A Pocket Guide

Building a device lab

by Destiny Montague & Lara Hogan

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Preface

A device lab is a highly functional way to provide handsets, tablets, and other Internet-capable devices to those interested in testing their work across a variety of screens and hardware. Designers, developers, content creators, and others can use a device lab to gain a better understanding of what users experience when visiting your site from these devices. By creating a device lab, you can empower your teammates to test their own work on real physical devices in an easy and intuitive way.

When we built Etsy's device lab, we optimized it for a large product organization made up of designers, developers, and product managers. We also had a budget for buying devices to cover more of what our members use to visit our site. We want to acknowledge this privilege, and also attest that our aim in writing this book is to help people learn how to build a device lab of any scale – from three devices to thirty. Throughout this book, we will detail how we built our own lab as an example, but we focus heavily on the fundamentals of power consumption, troubleshooting steps, and the philosophies of a good user experience, which apply to every lab. We've optimized this Pocket Guide for device labs built to help people test websites; this book will apply to organizations testing apps as well, but they will likely need additional tooling like automated testing on physical devices.

This book details the steps needed to build your first device lab chronologically; however, building a device lab isn't a one-time process. The tips and processes we outline in this book are evergreen; we have so far built three iterations of Etsy's device lab, and we're sure there will be more in Etsy's future as we learn more

about how people use the lab and how we can improve it. As you build your lab, picture your coworkers as your end users, and make sure that you're regularly user-testing, data gathering, and iterating on what you've got to make it as usable as possible for them.

Our aim with this book is to provide a Pocket Guide for you to keep as a reference, a companion manual to your device lab. We hope to save you from many of the headaches that we encountered as we continued to iterate on our own lab, and to equip you with the tools to build the best possible user experience for your device lab's users.

Destiny Montague co-founded Etsy's device lab while she was an engineer in Corporate IT. Her years of experience in computer software and hardware tech support equipped her to both understand the human factor and troubleshoot technical issues with the device lab. Destiny is currently a Security Engineer at Etsy, but the title on her business cards simply reads *Problem Solver*.

Lara Hogan is currently a Senior Engineering Manager at Etsy, and co-founded Etsy's device lab while she was running the Mobile Web engineering team. Her background in crafting user experiences on the Web equipped her to optimize the lab to reduce headaches and increase use, and also prepared her for the tasks of gathering feedback and iterating on efficacy over time.

Destiny and Lara built the device lab to help empower other engineering teams at Etsy to begin building for mobile, back in the days when product development was primarily desktop-focused. Since then, Etsy's product teams have been shipping new features across all of Etsy's platforms, and have been able to

test their work and troubleshoot bugs rapidly, even before their work hits production. The examples in this book come from the primary device lab that Destiny and Lara built and iterated upon, and Etsy has since leveraged this expertise to scale its device lab infrastructure to support remote offices, QA teams, automated testing, and more.

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Choosing devices

Naturally, the first step when building a device lab is gathering devices for testing. This first step will help you sort out the parameters for the rest of your lab – from the overall size of the lab, to what kind of cables and power supplies to purchase, to how big of a footprint you'll need. There are hundreds of devices out there to choose from; how do you pick from handsets and tablets, from smartwatches to video game systems, from the ever-expanding Internet of Things?

Developers instinctively test on the devices that they have in their pocket, or on their desk. But these are typically the shiniest, newest, fastest devices out there. They're not often representative of what your site or app's audience routinely uses to access the Internet. Your personal device probably won't give you a good picture of what bugs might crop up, how long a page takes to load, or how usable your site's UI is on a typical screen size. It's easy to forget that your day-to-day experience is unlikely the same as your site or app's target audience. A device lab comes in handy, as it'll open your eyes to the range of user interfaces, screen sizes, heft, and sluggishness that your users experience every day.

That being said, you can't test for every use case. Having a helpful device lab doesn't mean you have every device on the market; it means focusing on what your users are actually using to access your site and prioritizing by the amount of traffic and potential for bugs. Just having two or three additional device types, covering a range of operating systems and screen sizes, means that you can get a better sense of how your work performs for others. To figure out what those primary devices should be in your lab, you'll need your site's visitor data. We'll start by analyzing what devices your visitors are using and compare that list to what's important for you to test on your particular site. Then we'll walk through technical considerations when purchasing devices to make sure you are getting the most bang for your buck.

Analyze your users

Let's dig up the data about what visitors are actually using to access your site. In this example, I'll focus on using Google Analytics, as it's a fairly common analytics tool, but these tips will apply to any analytics solution's visitor data.

Once you're in Google Analytics, open the Audience section, then the Mobile section, and choose *Devices*. You'll see a list of users' devices and various pieces of data about their traffic to your site that will help you figure out what good device coverage looks like.

You can also open up an important secondary dimension: operating system version. You'll want to see what versions people are using the most when they visit your site, to make sure you have coverage of popular operating system versions in your lab. This is also something you'll want to check on regularly to see when to upgrade your devices' operating systems.
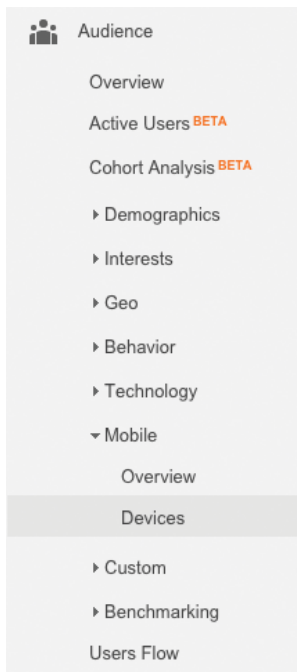
Find the 'Devices' option within 'Mobile' on the Google Analytics navigation menu.

Table 1–1 shows an example list of devices used to visit my personal website. I've included the top device names, the operating system versions used on those devices, some visit data, and noted my own classification of device size, from handsets through large tablets.

Device	OS Version	% Total Sessions	Size
Apple iPhone	8.2	36%	handset
Apple iPhone	8.1.3	13%	handset
Apple iPad	8.2	10%	small/large tablet
Google Nexus 5	5.0.1	3%	handset
Apple iPhone	8.1.2	3%	handset
Apple iPad	8.1.3	3%	small/large tablet
Apple iPhone	7.1.2	2%	handset
Google Nexus 4	5.0.1	2%	handset
Google Nexus 5	5.1	1%	handset
Apple iPad	7.1.1	1%	small/large tablet

Table 1–1: Example list of devices visitors used to access a website.

The data in Table 1–1 will help me figure out what operating systems and screen resolutions are important to have coverage of. Now that I have this data, how should I go about deciding what to buy?

Get the biggest bang for your buck

First, focus on roughly the 20% of devices that produce 80% of your traffic. While a large device lab can be beautiful and shiny, we really only need a handful of devices for good coverage of our user base, and it's important to optimize the total cost of the lab. The devices listed in Table 1–1 make up 74% of total sessions to my site, so this is a great starting list for me. There may be cases where you want to have some unique devices for testing strange bugs – we'll get to those cases in the next section.

Next, make sure that you have coverage of your visitors' screen sizes. In Table 1–1, we can see that my site's visitors mostly use handsets and iPads. It's hard to tell if the iPads listed are the iPad Mini or the full-size iPad, as these devices send the same user agent. If I invest mostly in handsets with maybe one iPad, I'll have fairly good coverage of screen sizes.

If you notice that a lot of people are using iPads or other devices with retina screens, make sure that you're testing on devices with high DPI. All of the newer versions of the devices in Table 1–1 are high DPI or classified as retina devices, so I should purchase devices that allow me to test things like how icons scale up on these screens or which responsive image sizes work best.

Buggy and older devices

In addition to the major device types and versions in your list, there are a few additional considerations for what to initially buy for your device lab. As you're using the lab for testing your work

to troubleshoot bugs and ensure a good user experience, it may be important to purchase some older devices or devices that could generate surprising bugs for your site.

It looks like my users are on recent versions of iOS and Android, so for now, I'll avoid buying devices running older operating system versions. If on my site I declared supporting older versions of operating systems, then I'd make sure that I had them in the lab so I could test for bugs. At Etsy, for example, we have a handset running Android 2.x, as older devices can be really helpful to reproduce user-reported bugs. That said, if you're just starting out building a device lab, stick with operating system versions that are representative of the majority of your user base. As you grow it over time, you can become more inclusive of your overall user base.

