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Hacks, Leaks, and Revelations

The Art of Analyzing Hacked and Leaked Data

CONTENTS

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INTRODUCTION

Unlike any other point in history, hackers, whistleblowers, and archivists now routinely make off with terabytes of data from governments, corporations, and extremist groups. These datasets often contain gold mines of revelations in the public interest, and in many cases are freely available for anyone to download. Yet these digital tomes can prove extremely difficult to analyze or interpret, and few people today have the skills to do so.

I wrote this book for journalists, researchers, hacktivists, and anyone else who wants to learn the technologies and coding skills required to investigate these troves of hacked or leaked data. I don't assume any prior knowledge. Along with lessons on programming and technical tools, I've incorporated many anecdotes and firsthand tips from the trenches of investigative journalism. In a series of hands-on projects, you'll work with real datasets, including those from police departments, fascist groups, militias,

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a Russian ransomware gang, and social networks. Throughout, you'll engage head-on with the dumpster fire that is 21st-century current events: the rise of neofascism and the rejection of objective reality, the extreme partisan divide, and an internet overflowing with misinformation.

By the end of the book, you'll have gained the skills to download and analyze your own datasets, extracting the revelations they contain and transforming previously unintelligible information into your own groundbreaking reports.

Why I Wrote This Book

I've worked as an investigative journalist for The Intercept since 2013, reporting on a large variety of leaked datasets. The first dataset I cut my teeth on was the Snowden Archive: a collection of top-secret documents from National Security Agency whistleblower Edward Snowden revealing that the NSA spies on pretty much everyone in the world who uses a phone or the internet. I wrote a dozen articles and helped publish over 2,000 secret documents from that dataset, helping bring the issues of privacy and government surveillance to the forefront of public consciousness and leading to the widespread adoption of privacy-protecting technologies.

Huge data leaks like these used to be rare, but today they're increasingly common. In my work at The Intercept, I encounter datasets so frequently I feel like I'm drowning in data, and I simply ignore most of them because it's impossible for me to investigate them all. Unfortunately, this often means that no one will report on them, and their secrets will remain hidden forever. I hope this book helps to change that.

Revelations based on leaked datasets can change the course of history. In 1971, Daniel Ellsberg's leak of military documents known as the Pentagon Papers led to the end of the Vietnam War. The same year, an underground activist group called the Citizens' Commission to Investigate the FBI broke into a Federal Bureau of Investigation field office, stole secret documents, and leaked them to the media. This dataset mentioned COINTELPRO. NBC reporter Carl Stern used Freedom of Information Act requests to publicly reveal that COINTELPRO was a secret FBI operation devoted to surveilling, infiltrating, and discrediting left-wing political groups. This stolen FBI dataset also led to the creation of the Church Committee, a Senate committee that investigated these abuses and reined them in. More recently, Chelsea Manning's 2010 leaks of Iraq and Afghanistan documents helped spark the Arab Spring, and documents and emails stolen by Russian military hackers helped elect Donald Trump as US president in 2016.

As you make your way through this book, you'll download a variety of real hacked and leaked datasets for yourself, learning how they're structured and how to extract their secrets—and perhaps, someday, you'll change history yourself. You'll read stories from many more datasets as well, some of which are private and not available for the public to download.

What You'll Learn

This book is split into five parts, with each building on the previous part. You'll begin with security and privacy considerations, including how to verify that datasets are authentic and how to safely communicate with sources. You'll then work with datasets in your computer's terminal and on remote servers in the cloud and learn how to make various kinds of datasets searchable, including how to scour email dumps for information. You'll get a crash course in Python programming, with a focus on writing code to automate investigative tasks. These coding skills will allow you to analyze datasets that contain millions of files, which is impossible to do manually. Finally, I'll discuss two exciting real-world case studies from some of my own investigations.

The following outline describes each chapter in greater detail.

Part I: Sources and Datasets

Part I discusses issues you should resolve before you start analyzing datasets: how to protect your sources, how to keep your datasets and your research secure, and how to acquire datasets safely.

In Chapter 1, you'll learn about how to protect your sources from retaliation. This includes how to safely communicate with sources, how to store sensitive datasets, and how to decide what information to redact. It also covers the critical step of how to authenticate datasets, using the example of chat logs from WikiLeaks and patient records from a far-right anti-vaccine group. You'll learn how to secure your own digital life, and by extension, how to secure the data-driven investigations you're working on. This includes using a password manager, encrypting hard disks and USB disks, sanitizing potentially malicious documents using the Dangerzone application, and more.

In Chapter 2, you'll learn how to acquire copies of hacked and leaked datasets. I'll introduce Distributed Denial of Secrets (DDoSecrets), a transparency collective I'm involved with that hosts copies of all of the datasets you'll work with in this book, and you'll learn how to download datasets from DDoSecrets using BitTorrent. I'll explain several ways to acquire datasets directly from sources and introduce security and anonymity tools like Signal, Tor Browser, OnionShare, and SecureDrop. As an example, I'll explain how I communicated with a source who leaked data from the conservative activist group Tea Party Patriots.

