engst, who saw this book through earlier editions and offered ebook help on this one! Thanks to Charles Fleishman, Jeff Carlson, and Scout Festa for their varied editing assistance across three editions!



About the Author

Glenn Fleishman was trained as a typesetter, received a degree in art, and works as a journalist and programmer. Glenn writes two weekly columns for Macworld, where he also co-hosts the Macworld podcast and files reviews and features.

Glenn appears regularly in TidBITS, *Fast Company*, The Ringer, *The Atlantic*, and other publications. He writes articles on unusual and quirky topics directly for his patrons via **his Patreon campaign**, which you can join. Glenn writes about security, privacy, nanosatellites, copyright, punctuation conventions, crowdfunding, and much more. His blog is **http://glog.glennf.com**, and he overshares on Twitter at **@glennf**.

In October 2012, he appeared on the *Jeopardy!* quiz show and managed to win—twice! Alex Trebek seems like a very nice fellow, but you never get to really know him.

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