At Etsy, we found that Kindles can be particularly buggy for our user experience, so we include them in the device lab for testing. If you have a Kindle in your top ten list of devices that visit your site, definitely consider getting one for testing. Similarly, if you have a lot of users on the Windows Surface or Chromebook Pixel, be sure to test on a device with a combination of touch and cursor. We've found some significant JavaScript issues that affected people's ability to log in to our site on these devices.

Target demographic

We've been looking very high-level at visitor data, but this may not provide the most accurate picture for what devices you need in your lab. As the last step before purchasing, find out if device usage differs if you segment your analytics data by audience region or

target market. It's possible that when you focus on visitors in your target demographic, you'll find variances that will impact which devices you should buy. Maybe you know that your primary user is located in the United States. Or maybe you collect age data on your users and it's important for you to know which devices teenagers are using to visit your site. Verify that the devices you buy cover what your target audience is using. It's important to make your site accessible to all, but when building a starting list for a device lab, focus on the best coverage of your target demographic.

Iterating over time

The Internet of Things constantly evolves. When we first started Etsy's lab, we included older Blackberries and a Google Glass. Every quarter or so, it's important to revisit your visitors' data to see how things are changing. Is there a new device that's gaining popularity? A new range of screen sizes to cover? Are you keeping up with the rate at which people are upgrading their operating systems? Be sure to routinely check in and make sure that your device lab stays on par with what your users are truly using to access your site. This way, you can budget to purchase used versions of these devices in the next quarter. Additionally, you'll want to consider updating a few devices' operating systems at a time, while continuing to keep some on older versions if necessary to test bugs.

So what would I buy based on the data in Table 1–1? If I purchase one iPhone running iOS8, that's 52% of my traffic covered. I could also purchase an iPad to cover tablets, and a Nexus 5 to cover Android handsets, bringing me to solid coverage of my top 10 with

just three purchased devices! If I had budget for a fourth devices, my next purchase would be an iPad Mini running iOS7, to cover the iOS7 test cases in the list.

Purchasing devices

Device lab costs can quickly escalate without proper planning. Devices alone cost hundreds of dollars, and it's important to have budget left over for your power chain, replacement parts, and improving the usability of the lab. Let's focus on optimizing the purchasing process to both lower the costs and increase the efficacy of the lab.

Used devices can give the best representation of what your visitors experience when they access your site. While in our pockets we may have the shiniest, newest devices, these devices don't reflect what our entire user base has in theirs, and therefore don't accurately represent their real user experience. Used devices will give you a better depiction of battery life, common bugs, and screen brightness, and they're generally cheaper than new ones.

When you purchase a device for the lab, you probably won't need to purchase a data plan. It's unlikely that you'll need any carriers or network contracts unless you are aiming to test voice capability or the device's speed or battery consumption over a cellular network. We recommend skipping the data plan and sticking to connecting your devices to a Wi-Fi network. We'll cover Wi-Fi setup and troubleshooting in *Chapter 4 – Networking*.

You can purchase used devices from sites like eBay, Amazon, and local cell phone dealers. Apple sells refurbished devices as well. If you need to estimate pricing for your budget, searching eBay is a good way to get a feel of what people are asking for a particular device. If you're buying something you won't be able to test drive in person, make sure the seller has a good return policy. When possible, get something still under warranty, and carefully read the description before purchasing. Does it come with all the necessary accessories and cables? Is the device unlocked? You can usually get a better price on devices with a less-than-mint appearance, but be sure the damage is only external and doesn't affect the functionality of the device.

In the next chapter, we'll focus on what lies between your new devices and the wall – your power chain! Few things are less fun than arriving at your lab, ready to get testing, only to find that your devices are drained or dead. After you receive your newly purchased lab devices, head to the next chapter to figure out your power setup.

Chapter Summary

Usability tips

- While it's good to test on the device in your pocket, remember that your audience is diverse. Optimize for a broader user experience.

- Get good coverage of major operating systems, pixel density, and screen sizes.

- Remember that your budget for the lab doesn't just include devices; be sure to have some funds leftover for your power chain and lab usability.

Budget tips

- Focus on the 20% of devices that produce 80% of your target traffic.

- You probably don't need to purchase a data plan.

- Whenever possible, purchase used devices.

- Allocate part the budget for purchasing new devices each quarter, based on visitor trends.

Power

After you purchase devices and begin setting up your lab, the next trickiest (albeit fun) bit is creating a power solution for your lab. It's just plugging in some cables and power strips… easy, right? Unfortunately, in our experience, troubleshooting power issues (not the political kind!) was the largest time sink we had while growing Etsy's device lab. By planning early and streamlining your power chain, you'll be able to save yourself quite a few headaches (and a bit of your budget!).

In this section, we'll cover typical power issues, how to suss them out and fix them, and how to keep your lab energy efficient. We hope to save you a lot of time troubleshooting!

Choosing your hardware setup

It may be helpful to see an example of one complete device lab power chain. Here's what Etsy's device lab power chain looks like, from the wall to the devices. In our lab, the devices are plugged in to either a power strip or into a USB hub. The power strips and USB hubs both get plugged into a single timed power supply so that we are able to turn the lab's power off at night. This single timed power supply gets plugged into a Modlet (a tool that measures energy consumption), and the Modlet is plugged into the wall outlet.

It took us quite a few iterations to get to this solution as we optimized for energy efficiency, usability and organization of cabling, and the capacity of different power supplies and USB hubs. We'll delve into the problems we ran into and how we resolved them, but first, we're going to brush up on Electricity 101. Having some basic knowledge will help you understand how to avoid problems in your device lab later on. Feel free to skip this section if you're versed on the basic principles of electricity.

Example power chain for a device lab, from the actual devices to the wall outlet, including USB hubs, a power strip, a timer, and a Modlet.
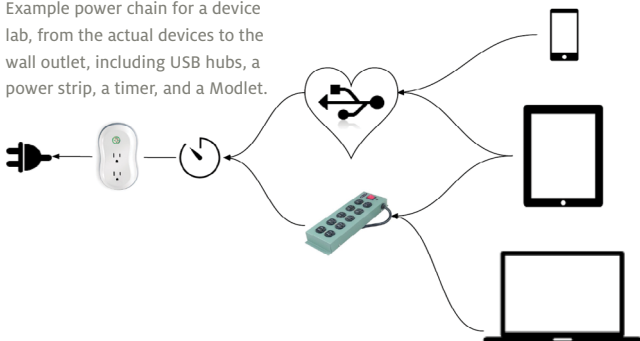
Electricity 101

The most common units of power you'll come across when planning for your device lab are amps, volts, and watts. Understanding how to measure electricity is important in figuring out how much power is needed to support each individual device properly, and also in figuring out how many devices a particular hub or surge protector can support. Doing this math early will save you many headaches later as you assemble the entire device lab and need to coordinate multiple devices' power needs.

You're probably wondering how amps, volts, and watts relate to each other. They're defined simply here, but we'll expand with more context through a few examples below.

- amps (A) – amount of electricity

- milliamps (mA) – 1/1000th of an amp

- volts (V) – force of the current

- watts (W) – the amount of work that can be done over a period of time

In the example on the next page, we can read the specifications for a power adapter. Most adapters have this information clearly marked. This particular adapter has an output voltage of 5.2 volts, and a current of 2.4 amps. If you multiply the volts with the amps, you get a measure of watts. So, this adapter outputs 12 watts.

Additionally, you could power the same device with an adapter that was 2 volts with 6 amps, because it would still output 12 watts. Math!

Example adapter with power specifications.

USB hubs

What makes this a bit trickier is when we introduce USB hubs into our power equation. The current for USB ranges from 100mA to a maximum of 500mA per port. A typical seven-port hub might have a 1A power supply, but that doesn't mean it would have enough power to fully drive a 500mA load on each of the seven ports. For example, this hub could power two iPads, but if you added a third iPad, it may not receive any charge since the first two are hogging it all.

Additionally, in Etsy's lab, we noticed some devices would be turned on, but as soon as you disconnected them from the hub, they would shut off and not power back on until plugged in. It was puzzling until we realized that only two of the ports would charge devices, while the rest would only power a device without charging.