You'll also download a copy of the BlueLeaks dataset, one of the primary datasets you'll work with in this book. BlueLeaks is a collection of 270GB of data hacked from hundreds of US law enforcement websites in the summer of 2020, in the midst of the Black Lives Matter uprising. As you'll see, it's full of evidence of police misconduct. BlueLeaks has been widely covered in the press, but most of it hasn't been reported on yet. By the end of this book, you'll have the tools you need to conduct your own BlueLeaks investigations.

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Part II: Tools of the Trade

In Part II, you'll practice using the command line interface (CLI) to quickly assess leaked datasets and to use tools that don't have graphical interfaces, developing skills you'll apply extensively throughout the rest of the book.

In Chapter 3, you'll learn the basics of controlling your computer through CLI commands, as well as various tips and tricks for quickly measuring and searching datasets like BlueLeaks from the command line. You'll also write your first shell script, a file containing a series of CLI commands.

In Chapter 4, you'll expand your basic command line skills, learning new commands and setting up a server in the cloud to remotely analyze hacked and leaked datasets. As an example, you'll work with the Oath Keepers dataset, which contains emails from the far-right militia that participated in a seditious conspiracy to keep Trump in power after he lost the 2020 election.

In Chapter 5, you'll learn to use Docker, technology that lets you run a variety of complex software crucial for analyzing datasets. You'll then use Docker to run Aleph, software that can analyze large datasets, find connections for you, and search the data for keywords.

Chapter 6 focuses on tools and techniques for investigating email dumps. You'll read emails from Nauru Police Force about Australia's offshore detention centers, including many messages about refugees seeking Australian asylum, and from the president of Nauru himself. You'll also investigate emails from a conservative think tank called the Heritage Foundation, which include homophobic arguments against gay marriage. Using the skills you learn, you'll be able to research any email dumps you acquire in the future.

Part III: Python Programming

In Part III, you'll get a crash course in writing code in the Python programming language, focusing on the skills required to analyze the hacked and leaked datasets covered in future chapters.

Chapter 7 introduces you to basic programming concepts: you'll learn to write and execute Python scripts and commands in the interactive Python interpreter, doing math, defining variables, working with strings and Boolean logic, looping through lists of items, and using functions.

Chapter 8 builds on the Python fundamentals covered previously. You'll learn to traverse filesystems and work with dictionaries and lists. Finally, you'll put theory into practice by writing several Python scripts to help you investigate BlueLeaks and explore leaked chat logs from the Russian ransomware gang Conti.

Part IV: Structured Data

In Part IV, you'll learn to work with some of the most common file formats in hacked and leaked datasets.

In Chapter 9, you'll learn the structure of the CSV (comma-separated value) file format, viewing CSV files in both graphical spreadsheet software and text editors. You'll then write Python scripts to loop through the rows

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of a CSV file and to save CSV files of your own, allowing you to further investigate the CSV spreadsheets in the BlueLeaks data.

Chapter 10 introduces a custom application called BlueLeaks Explorer that I developed and released along with this book, outlining how I built the app and showing you how to use it. You can use this app to investigate the many parts of BlueLeaks that haven't yet been analyzed, hunting for new revelations about police intelligence agencies across the United States. If you ever need to develop an app to investigate a specific dataset, you can also use this chapter as inspiration.

Chapter 11 focuses on the JSON file format and the Parler dataset of over a million videos uploaded to the far-right social networking site Parler, including thousands of videos of the January 6, 2021, insurrection at the US Capitol. This dataset includes metadata for each video in JSON format, including information like when the video was filmed and in what location. Some of these videos were used as evidence during Donald Trump's second impeachment inquiry. You'll write Python scripts to filter through these videos and plot the GPS coordinates of Parler videos on a map, so you can work with similar location data in future investigations.

In Chapter 12, you'll learn to extract revelations from SQL databases by working with the Epik dataset. Epik is a Christian nationalist company that provides domain name and web hosting services to the far right, including sites known for hosting the manifestos of mass shooters. The Epik dataset contains huge databases full of hacked customer data, along with the true ownership information for domain names for extremist websites—information that's supposed to be hidden behind a domain name privacy service. You'll use your new skills to discover domain names owned by one of the people behind QAnon and the far-right image board 8kun. If you're interested in extremism research, the Epik dataset might be useful for future investigations.

Part V: Case Studies

Part V covers two in-depth case studies from my own career, describing how I conducted major investigations using the skills you've learned so far. In both, I explain my investigative process: how I obtained my datasets, how I analyzed them using techniques described in this book, what Python code I wrote to aid this analysis, what revelations I discovered, and what social impact my journalism had.

In Chapter 13, I discuss my investigation into America's Frontline Doctors (AFLDS), a right-wing anti-vaccine group founded during the COVID-19 pandemic to oppose public health measures. I'll explain how I turned a collection of hacked CSV and JSON files into a major news report, revealing that a network of shady telehealth companies swindled tens of millions of dollars out of vaccine skeptics. My report led to a congressional investigation of AFLDS.