Similarly, if you've ever tried to use an iPhone charger to charge an iPad, you will have noticed that it takes a very... long... time. When choosing hubs, be sure to look at the specifications to find out how many full-load devices it will support. Otherwise, you may be stranded with some power-hungry devices!

Build to support your most power-hungry devices

Now that you've got the basics of electricity down, here are some additional things to ask yourself once you have devices in hand: How much power does each device in my lab draw, according to the manufacturer's specifications? You'll notice that tablets and newer devices will draw a lot of energy, so plan to connect them directly to power supplies so that they don't create issues with other devices attached to the same USB hub.

How many USB outlets or power outlets will I need for the lab? Count the number of devices that you have, and what kind of power they draw. Do some math to figure out how many can connect to USB hubs, and how many will need to connect directly to a power strip.

To optimize on space, how much power can each surge protector or power strip that I have support? Or, how much power can each USB hub support? By minimizing the amount of hardware you need to support your lab, you'll save on costs and footprint. Figure out how this setup will work with your shelving, and optimize for accessibility so that you can easily add or remove devices from the lab.

Troubleshooting power issues

You will still likely encounter power-related problems when building your device lab. Power problems exhibit a range of symptoms that at first glance might lead you to think a device itself is faulty. The trick here is to always look to troubleshoot power problems first before replacing a device. When we initially got Etsy's device lab up and running, we found that more than half of our devices had power-related problems (it is important to note that none of the problems were due to the devices being in used condition).

So – how do we fix these kinds of power problems? The trick is to troubleshoot one part of the power chain at a time. It can be time-consuming and exhausting; you may even want to just give up and replace the device or take it out of commission. But if you isolate each part of the power chain and test it individually and patiently, you'll be able to save yourself quite a bit of money.

You already have everyday experience with troubleshooting. For instance, what would you do if your phone suddenly stopped charging after you plugged it in? What steps would you take to resolve it? Perhaps you would try a different cable or outlet, or maybe you would power cycle your device.

Let's start with an example from our device lab. In the Table 2–1, we outline the symptoms and steps taken when engineer checked out a Windows Surface from our lab but noticed it wasn't charging.

Symptom	Potential faulty part	Troubleshooting step
Windows Surface wasn't charging when plugged in.	Original outlet.	Engineer tried plugging it into a different outlet across the room, to see if the original outlet itself was faulty.
The Surface still wasn't charging, even on a different outlet.	Device itself.	Engineer looked up the manufacturer's guide and tried their recommended troubleshooting steps.
No recommended troubleshooting worked.	Cable.	Since the Surface's charger is proprietary, we couldn't check and see if a different cable would help. We ordered a replacement charger to troubleshoot further. When the replacement arrived, the Surface began taking a charge again, confirming that the original charger had died.

Table 2-1. Example troubleshooting steps used to investigate a device's power issues.

What could have been the cost of a new Windows Surface ended up being only $40. Here's the thing: troubleshooting can initially be time consuming but it can save a lot of time and money in the long run. Although replacing a device might seem like the easiest solution, it is usually not necessary.

When it comes to troubleshooting power problems, start with the most simple and most probable. There's a saying that goes, "*When you see hoof prints, look for horses, not zebras.*" After all, if your phone didn't turn on, you probably wouldn't have an electrician come rewire your apartment!

In order to isolate a cause, you essentially want to try to recreate the issue by systematically making one change at a time

and then checking results. In this diagram, we divide the problem space into two parts: hardware and software. Within each problem space, there are different components we can check:
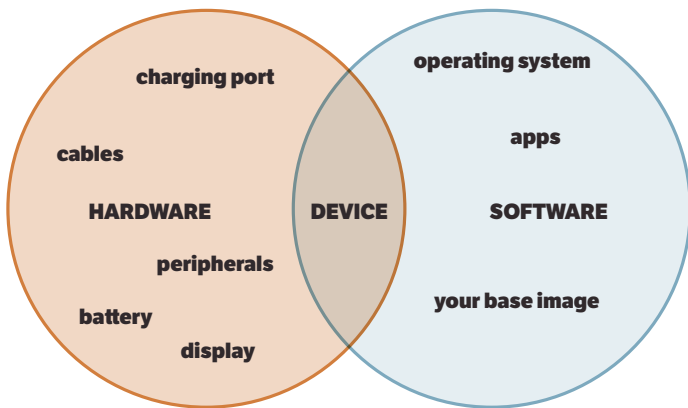
For each device, there are two sets of potential components contributing to power issues: hardware and software.

In our device lab, we were finding that some devices were drawing too much power from shared USB hubs, while others weren't getting enough power. We fixed this issue by isolating the devices that overdrew power and plugging them directly into the power supply. When we encountered a bad USB cable or other peripheral, we replaced it and bought a few spares to quickly solve future issues. Other times, we needed to update software to help us troubleshoot.

It's helpful to have spare cables and peripherals on hand to help

you isolate hardware problems, and to have an easy way to back up to a previous image of the device (or uninstall/reinstall apps) to troubleshoot software problems. Once you have fixed any existing power issues, it's time to consider iterating on your power supply chain.

Iterate on power solutions

If you do the energy math early, you may be able to shortcut the power solution process and come up with a great solution early. But because we were learning about best practices and usability as we built the lab, we ended up optimizing our lab by going through four iterations of power supply chains:

1. Devices were plugged directly into two 10-port surge protectors, which were plugged into a timer. The timer controlled what time the lab would turn on and off daily. However, we quickly realized that space would become an issue, so we decided to introduce USB hubs into our power chain.

2. We added USB hubs that connected to the surge protectors and then plugged all of our lab's devices into the hubs. However, we learned that these particular hubs were incompatible with our timer solution; the hubs had to be manually powered on each day when the timer turned back on in the morning (rather than automatically routing power to the devices). This was inconvenient for our maintenance of the lab and required it to be babysat. We needed better, smarter USB hubs.

3. We implemented better USB hubs that automatically turned on when the timed power supply turned on in the morning. These better USB hubs, described below, also helped us troubleshoot faulty devices and devices that overdraw power. We were still having problems with maintenance, however; our cabling was inconvenient to maintain and kept the lab looking cluttered. We also realized that we needed more data about how much energy the device lab was consuming.

4. We reorganized our cabling solutions to make it easier for us to maintain the lab and prevent cable stealing, and we added power monitoring with a Modlet.

USB hubs are ideal for lower powered devices (like most of the ones we have our Device Lab) but they are not suitable for larger, more power hungry devices like the iPad or other tablets. Tablets generally require a higher charging level, so they will charge very, very slowly, or not power on at all. Depending on the USB hub, they can also prevent other devices from effectively charging.

The USB hubs we ended up choosing in the third version of our iteration can handle up to 32 devices. Each port on each USB hub is powered to the maximum of the USB standard. The hubs include a safety protection device that prevents a higher charge from going to any one port, and a fault indicator light that helps us identify problematic devices. The hub disables devices consuming excess current, leaving non-faulty devices charging. Overall, they have been a great solution to help us manage power to devices in the lab.

In addition to the above tips about iterating on power supplies

and USB hubs, we recommend that you standardize your cabling as much as possible. It makes troubleshooting easier in the long run. Not all cables were created equally; some are weaker and some are more powerful. Keep in mind that some device cables you just can't standardize, as their charging method is proprietary (like the Windows Surface). If your budget allows for it, keep duplicates of standard cables, surge protectors, and other parts of your power supply chain in or nearby your lab. These duplicates can act as back-ups in case a piece of the chain dies, and as tools for troubleshooting.

Energy efficiency

Device labs are inherently power-hungry. Etsy is a B-Corporation, and we care about the environment and our energy consumption. B Corps, or benefit corporations, are certified to meet rigorous standards of social and environmental performance, accountability, and transparency. Naturally, we were curious about how much energy we were consuming with our lab. We take social responsibility seriously, and being green matters to us. In the fourth version of our power organization, monitoring helped us measure our energy consumption.

Etsy's device lab devices are plugged into a timed power supply that is only on between 10am and 6pm on weekdays. This ensures devices are alive for testing, but also aren't sucking energy 24/7. The Modlet we implemented tells us how much energy we're consuming through that power supply.

timer
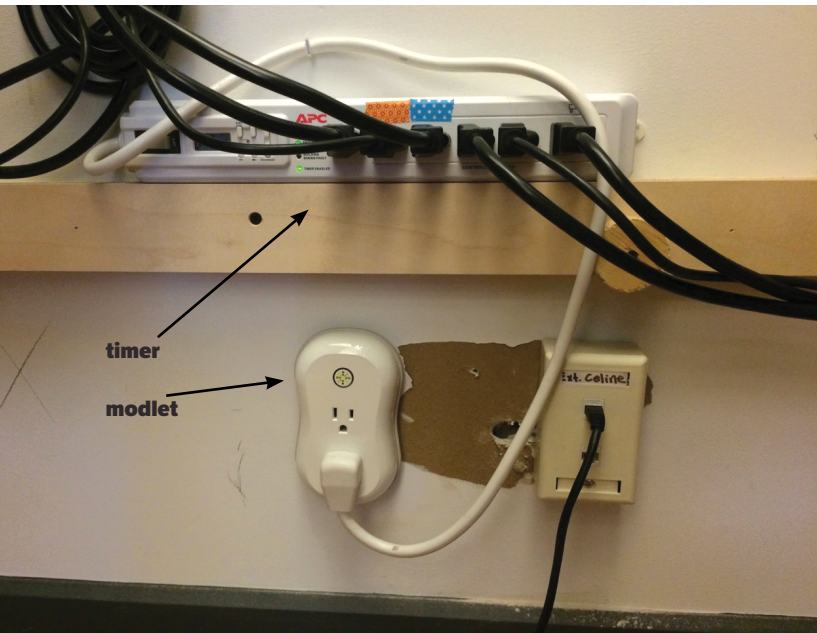
modlet

Etsy's power setup includes a timed power strip to reduce energy usage and a Modlet to measure energy consumption.

Below is a graph of the data that the Modlet provides. This kind of graphing comes out of the box with Modlet and is super easy to set up.
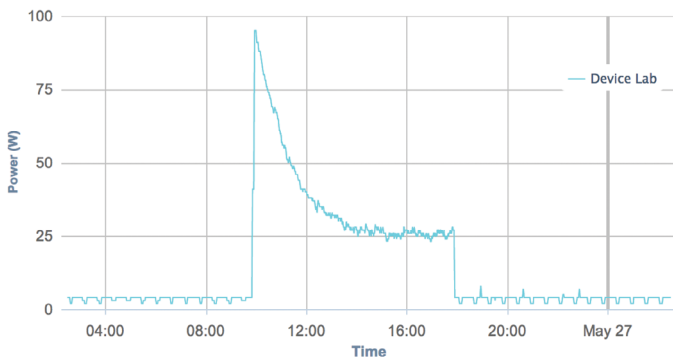
Example output of a Modlet's energy consumption data.

As you can see, we have a spike in energy consumption at the time that the lab turns on every weekday, and that level decreases as devices reach full charge during the day. When the device lab is off at night, there is just a trickle of energy being consumed. In the future, we can consider experimenting with what times of day the device lab is *on*, and what impact this has in our overall energy consumption (particularly when it turns *on* in the morning).

In the next chapter, we'll focus on setting up and configuring the devices in your lab. From emails to apps, from labels to managing your suite of devices over time, it's important to standardize the way you set up devices in your lab to save you headaches and to increase the lab's intuitiveness.

Chapter Summary

Usability tips

- Understand the way energy works so that you can figure out what power solutions will work best for the particular devices in your lab.

- Build to support your most power-hungry devices.

- To troubleshoot power issues, isolate each component one at a time. Keep spare cables and peripherals around for troubleshooting.

- Focus on the usability of your power setup as well as its energy efficiency. Iterate on these over time.

Budget tips

- Do the math early on how much power each device needs to save you costs in iterating on your power supply chain over time.

- If possible, budget for spare cables and peripherals for troubleshooting problems in your lab.

- Measure the energy consumption of your lab to save on energy costs.

Device Setup and Configuration

The configuration of your lab's devices is integral to the accuracy of your testing environment and success of your lab's users. It's important to replicate real-life user scenarios in your lab, and you certainly don't want to start with a device that's buggy or doesn't have the right software for testing. When you get a new device for the lab, clean it up and install the right apps for easy use by your device lab's users. Over time, you may want to invest in a mobile device management (MDM) solution.

Initial Setup

When you purchase a new device for your lab, it's important to give it a blank slate, especially if it's a used device. This way, you can be sure that you know exactly what condition the device is in, what apps it has, what network it chooses, and how prepared it is for your device lab's users to pick up. Start with a factory reformat to clean the device and get it ready for all of the awesome testing that's about to happen.

All devices have a way to reset them to factory standard. You can usually do this from the device's settings menu, or through a wired USB connection to a computer, depending upon the operating system and its version. A factory reset will delete all data and apps, and will also help you bypass any existing lock codes that any previous user configured. We won't go into the specifics of device resets here because they are unique to each brand of device, but resets for various device types are easily-Googleable, and you should have no trouble finding the right one for each device in your lab.

App configuration

Once your device is a blank slate, it's time to configure its apps. You want to have only the apps necessary for testing on your device, and you'll want to configure these apps to give your lab's users as few problems as possible.

Start by turning off any auto-upgrades and auto-updates on applications and the device's operating system. This is especially important to do if you want to maintain a specific operating system

version or a particular app release for testing and reproducing bugs. We've seen lots of our lab's users go ahead and upgrade the system or apps when they're prompted to do so on the device; this can cause maintenance problems down the line. So turn off system update notifications so that your lab's users won't be tempted to upgrade the device for the lab. On iOS devices, it's particularly difficult to return to previous operating system versions; prevention is key! When possible, also turn off devices' ability to sync to computers. Again, we're optimizing for maintenance of the lab over time, as well as consistency of the testing experience across devices in your lab.

Let's start installing extra apps for basic testing needs, like your company's apps and any standard mail clients for testing newsletters. At Etsy, we install our Buyer and Seller apps on all devices for easy testing, in addition to mail apps like Gmail (we talk more about configuring email in the next section). We also install Adobe Edge Inspect on all of our devices, which lets us test on the web across devices from a central browser. Examine what browsers your users are using; install them (such as Chrome or Opera Mini) as well.

When it comes to configuring browsers, setting up a few defaults can be key to making the testing process simple. At Etsy, we set the default homepage to etsy.com in each device's web browser so that the lab's users can quickly test how the site looks on a mobile browser. We also install security certificates to make sure that any images, CSS, JS, or other assets served from development environments will automatically load if someone tests a page from their virtual machine on which they are building a new feature.

 After completing app configuration, make use of your devices' wallpaper to aid in the device lab workflow. We use our devices' wallpapers to share at-a-glance information about device lab policies, as well as an indication of who to email with questions about the lab. Constant reminders really come in handy.

To keep your devices a little safer (but still just as intuitive to use for testing), set up a common passcode across them. This prevents just anyone who walks by from using the device, but still allows your co-workers to easily remember how to access each of the devices.
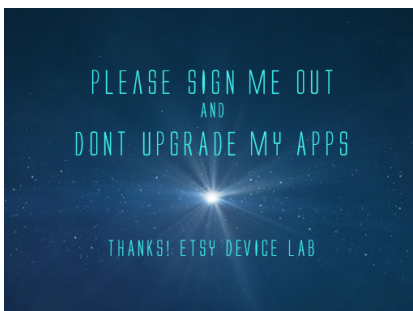
A device's wallpaper can showcase reminders for lab users.

Consistency is key across your fleet of devices. The more that you can standardize which apps are installed, how browsers are configured, and how they're used for testing, the easier it will be for your device lab's users to do their work. A confusing or frustrating lab will turn them off from testing their work; putting in the effort to keep each device clean and their workspace intuitive will pay off.

Email

For consistency and ease of use, assign a single email address for all device lab setup and testing. This email address can be used for downloading apps from the native app stores and syncing those purchases across devices (making it much easier to make your devices consistent across platforms). Also, some apps need an email to login and use them for testing; having a single email address makes this easy to remember.

Figure out which major email apps your users use to open your newsletters, then set up the same apps on all of your devices. You can set them up using a central email address (it can be the same as your main email address for the lab!) on all these apps. This way, you can test HTML newsletters by sending one email to that address and see it populated across devices and their various mail applications.