In Chapter 14, I describe how I analyzed and reported on massive datasets of leaked neo-Nazi chat logs. I also discuss my role in developing a public investigation tool for such datasets, called DiscordLeaks. This tool aided in a successful lawsuit against the organizers of the deadly Unite the Right rally in 2017, resulting in a settlement of over $25 million in damages against the leaders of the American fascist movement.

Appendixes

Appendix A includes tips for Windows users completing the exercises in this book to help your code run more smoothly. Appendix B teaches you *web scraping*, or how to write code that accesses websites for you so that you can automate your investigative work or build your own datasets from public websites.

What You'll Need

This book is an interactive tutorial: every chapter other than the case studies in Part V includes exercises. Many later exercises require you to have completed earlier ones, so I recommend reading this book sequentially. For example, in Chapter 2, you'll encrypt a USB disk to which you'll download a copy of the BlueLeaks dataset in Chapter 3.

Read this book with your computer open next to you, completing the exercises and trying out technologies and software as you learn about them. The source code for every assignment, as well as the code used in case studies and appendixes, is available in an online repository organized by chapter at *https://github.com/micahflee/hacks-leaks-and-revelations*.

To make this book as accessible as possible, I've tried to keep the requirements simple and affordable. You will need the following:

- **A computer that's running Windows, macOS, or Linux.** Windows is very different from macOS and Linux, but I'll explain all the extra steps Windows users will need to take to set up their computers appropriately. If you're a Linux user, I assume that you're using Ubuntu; if you're using a different version of Linux, you may need to slightly modify the commands.
- **A USB hard disk with at least 1TB of disk space.** You'll use this to store the large datasets you'll work with.
- **An internet connection that can download roughly 280GB of datasets and several more gigabytes of software.** If you live in a country with decent internet service, your home internet should work fine, though it may take hours or days to download the largest datasets in the book. Alternatively, you might find more powerful internet connections at local libraries, coffee shops, or university campuses.
- For the two exercises in which you'll work with datasets from servers in the cloud, you'll also need **a few US dollars (or the equivalent) and a credit card** to pay a cloud hosting provider.

Now grab your laptop, your USB hard disk, and perhaps a coffee or tea, and get ready to start hunting for revelations.

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PART I

SOURCES AND DATASETS

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1

PROTECTING SOURCES AND YOURSELF

Most of us aren't very aware of it, but we're all under surveillance. Telecom companies and tech giants have access to a massive amount of private data about everyone who uses phones and the internet, from our exact physical locations at any given time to the content of our text messages and email, and they can share this data with leak investigators.

Even when our private data doesn't get sent directly to tech companies, our devices still record our every move locally. Can you name every single web page you visited last month? Your web browser probably can, and so can web trackers that follow your activity across the internet.

In addition to the constant background surveillance that everyone faces, workers with access to sensitive datasets are often under even stricter corporate or government surveillance. Their work computers and phones come preinstalled with spyware that monitors everything the employees do. Database systems keep track of exactly who searches for which search terms and when, and which documents they open, download, or print.

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It's in this environment that ordinary people find themselves becoming sources. Through the course of their work, they witness something unethical or disturbing. They might make a folder with incriminating documents, or take screenshots of the company chat, or do some searches on internal databases to learn more and make sure their suspicions are correct. They might email themselves some documents or copy files to a USB stick that they plug into their work computer. They might text their friends or family for advice while thinking about what to do next. Most sources aren't aware of the massive digital trail that they've already left by the time they reach out to a journalist or regulator.

In this chapter, you'll learn about protecting sources and securing the datasets you obtain from them. I'll go over the editorial and ethical considerations involved in redacting documents and deciding what information to publish, as well as where you should store datasets based on how sensitive they are. I'll show you how to verify that datasets are authentic, describing how I've done so in the past for hacked data from COVID-19 pandemic profiteers and chat logs from WikiLeaks. Verifying the authenticity of datasets is not only important to writing accurate stories but also critical to protecting your reputation as a journalist. Finally, you'll learn how to use password managers, encrypt disks, and protect yourself from malicious documents.

Safely Communicating with Sources

Because everything we do leaves a data trail, protecting sources is complicated and difficult. After you publish a blockbuster report based on information you've obtained from an anonymous whistleblower, you should expect the target of your investigation to launch an investigation of their own into your source's identity. The balance of power between a confidential source and the investigators on their trail is extremely asymmetric. If you're a journalist or researcher trying to protect your source, even doing all the right things perfectly isn't always enough. Because so much of source protection is beyond your control, it's important to focus on the handful of things that aren't.

As a journalist or researcher, verifying that data you've obtained is authentic is one of your core responsibilities. The simplest way to authenticate documents is to ask the company or government that produced them if they're real, but this is fraught with risk to your source. In some cases, you don't want to give up any details that might reveal your source's identity. I'll discuss this further in the "Authenticating Datasets" section later in the chapter. You also might not want to reveal that specific documents have been leaked, a topic you'll learn more about in this chapter's "Redaction" section.