Identification

Once you're done setting up the software on each device, it's time to set them up in the lab itself. If you have more than a handful of devices, it can be confusing for users to figure out where to return them in the lab after they've been using them. It can

Assign a unique name or number to each device, and adhere matching labels to the device and its place in the lab.

also be a challenge to remember which devices have which versions of operating systems. By assigning a unique name or number to each device, you can start organizing the lab and keeping better track of your assets.

Affix an asset tag or some physical identifier to the back of each device. This will make it easy to identify which device is which when a lab's user is returning it, and it also makes it much easier for you to keep track of what's what in the lab. Read more about our labeling system in *Chapter 5 – User Experience*.

This LG Optimus has a scannable asset tag – 2386. Note that it matches up with the label on the shelf. This makes it easy for us to track devices, but also easy for the lab's users to match a device back up to its place on the shelving. It also helps to differentiate multiple devices of the same make and model. If it's possible to change the default device name in its system, give it a name that will be easy to identify on a network. Up-front organization is key to saving you a ton of headaches down the road.

Device management over time

Now let's level up our device configuration game! With so many people sharing a single device for testing, it's pretty likely that someone will accidentally install or upgrade something that breaks the device or reduces its usefulness. If a device's software gets changed or broken, you'll want to have an easy way to get it back to its original configuration. The more devices you have, the more time

consuming this becomes if you're doing it by hand, one at a time.

You've got a few options for non-manual-device management. If you primarily have iOS devices, Apple offers *Apple Configurator* for free in the App store. Among other things, Apple Configurator allows you to essentially take a snapshot of an existing configuration, and then apply that image en masse to other iOS devices. From a Mac, you can use the app to:

- Erase and/or restore devices and install a specific iOS release

- Update the existing iOS version

- Backup and/or restore data from an existing snapshot (backup)

- Install and update apps (including internal apps for your org)

- License paid apps using Apple's Volume Purchase Plan for business or education

- Restrict devices from syncing to other computers

- Set a lock-screen image for your organization

This solution still requires you to physically plug in devices to a computer and use the program.

If you have a more diverse fleet of mobile devices (as you should!), you may want to consider remote device management.

Mobile Device Management (MDM) Systems

For roughly the first year of our device lab, we configured and administered all of the devices manually. As the device lab grew, so did the amount of (wo)man hours needed to manage our fleet. We looked for a more automated solution – something that would allow us to save time by centrally controlling and monitoring all of our devices – and Mobile Device Management (MDM) software appeared to be the answer. Though MDM software is costly and can be time-intensive to set up, it may be an overall more efficient solution for you if you are managing a larger device lab.

MDM products can be used to monitor, manage, and otherwise support devices across multiple service providers and platforms. Many MDM products support BYOD, short for *Bring Your Own Device*, which means you can manage company data and network security on the personal devices of employees. Some of the features we use in our lab are: installing and updating applications such as our internal app builds, applying network configuration settings, and requiring a lock screen passcode. Instead of manually setting up and maintaining devices, you can have an MDM do all the work over-the-air, removing the hassle of connecting a physical cable to each device. Switching to an MDM probably saved us days of work per month in device lab maintenance.

There are many MDM providers out there. We won't be recommending a particular solution, as they're not one-size-fits all. But let's go over the most important features you'll need to pay attention to when choosing your solution.

Scalability: Does this MDM solution have location-specific options? Does it have failover capability, or load balancing?

App management: Does it let you push app configuration? Can you pull app feedback/data from the devices? Can you separate managed and unmanaged data?

Admin console: What type of admin console does it have? Look for something that is cross-platform so that it's easy to access from the places that are crucial to your workflow. Maybe you need something web-based or desktop-based; maybe you want to manage your lab from an iOS device. Figure out which solution best offers you easy access.

User experience: Are the tools and interface intuitive? Can you see a demo and play around to make sure that the options and configurations are easily understandable?

Security: What happens if a device with private data gets into the wrong hands? Can you remotely wipe or lock a device? Does it have geofencing capabilities, such as the ability to trigger alerts if a device leaves a certain defined area?

There are many different MDM options out there, so we encourage you to do your own research to see what best fits your needs. If you have the time and budget, we do recommend investing in setting up an MDM, which will save you a ton of manual labor in managing the devices in your lab.

Now that you have your devices in hand and configured, it's time to connect them to a network for testing. There are some nuances and potential pitfalls in this step, so we'll dig deeper into network configuration best practices in the next chapter.

Chapter Summary

Usability tips

- Consistency is key across your devices. When a user picks up a device from the lab, they should be able to anticipate what apps will be on it and what version it has installed.

- By using a single email address for purchasing apps and testing email newsletters, you'll be able to simplify your configuration and testing workflows.

- Name or number each of your devices and affix a label or other physical identifier to each device, for easy management and maintenance.

- Configure browsers, security passcodes, and wallpapers to all be the same across devices, for ease of use.

Budget tips

- MDM (Mobile Device Management) software can be costly. If you're maintaining a large fleet of devices, consider budgeting extra for an MDM solution, to save you time and headaches.

4

Networking

The devices in your lab will need to connect to a network so that your lab's users can test their work. As mentioned in the first chapter, it's unlikely that you'll need cell service or a data plan for your devices; you should be able to just use Wi-Fi (unless you're testing something like performance on cellular networks). Surprisingly, there are still a few potential pitfalls when setting up and connecting to Wi-Fi networks for testing, especially if your lab's users are testing work on their development or staging environments. Read on for troubleshooting network issues and standardizing your network for ease of testing.

Unlocking devices

Some used devices, if not registered with a carrier, will arrive unlocked. But you may still have a blocker to testing on Wi-Fi: regardless of whether your device is unlocked, you may discover that you can't get past the activation screen to the Wi-Fi settings without a SIM card. We had this occur a handful of times when we'd purchase used devices. But don't worry – this is a challenge you can overcome!

You will likely have success searching online for the right way to bypass those activation screens. For example, on some Android devices, if you tap the screen in all four corners in a particular order, you're able to bypass activation and connect to Wi-Fi. We won't cover all the ways that you may need to try unlocking your devices, as they are really diverse across models, but Googling should help you find the best solution.

Setting up Wi-Fi

When setting up a Wi-Fi network, you can certainly just have devices connect to the same old network that everybody else uses in your workplace. However, we encourage you to consider creating a new, secured network that only your labs' devices can access. A private network will allow you to supply or limit access to different things on your network depending upon your device lab's needs, like development environments or a staging environment.

Additionally, it's easier to troubleshoot network issues when you have a separate network.

A customized network setup for your office and device lab could look something like this:

	Guest Network	Device Lab Network	Internal (Employee) Network
Basic Web	✓	✓	✓
Testing and staging environments		✓	✓
Internal sites, like Wikis and other Staff resources			✓

Example customized network setup for your office and device lab.

Originally, we planned on restricting access to our staging and testing environments only to devices that could connect to our VPN. However, we bumped into a major issue: some devices have a difficult time connecting to a VPN, and other devices (like the Firefox OS phone) don't have any VPN app or option for us to use. By creating a private network, you can circumvent the VPN limitations that those operating systems have.

Wi-Fi performance issues

After connecting devices to the private Wi-Fi network, we noticed an array of performance issues with some devices, such as:

- a decrease in the wireless range
- Wi-Fi connection was intermittent or would drop
- difficulty pairing with bluetooth
- data throughput speed was impaired

We learned that all of these symptoms stemmed from interference, or *noise* caused by having a large number of devices in close proximity, all using the same wireless signal.

The 2.4 ghz band is very common and many devices use this band, such as your wireless mouse or keyboard. Even appliances like a microwave oven or garage door opener operate on this band, so you can imagine how crowded it might become. Interference can be caused by many devices using the same band in close proximity. Naturally, in a typical office environment filled with lots of employees using lots of peripherals, you're going to encounter these same issues.

One study documented in an *Intel Whitepaper* found that USB 3.0 devices (such as an external hard drive) can cause noticeable degradation in wireless performance for other devices sharing the band. For example, a wireless mouse being used with a laptop that has a USB 3.0 device attached experienced lag and loss of smoothness.