In this section, I'll describe which sources face risks and which don't, as well as strategies for reducing those risks. I'll also discuss the differences between working with confidential sources who have legitimate access to inside information and hackers who break the law to obtain it. It's important to carefully consider how your own choices as an investigator could impact your source, preferably before you even begin speaking with one.

Working with Public Data

Some datasets don't pose any risk to the source at all. When the government publishes a set of documents in response to a public records request or when documents are made public as part of a lawsuit, you can include as much of the data as you like in your report. This data might contain revelations that powerful people don't want anyone to know, but sharing those won't put anyone at risk of retaliation, since the data is already public.

Similarly, you don't need to worry about source protection for datasets that may contain sensitive data but are public and widely available, such as the BlueLeaks dataset you'll download in Chapter 2. Any information you discover from that dataset has already been scoured by the FBI investigators trying to determine who the hacker was. In these cases, it doesn't matter how many people had access to the documents. There's no chance of accidentally burning your source by providing too many details to a government or corporate media office when you ask if the data is real and if they have a statement. Since the dataset is already public, any damage to the source has already been done.

Protecting Sensitive Information

If you're dealing with a dataset from a *confidential* source, revealing their identity could cause your source to be fired, arrested, or even murdered. The most basic step you should take to protect your source is to simply not talk about them with anyone that isn't closely collaborating with you on your investigation. Don't post to social media any details about your source that you're not planning on making public, don't talk about them to your friends at parties, and don't even talk about them to colleagues who aren't involved in the investigation.

If you're interviewing a company or government agency about a leaked dataset you've obtained, don't give them any details about your confidential source, even if they directly ask. If you get arrested and the police are demanding to know who your source is, you have the right to remain silent, and you should exercise it: don't give the police any information they don't already have. The only time that you're obligated to reveal information about your source is if a judge orders you to—and even then, you can resist it.

Minimizing the Digital Trail

Be sure to leave the smallest digital trail possible when communicating with your source. As much as you can, avoid communication by email, SMS messages, phone calls, direct messages in social media apps, and so on. Don't follow your confidential source on social media, and make sure they don't follow you.

If you must send messages or make calls, use an encrypted messaging app like Signal, which I'll cover in Chapter 2, and make sure your source

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deletes any records of their chats with you. You'll often need to record what your source told you in order to report on it, but take steps to protect those records, such as removing them from messaging apps on your phone and keeping them locally on your computer rather than in a cloud service. If you no longer need your own records of conversations after you've published your report—for potential follow-up stories, for example—then delete them.

Make sure your source knows not to search the internet for you or for the reports you've published in a way that could be associated with them. Google search history has been used as evidence against sources in the past. For example, in 2018, Treasury Department whistleblower Natalie Mayflower Sours Edwards was indicted for allegedly providing a secret dataset to BuzzFeed journalist Jason Leopold. The documents she was accused of leaking detailed suspicious financial transactions involving Republican Party operatives, senior members of Donald Trump's 2020 election campaign, and a Kremlin-connected Russian agent and Russian oligarchs. During the leak investigation, the FBI obtained a search warrant to access her internet search history, and her indictment accused her of searching for multiple articles based on the contents of her alleged leaks shortly after they were published.

Working with Hackers and Whistleblowers

The steps you must take to protect your source vary greatly depending on the person's technical sophistication. Not all sources are *whistleblowers*, people with inside access to datasets or documents who leak evidence of wrongdoing for ethical reasons. Sometimes your source may be a *hacktivist* who wants to bring down companies or government agencies that they find unjust.

Unlike most whistleblowers, hackers tend to understand that they're under surveillance and that everything they do leaves a digital trail, so they usually take countermeasures to hide their tracks. It's common for whistleblowers to reveal their identities to journalists for verification reasons, even if they aren't publicly named, but hackers typically remain fully anonymous. However, hackers can often provide technical information you can use to independently authenticate a dataset using open source intelligence. As with any source, you can't necessarily trust what hackers tell you, but their expertise can help you independently verify that the data they sent you is authentic. For these reasons, there's often less risk to your source when you publish documents from hackers rather than from whistleblowers.

When communicating with a hacker source, it's important that you stick to your role as a journalist or researcher. In the US, you're not breaking any laws just by speaking with a source who's a hacker, but *your source is almost certainly breaking laws* by hacking into companies or governments and stealing data. Don't do anything that could be construed as conspiring with them. For example, don't ask them to get specific data for you; let them give you whatever data they choose. If you're a journalist working with an established newsroom, you might fare better against legal threats than a freelancer would. While everyone should be protected equally under the law, newsrooms often have resources like lawyers and defense funds. When you're not sure whether something you're doing could get you in trouble, consult a lawyer.

Sometimes sources pretend to be hacktivists or whistleblowers but are actually state-sponsored hackers. For instance, Russian military hackers posed as hacktivists when they compromised the Democratic Party and Hillary Clinton's presidential campaign in 2016, interfering with the US election by sending hacked datasets to WikiLeaks. This sort of dataset might be authentic and newsworthy, but you don't want to end up being a pawn in someone else's information warfare. If you're unsure about your source's credibility or believe that they might have ulterior motives—or if you're confident that they're being dishonest with you—it's important to mention your skepticism about your source, and why you have doubts, in your reporting. WikiLeaks did the opposite: it insisted its source wasn't Russian intelligence when it knew otherwise, and it even spread the conspiracy theory that Seth Rich, a Democratic Party employee who was murdered, was the group's real source, leading to years of harassment against Rich's family members.

Secure Storage for Datasets

As you prepare to receive a dataset from a source, first assess how sensitive you think that dataset is, since this will inform how you should go about protecting it, as well as how you'll continue protecting your source. As mentioned, some datasets are completely public, while others are highly classified national security secrets, and others are somewhere in between. You might encounter a dataset with unique challenges that doesn't fit into one of these categories, but in general, there are three different levels of sensitivity: low, medium, and high.

Low-Sensitivity Datasets

A dataset might be low sensitivity if it meets one of the following criteria:

- It's already completely public, such as documents in response to a public records request or public datasets that anyone can download from a transparency collective like Distributed Denial of Secrets. (You'll learn more about DDoSecrets in Chapter 2.)
- Law enforcement or an adversarial corporation has already gained access to the dataset, meaning how you store it won't lead to retaliation against your source.
- It doesn't contain *personal identifiable information*, or *PII*, which I describe in detail in the "Redaction" section.

Basically, if you can't think of any harm that would result if a given dataset is shared more widely than you intended, including with law enforcement or leak investigators, it's probably low sensitivity.

It's safe to work with low-sensitivity datasets in *the cloud*, by which I mean storage services like Google Drive, iCloud, and Dropbox; hosting services like Amazon Web Services (AWS); and any other service where anyone besides you and the people you're working with will have access to the data. Cloud services are all vulnerable to legal requests, however, so if you're investigating governments or corporations with powerful lawyers, they can send subpoenas to cloud providers to get data associated with your account. Additionally, the data you store in the cloud is only as safe as your account itself. Make sure you have a strong password and turn on features like two-factor authentication to make your account significantly more difficult to hack.

Medium-Sensitivity Datasets

Most datasets that aren't low sensitivity are medium sensitivity; that is, they're not already public, but securing them doesn't require you to go to extreme measures. For example, a dataset I describe later in this chapter that includes medical records of hundreds of thousands of patients is medium sensitivity. These datasets should be stored on disks that are *encrypted*, or locked in such a way that only the owner should be able to unlock them to access the data. This way, if your laptop is stolen, lost, or seized in a police raid, no one can access your files. If you haven't already encrypted your disk, you'll do so in Exercise 1-3.

Medium-sensitivity data should also stay on your computer's hard disk or a removable disk. Avoid storing it in cloud services unless you have a good reason to do so or you're able to encrypt it in way that the cloud service can't decrypt it. Storing datasets on local, encrypted disks greatly reduces the risk of anyone else gaining unauthorized access to them.

You can work with medium-sensitivity data on your typical work computer, as long as you secure your machine. Here's how:

- Make sure your computer's hard disk is encrypted.
- Take steps to protect your computer physically. Make sure the screen locks automatically after a short amount of inactivity and requires a password to unlock.
- Install software updates promptly, and be wary of what programs you install and what documents you open on your computer. If you accidentally run malicious software or open a malicious document, someone could hack your computer and gain access to your datasets.
- Store the dataset on an external USB disk, which allows you to store more data than will fit on your computer and means you can travel with your laptop without worrying about protecting the datasets stored on it. Make sure your external disk is encrypted as well (see the "Disk Encryption" section for instructions).
- Don't store files in parts of your computer that are automatically uploaded to the cloud. For example, many Mac users configure their computers to upload their *Documents* folder to iCloud, Apple's cloud

storage service. If your computer is set up this way, don't put files related to these investigations in that folder.

In general, work with medium-security data *locally*, meaning as files stored on your hard disk that aren't exposed to any online services. In some cases it's reasonable to work with medium-security datasets remotely. If you're working with other people, you may need to use an encrypted file-sharing solution so that the service you're using can't decrypt the files, but you and your colleagues can. One simple option is to send files back and forth using the Signal messenger app. And if you or your organization is hosting a secure tool for searching datasets, such as Aleph (covered in Chapter 5), it's also reasonable to copy the data into that tool.

All of the datasets you'll be working with in this book are low sensitivity, since they're already public. The techniques you'll learn throughout the book will apply for medium-sensitivity datasets as well, however, as you'll work with the data locally on your computer. While it's fine to work with these particular datasets in the cloud, learning to work with them locally will give you the practice you need for handling more sensitive datasets.