So how can you solve for this issue? You would think with all these symptoms that maybe you'd want to boost the signal strength of the Wi-Fi. But in Etsy's office, the opposite turned out to be true. When we attempted to boost the signal strength, the Wi-Fi signal was too strong and ended up causing an overlap, which resulted in additional interference.

Unfortunately, there's no great single solution to this problem. Every office layout is different, but there are some things you can try to abate these Wi-Fi network symptoms:

- Move the devices closer to the Wi-Fi access point.

- Try to limit the amount of devices confined in a small space.

- Play around with different channels. There are three that 2.4 ghz can operate on.

Hopefully you'll be able to find a good balance of Wi-Fi signal strength, device lab location, and channels so that your device lab users will be able to continually test on the devices without issue.

Now that you have the devices, power, and network set up in your lab, it's time to focus on the most important piece: the usability of the lab. While it's true that you can just have a pile of devices and cables and call it a device lab, it's going to be really tough for users to dig through the devices to find what they're looking for, make sure it's charged, and easily test their work. You'll also find that without solid organization and maintenance of the lab, lots of unfortunate things may occur: cables may be *borrowed* long-term, people may not

return devices properly, devices can be messed with to the point of unusability, and more. In the next chapter, we'll focus on improving the usability of your lab, not just for ease of testing, but to reduce your headaches in the long term.

Chapter Summary

Usability tips

- Search online for ways to unlock your phone (to detach it from a carrier, if necessary), as unlocking techniques vary by device model.

- Consider setting up a private Wi-Fi network for your device lab, to facilitate testing and troubleshooting.

- If you run into Wi-Fi performance issues, try moving the devices closer to the access point or playing around with different channels.

User Experience

What elevates a good device lab to greatness? Usability. As developers, designers, and product managers, we think about our product's users all day. We develop user stories, we do user research, we iterate until we can develop the best user experience possible. When it comes to your device lab, think of your fellow coworkers as your end users. What can you do to make your lab as intuitive as possible for this audience?

Focusing on improving the UX of your lab has a number of terrific side effects: it eases your teammates' work, it makes the lab more inviting, and it makes your job easier in the long run.

That last side effect is an important one. In our first year of iterating on the device lab at Etsy, we encountered a number of surprises when we'd check in on our setup. We found devices with changed passcodes, networks, and wallpapers. We found devices with broken screens, missing batteries, and stolen cables. We discovered that people had connected personal email addresses and social media accounts, had accidentally upgraded operating systems, and so much more. Focusing on the ease of use of your lab will help more than your users; it'll help save you from a ton of headaches, too. We promise: usability should be your top priority as you finish building your device lab.

Hardware

Your devices aren't the only pieces of hardware in your lab. There are lots of opportunities for you to improve the usability of your lab between the wall and your devices. From cables to stands to screen wipes, organize the lab to ensure it's easy for people to pick out and return devices.

Cable management
The number one rule of thumb when it comes to cable management in your lab: make it easy to plug devices back in. It sounds simple,

Affix cables in the lab to make it as easy as possible to plug devices back in.

but we found that this tip massively increased the rate at which people returned devices properly to the lab. We had spent months trying to figure out why people just weren't returning devices to their proper place. Why leave cables dangling just a quarter inch above a device? Why not just ensure things are charging correctly? The fact is: people are lazy, and it's something you'll need to account for as you build the lab. When we started organizing cables better and making them easier to use, this went a long way to helping people do the right thing.

To start, make sure that there are enough cables for devices, and that the cables are always at-the-ready and plugged into a charging station. If a device's cable isn't dangling exactly where a person expects it, that person is very unlikely to completely plug the device back in. It's understandable; people are in a hurry, and they want to be able to drop their device and go. In an early version of our lab, we learned that if a cable had fallen behind the lab's shelving, or

if it wasn't clear which cable went to which device, our lab's users would just return devices by laying them down on a shelf without plugging them back in.

To combat this complication of battery drain and disorganization, we instituted new hooks and *cable drops* to make sure that cables stayed in place. Cable drops are small clamps that can be adhered to your lab to hug your cable in place. They helped us ensure that the end of a charging cable remained close to each device stand, making it much easier to plug devices back in when they're returned. Hooks on the back of shelves can also help keep cables organized and untangled.

In your lab, there will likely be devices with proprietary power cables, devices that overdraw, and devices that you might want to group together. Employ colorful washi tape or other kinds of labels on power bricks and cables to help keep things organized.

Group similar devices in your power chain. When we grouped
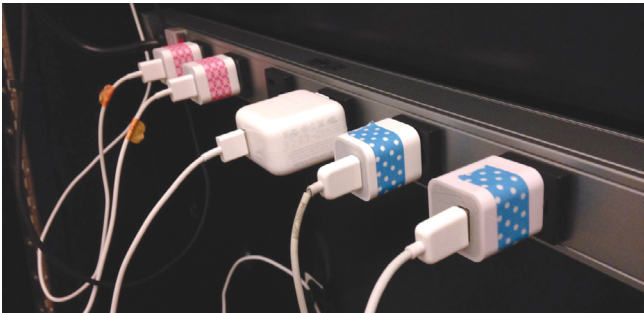
Label cables to make it easy to troubleshoot power issues and reorganize when necessary.

iOS devices along the same power supply and noted which cables went to iPhones and iPods and which went to iPads, we found it much easier to troubleshoot bogus cables and reorganize when necessary.

An added benefit of tying back cables and marking them is that they'll be much harder for your coworkers to borrow; fewer cables will go missing from your lab when your teammates need to recharge their personal phone. We found that by keeping our power strips and cables behind closed doors (rather than out in the open on shelves), we mitigated a lot of the cable attrition in the lab. Since it naturally occurs to people to check the lab when they forgot their personal charging cable at home, we chose to keep the lab stocked with a basket specifically for USB cables for them to borrow. If you go this route, plan on replenishing a basket like this every quarter or so.

Device stands

The second rule of thumb is: make it easy to return devices.

When people return devices to your lab, they'll have a choice about how nicely they place devices back. Your choice of device stands contributes to how successfully devices are returned, and you've got many options for good stand solutions.

You could purchase a number of individual stands for your devices in a range of sizes. We bought stands for all of our devices off of Etsy for an early version of the lab, and found that the style of device stands really has an effect on how organized or cluttered your lab looks.

An assortment of device stands with different materials, sizes, and styles.

Stands are rarely one-size-fits-all. Focus on purchasing easel-style stands which allow the device to lean on the stand to stay upright, especially if you have older devices (which tend to be thicker). If you have newer, thinner devices, try some stands that have a slot in the base for keeping devices upright. Remember to test any stands with larger devices to ensure they won't tip over in portrait and landscape modes.

The trick with using individual stands is that they'll get bumped around a lot and can look disorganized if they're not adhered to the shelf. You'll find that some people will leave devices on top of stands rather than standing upright in them, perhaps out of hurriedness or laziness. Perhaps they just didn't know which stand to use and made a quick (and poor) decision. Test a number of stands to see what works best for your lab and its user base, and

be sure to label things well. It should be as easy as possible to return devices properly in your lab; your lab's users shouldn't have to think too hard about where to put a device back, where its cable is, or how to place it in a stand.

In a later version of our device lab, we replaced the bookshelves and individual stands with shelving that has built-in stands. The newer lab's shelving sits at a slight angle, allowing devices to lean against the lab itself in a one inch-wide felt-lined gap. The gap is wide enough to accommodate a range of device sizes, and also

Build stands directly in to your device lab for more easy organization and testing.

allows us to move devices around and across shelves as we replace devices over time. This solution ended up looking cleaner for our needs, as we no longer had to deal with individual stands that unfortunately got bumped around often.

With this new kind of lab furniture, we also introduced holes wide enough for a range of device cables to fit through (including older 30-pin iOS cables). We found that this combination of cable management and shelving made it easier for people to return devices properly, and led to fewer headaches for us as we maintained the lab.

Things to steal

It's a device lab fact: people will steal (uh, *long-term borrow*) things from the lab. Earlier we mentioned providing extra cables for folks to grab; we also provide baskets for USB wall chargers and screen wipes, as people naturally come to the lab thinking we might have spares.