High-Sensitivity Datasets

High-sensitivity datasets are by far the most difficult to work with, for good reason. The Snowden Archive, for example, is high sensitivity. I spent years reporting on this massive trove of secret government documents from National Security Agency (NSA) whistleblower Edward Snowden, who exposed the fact that US and allied spy agencies were conducting warrantless surveillance and privacy invasions on an unimaginable scale. We didn't want the FBI or NSA to gain access to it, which made cloud services out of the question, but more important, we didn't want foreign intelligence services to access it either. We assumed that nation-state attackers had the capability to remotely hack pretty much any computer we used unless we took steps to make sure it never connected to any remote network.

Going into detail on how to conduct high-sensitivity investigations is beyond the scope of this book, and you won't need such skills to work through later chapters. However, for future reference, this section outlines how you should proceed if you find yourself working with a cache of top-secret documents.

If a dataset is high sensitivity, until you are close to publishing your report, store it or access it only using *air-gapped* computers—those that never connect to the internet. Move files off the air-gapped computer only when they're already redacted and necessary for publishing. In short, buy a new computer, never connect it to the internet, and use that. Or, if you have an old computer that would work, you can format its disk, reinstall the operating system, and use that computer while never connecting it to the internet. These steps will help you ensure that you're starting from a clean system free of existing trackers or malware. To make it even more secure, unscrew the computer's case and physically remove the wireless hardware.

You'll run into all sorts of challenges related to moving data between your air-gapped computer and your normal work computer—for example, installing or updating software on your air-gapped computer requires downloading it on another computer, carefully verifying that it's legitimate software, and then transferring it to your air-gapped computer to install it. The extra steps are worth it, though, when a breach might have severe consequences.

It's also important that the disk in your air-gapped computer and any USB disks that you use with it are encrypted with strong passphrases. Also consider the physical security of where you store your air-gapped computer and USB disks. If possible, keep them in a safe or vault with a good lock. If that's not possible, at least keep them in a locked room to which few people have keys. Always power off your air-gapped computer when you're not using it to make it harder for attacks against the disk encryption to work.

When working on air-gapped computers, be mindful of nearby internet-connected electronic devices with microphones or cameras. Avoid having conversations related to highly sensitive documents within earshot of microphones, and consider whether any nearby cameras (including smartphones) could capture photographs of your screen.

Authenticating Datasets

You can't believe everything you read on the internet, and juicy documents or datasets that anonymous people send you are no exception. Disinformation is prevalent. It's important to explain in your published report, at least briefly, what makes you confident in the data. If you can't authenticate it but still want to publish your report in case it's real, or in case others *can* authenticate it, make that clear. When in doubt, err on the side of transparency.

How you go about verifying that a dataset is authentic completely depends on what the data is. You have to approach the problem on a case-by-case basis. The best way to verify a dataset is to use *open source intelligence (OSINT)*, or publicly available information that anyone with enough skill can find. This might mean scouring social media accounts, consulting the Internet Archive's Wayback Machine (*https://web.archive.org*), inspecting metadata of public images or documents, paying services for historical domain name registration data, or viewing other types of public records. If your dataset includes a database taken from a website, for instance, you might be able to compare information in that database with publicly available information on the website itself to confirm that they match.

This book's discussion of OSINT focuses on how I've used it in my own investigations. If you want to learn more, see Michael Bazzell's *OSINT Techniques: Resources for Uncovering Online Information*, along with the companion tools listed at *https://inteltechniques.com/tools*. Bazzell describes a large number of tools and techniques for discovering details that might help you verify datasets using OSINT.

In this section, I'll share two examples of authenticating data from my own experience: one about a dataset from the anti-vaccine group America's

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Frontline Doctors, and another about leaked chat logs from a WikiLeaks Twitter group.

Authenticating the AFLDS Dataset

In late 2021, in the midst of the COVID-19 pandemic, an anonymous hacker sent me hundreds of thousands of patient and prescription records from telehealth companies working with America's Frontline Doctors (AFLDS). AFLDS is a far-right anti-vaccine group that misleads people about COVID-19 vaccine safety and tricks patients into paying millions of dollars for drugs like ivermectin and hydroxychloroquine, which are ineffective at preventing or treating the virus. The group was initially formed to help Donald Trump's 2020 reelection campaign, and the group's leader, Simone Gold, was arrested for storming the US Capitol on January 6, 2021. In 2022, she served two months in prison for her role in the attack.

My source told me that they got the data by writing a program that made thousands of web requests to a website run by one of the telehealth companies, Cadence Health. Each request returned data about a different patient. To see whether that was true, I made an account on the Cadence Health website myself. Everything looked legitimate to me. The information I had about each of the 255,000 patients was the exact information I was asked to provide when I created my account on the service, and various category names and IDs in the dataset matched what I could see on the website. But how could I be confident that the patient data itself was real, that these people weren't just made up?

I wrote a simple Python script to loop through the 72,000 patients and put each of their email addresses in a text file. I then cross-referenced these email addresses with a totally separate dataset containing PII from members of Gab, a social network popular among fascists, anti-democracy activists, and anti-vaxxers. In early 2021, a hacktivist who went by the name "JaXpArO and My Little Anonymous Revival Project" had hacked Gab and made off with 65GB of data, including about 38,000 Gab users' email addresses. Thinking there might be overlap between AFLDS and Gab users, I wrote another simple Python program that compared the email addresses from each group and showed me all of the addresses that were in both lists. There were several.

Armed with this information, I started scouring the public Gab timelines of users whose email addresses had appeared in both datasets, looking for posts about AFLDS. Using this technique, I found multiple AFLDS patients who posted about their experience on Gab, leading me to believe that the data was authentic. For example, according to consultation notes from the hacked dataset, one patient created an account on the telehealth site and four days later had a telehealth consultation. About a month after that, they posted to Gab saying, "Front line doctors finally came through with HCQ/Zinc delivery" (HCQ is an abbreviation for hydroxychloroquine).

Chapter 13 focuses entirely on my AFLDS investigation and describes the technical details of my Python script in greater depth. By the time you've worked through the intervening chapters, you'll have the Python knowledge to understand how that script worked.

Authenticating the WikiLeaks Twitter Group Chat

In late 2017, journalist Julia Ioffe published a revelation in the *Atlantic*: WikiLeaks had slid into Donald Trump Jr.'s Twitter direct messages. Among other things, before the 2016 election, WikiLeaks suggested to Trump Jr. that even if his father lost the election, he shouldn't concede. "Hi Don," the verified @WikiLeaks Twitter account wrote, "if your father 'loses' we think it is much more interesting if he DOES NOT conceed [*sic*] and spends time CHALLENGING the media and other types of rigging that occurred—as he has implied that he might do."

A long-term WikiLeaks volunteer who went by the pseudonym Hazelpress started a private Twitter group with WikiLeaks and its biggest supporters in mid-2015. After watching the group become more right-wing, conspiratorial, and unethical, and specifically after learning about WikiLeaks' secret direct messages (DMs) with Trump Jr., Hazelpress decided to blow the whistle on the whistleblowing group itself. She has since publicly come forward as Mary-Emma Holly, an artist who spent years as a volunteer legal researcher for WikiLeaks.

To carry out the WikiLeaks leak, Holly logged into her Twitter account, made it private, unfollowed everyone, and deleted all of her tweets. She also deleted all of her DMs except for the private WikiLeaks Twitter group and changed her Twitter username. Using the Firefox web browser, she then went to the DM conversation—which contained 11,000 messages and had been going on for two and a half years—and saw the latest messages in the group. She scrolled up, waited for Twitter to load more messages, scrolled up again, and kept doing this for *four hours*, until she reached the very first message in the group. She then used Firefox's Save Page As function to save an HTML version of the web page, as well as a folder full of resources like images that were posted in the group.

Now that she had a local, offline copy of all the messages in the DM group, Holly leaked it to the media. In early 2018, she sent a Signal message to the phone number listed on The Intercept's tips page. At that time, I happened to be the one checking Signal for incoming tips. Using OnionShare—software that I developed for this purpose, which I describe in detail in Chapter 2—she sent me an encrypted and compressed file, along with the password to decrypt it. After extracting it, I found a 37MB HTML file—so big that it made my web browser unresponsive when I tried opening it, and which I later split into separate files to make it easier to work with—and a folder with 82MB of resources.

How could I verify the authenticity of such a huge HTML file? If I could somehow access the same data directly from Twitter's servers, that would do it; only an insider at Twitter would be in a position to create fake DMs that show up on Twitter's website, and even that would be extremely challenging. When I explained this to Holly (who, at the time, I still knew only as Hazelpress), she gave me her Twitter username and password. She had

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already deleted all the other information from that account. With her consent, I logged in to Twitter with her credentials, went to her DMs, and found the Twitter group in question. It immediately looked like it contained the same messages as the HTML file, and I confirmed that the verified account @WikiLeaks frequently posted to the group.

Following these steps made me extremely confident in the authenticity of the dataset, but I decided to take verification one step further. Could I download a separate copy of the Twitter group myself in order to compare it with the version Holly had sent me? I searched around and found dmarchiver, a Python program that could do just that. Using this program, along with Holly's username and password, I downloaded a text version of all of the DMs in the Twitter group. It took only a few minutes to run this tool, rather than four hours of scrolling up in a web browser.

NOTE *After this investigation, the dmarchiver program stopped working due to changes on Twitter's end, and today the project is abandoned. However, if you're faced with a similar challenge in a future investigation, search for a tool that might work for you. You could also consider developing your own, using programming skills that you'll learn in Chapters 7 and 8.*

The output from dmarchiver, a 1.7MB text file, was much easier to work with compared to the enormous HTML file, and it also included exact timestamps. Here's a snippet of the text version:

```
[2015-11-19 13:46:39] <WikiLeaks> We believe it would be much better for GOP
to win.
[2015-11-19 13:47:28] <WikiLeaks> Dems+Media+liberals woudl then form a block
to reign in their worst qualities.
[2015-11-19 13:48:22] <WikiLeaks> With Hillary in charge, GOP will be pushing
for her worst qualities., dems+media+neoliberals will be mute.
[2015-11-19 13:50:18] <WikiLeaks> She's a bright, well connected, sadistic
sociopath.
```

I could view the HTML version in a web browser to see it exactly as it had originally looked on Twitter, which was also useful for taking screenshots to include in our final report, as shown in Figure 1-1.