What goes in these buckets depends on your lab and your coworkers' needs. We found that people began to check the lab for

Provide extra cables, adapters, and screen wipes
for your lab's users to long-term borrow.

things like international power adapters, micro SIM cutters, and
other random things – so we started to supply them! The happier the
device lab can make people, the more they'll want to use it. We want
it to be as intuitive, friendly, and welcoming as possible, so that our
coworkers will be able to develop the best mobile user experience
possible for our site's users.

Device Organization

It can be handy to develop an organizational system for where they
each sit if you have more than a handful of devices in your lab. This
will help your lab's users easily find the devices they're looking for,
and return them properly later.

Group your devices

There are many ways to organize your devices. The key here is to be
consistent across shelves, such as grouping by:

- device size (handsets, small tablets, large tablets, etc.)

- operating system (Android, iOS, Windows, etc.)

- put the unique devices on the top shelf (Google Glass, Firefox OS,
Windows phone)

Grouping devices of like size together can help people who are
testing responsive designs and who need to borrow an array of

screen sizes. Grouping by operating system can also help people who are troubleshooting bugs on a particular platform, especially if you label devices by their operating system version.

Be sure to build in space so that you can add to the device lab over time. It should be easy to move devices around, decommission devices, and re-group devices if necessary. Again, build for ease of maintenance in the long-term!

Label everything

Good labeling makes it easy to pick out a device for testing and to match a device to its home base. You can go a little nuts with labeling (we sure did) but it's easy to start with the information that'll be the most helpful to your users. For our coworkers, the most helpful information was each device's name, operating system version, and ID number, labeled in a place that's easy to refer back to.

Maybe you want to name each of your devices; I know of one lab that named devices after United States presidents' dogs so it was easy to refer to each individually in conversation. At Etsy, we used the common device name like 'Samsung Galaxy S3' and included our asset number for the device (#1449) to help differentiate duplicate device models. We labeled the front of the shelf and the back of the device with the same exact wording so that it was really easy to match a device to its stand upon return. This also meant it was easy to connect the device name to what we were seeing in our analytics' visitor data.

Picking out devices can be harder for your device lab's users than returning them. To troubleshoot this, ask yourself why

your users are coming to use the lab. Are they on the support team, trying to reproduce a bug on a particular operating system version? Are they a designer who is beginning to figure out what a product should look like on smaller tablets? Are they a developer, implementing a responsive design for an HTML email? Depending upon these use cases, you may want to provide information nearby for each of your devices, such as:

- screen resolution

- pixel density

- operating system version

- primary email application

In earlier versions of our lab, we used library cards to list this information and placed them underneath each device. We included a cup of pencils so that people checking out devices could note what date they grabbed them. But the error rate here was high; people often forgot to sign their name, or thought they'd be right back and would forgo the sign-out process. It became clear that while our labeling solution was okay, our sign-out process needed

improvement.

Our next iteration, which solved a whole host of problems in addition to tracking devices, was to move to an online library of information about our lab devices. We created a database of devices and stored this same information on an internal site so that people could see at a glance what devices were available and which best suited their testing needs. We included the same kind of information that we'd had on the library cards – operating system version, screen size, pixel density, and more – but added *status* of whether the device was signed in or out, and by whom. Below is a screenshot of the device lab's home page, and each individual device name links to additional information about it:

Etsy Library

All Devices

[+ Add a New Device] [Device Stats]

Rank	Name	Asset ID	Kind	Operating System	Version	Status
47	HTC One	2421	Phone	Android	4.1.2	Elizabeth [Apr 1, 09:18]
41	Galaxy Nexus GSM	2061	Phone	Android	4.2.2	
40	Nexus S	2045	Phone	Android	4.0.4	
38	Google Glass	2927	Phone	Android		
37	Galaxy S4	2423	Phone	Android		Kristyn [May 20, 10:14]
25	Kindle Fire HD (2nd gen.)	2153	Tablet	Kindle	7.3.1	
25	LG Optimus L5	2386	Phone	Android	4.0.3	
23	Nexus 7	2449	Tablet	Android	4.3	
23	Kindle Fire (1st gen.)	2047	Tablet	Kindle	6.3.2	
23	Windows Surface	2364	Laptop	Windows	6.2.9200	Jocelyn [Apr 14, 11:08]
22	HTC 8X	2422	Phone	Windows	8.0.9903.10	Dan [Apr 4, 15:56]
21	Kubi (6833A7)	3148	Other	n/a		Allison [May 19, 13:01]
21	Raspberry Pi (inky)	1002	Other	n/a		

Provide information about your lab's devices in an easy-to-access way so users know what is available for their testing needs.

So how did we figure out who had checked out a device last? By implementing an electronic checkout system that integrated with our employee key cards, it's been easier for people to remember to check in and out devices, and easier for us to gather data about device lab usage.

For this electronic checkout system, Etsy's Office Hackers made a custom Radio-Frequency Identification (RFID) system. They programmed a Raspberry Pi to work with the reader that was plugged into our network via ethernet. Each device got its own RFID tag so that it could be uniquely identified.

When an employee wants to check something in or out, all they need to do is tap the device, then tap their employee badge, on the RFID reader! This data is sent over our network, where internal users can access this dashboard, which shows when a device was last checked out and by whom. You can read more about this setup in the office hackers' *Code as Craft blog post*, and check out their *open sourced checkout system code*. In our case, the Raspberry Pi lives in a *stump* hand crafted by an Etsy seller, which adds a new level of friendliness and uniqueness to the lab, making people want to *bump the stump* with their employee badges to see the system light up.

Whether you use library cards or something more high-tech to keep track of devices, the ease of checking devices in and out of the lab is crucial for its overall usability (and your stress levels).

Document a how-to

It's true that people rarely read information until they absolutely need it. When it comes to the device lab, we started gathering the most typical questions we get when people go to use it for the first time without reading up about it first. It's become hugely beneficial to have a central wiki page that includes:

- passcodes (which are the same for every device to improve ease of use)

- instructions for testing on development and staging environments

- instructions for taking screenshots and checking email on various operating systems

As mentioned in *Chapter 3 – Device Setup and Configuration*, we also set up email applications across devices so that our marketing team can test newsletter designs. We use a common email address across all devices so that the team can send once and test everywhere. Install a default email client and any other major email applications that your audience uses on your devices to make it even easier to test at a glance.

Put reminders everywhere

To stave off headaches, you'll likely need to constantly remind people to not upgrade applications or operating systems, as well as remind folks to check out their devices. By 'constantly', we mean on the walls near the lab, as wallpaper on the devices, and on all documentation.

It's true that reminders aren't going to work every time. It's also true that positive reminders work much better than angry reminders – aim to use the carrot, not the stick! We like to kindly remind folks to not upgrade things, and we place that reminder right next to an invitation to reach out to us, with clear contact information, if someone has a question or something in the lab seems not-quite-right. The more inviting you can be, the more likely it is that someone will come forward truthfully when something breaks or gets lost. This is time saved in detecting something's awry, and will also save you many headaches in the long run.

Software

It should be really easy for your coworkers to use the devices in your lab, and equally easy to not mess anything up on a device. In addition to the initial configuration tips listed in Device Setup, we recommend some additional steps to save you and your lab's users time and energy.

Keep passwords a secret
The device unlock passcodes should all be the same and well-known to your coworkers. But don't tell anybody who's not a device lab administrator:

- app store passwords, as you don't want surprise app downloads on your devices.

- email passwords, as you don't want anybody to change the email testing setup across your devices.

- Wi-Fi network password, if you're using a private network specifically for the device lab, as you don't want to compromise the security of the lab.

Make it easy to test

Mobile device testing shouldn't just happen for work that's made it to production. Your lab will come in handy when designers and developers want to test what they're currently working on to see how it performs across various screen sizes and operating systems.

If your coworker tries to visit their virtual machine from a device in your lab, it should render as expected, like it does on their laptop. This means ensuring that necessary security certificates are installed and that the Wi-Fi network that the lab uses allows access to testing and staging environments.

If you use a tool like Adobe Edge Inspect to test across many devices at once from one primary browser, you'll probably need to manually connect to each of those devices one by one. This can get really annoying if you're visiting the lab for the first time to use Adobe Edge Inspect and need to connect your laptop's browser to each individual device running the app by typing in each device's pin.

To circumvent this, you can include a cheaper laptop in your lab that can be checked out for testing too. Connect this laptop to all of those devices once, and let people know that they can use this

laptop for Adobe Edge Inspect rather than their personal one to avoid the hassle of setup! If you go this route, choose a laptop type that isn't typically used by the people in your organization so that it's an additional option for routine desktop testing needs.

Manage with a MDM

In *Device Setup*, we covered what to look for in a good mobile device management solution (MDM). If you go this route, use your MDM to routinely check on the operating system versions of your devices and the apps installed. If necessary, reset devices from your MDM to clean them up; it's inevitable that someone has accidentally installed or upgraded something on a device. Keeping the installed applications to a short list will be helpful in keeping the lab manageable, and consistency across devices reduces surprises in the testing process.

Check the lab regularly

In addition to routinely checking in with your mobile device management solution to ensure that things haven't been upgraded or installed on your devices, visit your lab routinely to check out how it's faring. On the next page is a checklist to run through with each device; we find that although a visual spot-check is helpful for devices, you should also unlock and check each individual device to find and fix additional surprises. *Appendix C* covers this as well as quarterly checkups on your lab.

- Is the device missing from the shelving but not checked out in your system? When was the last time it was checked out correctly? Does the last person to check it out still have it?

- Are there any new scratches, bumps, or broken glass on the device?

- Is the device plugged in? Is it actually charging? Sometimes devices will be plugged in but have a faulty cable, leading to the false appearance of charging correctly.

- Does the passcode still work? (Surprisingly, people have changed the passcodes in our lab's devices, for unknown reasons.)

- Is the device connected to the right Wi-Fi network?

- Is this device's operating system version still accurate?

- Have any new applications been installed?

- Has anyone connected their personal accounts (Facebook, Twitter, etc.) to the installed apps?

- Do the mail applications still use the correct device lab email address?

Doing a routine check (at least once per week) will help you find and troubleshoot issues quickly. It's unfortunate, but people are often reluctant to report issues in the lab right away, as they don't want to be blamed for someone else's mistake or misuse of the lab. Checking the lab routinely will also make it easier for you to track down missing devices; the longer the disappearance, the less likely it is that you'll find it again.

Keep it inviting

A good-looking lab is inviting. New hires see it on their tour of the office, and guests want to check it out and see how it works. Existing coworkers don't want to work next to clutter. And the more organized the lab is, the more likely your coworkers will want to use it and put stuff back properly!

Keep it clean and organized. Make sure that labels are intuitive and helpful. Tie back and hide cabling, space out devices, and wipe down their screens once in a while. Keep the screens facing out towards your lab's users. Keep your signage helpful and simple.

Collaboration

Make it really easy to collaborate near your lab! People often want to test their work on devices and get feedback as they tweak. We've also seen plenty of people share learnings with others sitting near them as they test; we found that the lab has been integral to our adoption of a mobile-first development approach as people talked with each other as they developed near the lab.

To aid this kind of collaboration, set up comfortable seating nearby. A couch, comfy chairs, or other grouped seating is helpful. Nearby long tables can be handy, too, so people can set up their laptops and don't have to walk far to make changes to their code as they test.

Make sure additional outlets are available for people to plug in their own laptops; you don't want people to unplug devices so that they can work nearby. Ensure that people don't have to walk

back to their desks to test their work. The easier it is to set up and collaborate near the lab, the better!

These usability tips will help you empower your teammates to do their best work. By testing your site and apps on real physical devices, designers and developers can get a significantly better understanding of the real user experience you are crafting. By collaborating, learning from each other, and continuing to improve on the lab over time, you and your teammates will be equipped with the tools you need to stay ahead of the ever-changing mobile landscape.

Chapter Summary

Usability tips

- Make it easy to plug devices back in.

- Make it easy to return devices to their rightful place in a stand or on a shelf.

- Supply spare USB cables as well as screen wipes, USB wall chargers, and anything else people may want to *long-term borrow*.

- Group your devices consistently across shelves, in a way that's intuitive for your device lab's users.

- Label your devices and provide helpful information about them nearby.

- Make it easy to check in/check out devices.

- Document a how-to that's easy to share with others about your device lab, and put reminders about best practices everywhere around the lab.

- Make it easy to test in-development work on the devices.

- Routinely check in on the lab to suss out any issues and remedy them.

- Keep the lab inviting and make it easy for people to collaborate nearby.

Budget tips

- Budget for spare USB cables and anything else people may want to long-term borrow.

- If possible, budget for comfortable seating near the lab.

- You may also want to budget for an electronic check-out system for ease of maintenance.

Resources

Appendix A: Online resources

Etsy's Device Lab Setup

- Blog Post: *Etsy's Device Lab*

- Slides and Video: *Building a Device Lab Tutorial*

- Video: *Automated testing in Etsy's apps presentation*

Choosing Devices

- Blog Post: *Additional tips on choosing devices*

- Blog Post: *How to build a device lab, with a thorough bit on choosing and acquiring devices*

Power

- *Modlet*

Device Setup and Configuration

- *List of MDM providers*

- Tutorial: *Preview and inspect web designs on devices with Adobe Edge Inspect*

Networking

- *Intel Whitepaper on Signal Interference*

User Experience

- Blog Post: *Device Lab Checkout - RFID Style*

- Github Repository: *Low Frequency RFID check out/in client for Raspberry Pi*

Appendix B: Budget

Though devices will make up the largest portion of your lab's budget, there's some more equipment and software that you'll want to invest in. On the facing page, we've outlined must-have items, and some recommended items to budget for as you upgrade and improve your lab over time.

Plan for replenishing your supplies of things to borrow quarterly, around the same time as you check your analytics to see if there's been a shift in the kinds of devices your users are using to access your site. Routinely checking in and upgrading your lab is a great idea, as it'll be a good time to iterate on its usability and gather some data from your coworkers on how it can be improved.

Category	Highly recommended item	Reason
Power	Power strips, USB hubs	Maintainable power chain
Power	Spare micro USB and iOS cables	Troubleshooting; Consistency Supply for people to borrow from the lab
Labeling	Asset tag or other physical identifier	Device maintenance and organization
Shelving	Shelving with stand built-in, or individual device stands	Device organization and ease of use

Category	Optional item	Reason
Power	Modlet	Measuring energy consumption of the lab
Power	Cable drops, hooks, or ties	Organization of cabling
Labeling	Labels on shelves for devices	Device maintenance and organization
Software	Mobile Device Management Software	Device maintenance and organization
Software	Device check-out system, and/or library of all the devices' specifications	Device tracking and organization
Software	Adobe Edge Inspect	If you want to upgrade your license for more functionality
Shelving	Crates/buckets for spare cables, screen wipes, or other things for folks to long-term borrow (steal)	Supply for people to borrow from the lab

Appendix C: Routine Check-ups

Routine maintenance will save you a ton of headaches in the long run, and will help your device lab's users have the best experience possible. Check in on the device lab weekly to make sure there aren't any major issues with devices, and quarterly to iterate on the efficacy of the lab.

Time Frame	Check on
Weekly	Have any operating systems or applications been upgraded?
Weekly	Is any device missing from the shelving but not checked out in your system?
Weekly	Are there any new scratches, bumps, or broken glass on the devices?
Weekly	Is every device plugged in and charging?
Weekly	Does every passcode still work?
Weekly	Is every device connected to the right Wi-Fi network?
Weekly	Have any new applications been installed?
Weekly	Has anyone connected their personal accounts (Facebook, Twitter, etc.) to the installed apps?
Weekly	Do the mail applications still use the correct device lab email address?
Quarterly	Check your site's visit traffic. What devices might you need to budget for next quarter?
Quarterly	Check your device lab's usage. Are there any popular devices that are always checked-out? Should you purchase more of them so that coworkers have more access for testing?
Quarterly	Purchase new devices based on last quarter's visit traffic trends.
Quarterly	Are devices grouped well? Should there be space made for new devices, or should devices be decommissioned?
Quarterly	How are devices looking? Go through and screen wipe everything, fix iffy labels, realign cabling.
Quarterly	How much energy is the lab consuming? Have usage behaviors changed? Can you optimize for better energy efficiency?
Quarterly	How full are the bins for cables and other items for coworkers to "borrow"? Should they be replenished?
Quarterly	Survey your device lab's users. How are they finding the experience? Is there anything that could be improved upon?