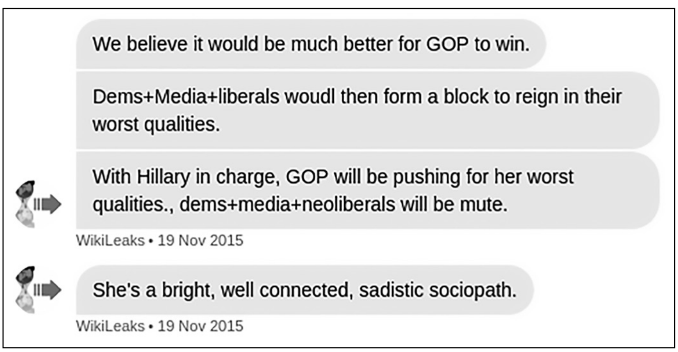

Figure 1-1: A screenshot of the leaked HTML file

Along with the talented reporter Cora Currier, I started the long process of reading all 11,000 chat messages, paying closest attention to the 10 percent of them from the @WikiLeaks account—which was presumably controlled by Julian Assange, WikiLeaks' editor—and picking out everything in the public interest. We discovered the following details:

- Assange expressed a desire for Republicans to win the 2016 presidential election.
- Assange and his supporters were intensely focused on discrediting two Swedish women who had accused him of rape and molestation, as well as discrediting their lawyers. Assange and his defenders spent weeks discussing ways to sabotage articles about his rape case that feminist journalists were writing.
- Assange tried to discredit filmmaker Laura Poitras because of how she portrayed him in *Risk*, the 2016 documentary about WikiLeaks. The film includes a scene in which Assange tells his lawyer that his accusers were part of a "thoroughly tawdry radical feminist political positioning thing," and in another scene he says, "Part of the problem in this case is there's two women, and the public just can't even keep them separate. If there was one, you could go, 'She's a bad woman.' I think that would have happened by now."
- Assange used transphobic and misogynistic language when talking about Chelsea Manning, his source from 2010, and her friends. I discuss Manning's relationship with WikiLeaks further in Chapter 2.
- After Associated Press journalist Raphael Satter wrote a story about harm caused when WikiLeaks publishes personal identifiable information, Assange called him a "rat" and said that, "he's Jewish and engaged in the ((())) issue," referring to an antisemitic neo-Nazi meme. He then told his supporters to "Bog him down. Get him to show his bias."

You can read our reporting on this dataset at *https://theintercept.com/2018/02/14/julian-assange-wikileaks-election-clinton-trump/*. After The Intercept published this article, Assange and his supporters also targeted me personally with antisemitic abuse, and Russia Today, the state-run TV station, ran a segment about me. I discuss WikiLeaks and its history in greater depth in Chapter 2.

The techniques you can use to authenticate datasets vary greatly depending on the situation. Sometimes you can rely on OSINT, sometimes you can rely on help from your source, and sometimes you'll need to come up with an entirely different method.

Redaction

Once you've authenticated your dataset, you must consider whether or how you want to redact—that is, hide or delete—sensitive information before publishing the results of your investigation. In some cases it might be safe to publish original documents without any redaction, and in others you

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might choose not to publish any documents at all. In this section I'll discuss how to make these decisions and the reasons you might choose to redact, or not redact, information.

Deciding What Data to Publish

When deciding how much data to publish, consider whether your method of reporting the revelations will enable leak investigators to uncover your source. For example, if a company's human resources department sends an email to all of its 10,000 employees and one of them leaks the message to you, it will be very hard for the company to find the culprit. But if only 10 people have access to a document—or database logs show a list of 10 people who recently accessed it—the company has a real suspect list to work from.

How many people had access to the data you've obtained, how sensitive it is, what your source is risking, and what they're comfortable with are all factors that will determine the different types or quantities of data you publish. The following list provides options to consider, ordered from the most risk to your source to the least:

- Publish unaltered documents or datasets.
- Publish documents after you've redacted them and stripped them of metadata.
- Publish documents after re-creating them from scratch by typing them by hand into new separate documents and publishing those instead. When you re-create documents, you remove any hidden trackers and make it impossible to tell from the documents themselves whether your source obtained them by photographing their screen, copying them to a USB stick, uploading them to a website, or using some other method.
- Don't publish the documents at all; only describe and quote from them.
- Don't even quote from the documents, just describe the revelations they contain. If leak investigators don't know what documents were compromised, only that an accurate news story somehow reveals confidential information, they'll have a harder time making progress in their investigation.

Publishing documents is more transparent to your readers, and providing direct evidence makes your work more credible, but doing so has to be weighed against protecting your source. You'll make these decisions on a case-by-case basis, but always keep in mind the risks that your source faces.

Determining What to Redact

If you've carefully considered the risks to your source and decided to publish documents rather than just describing them, the next step is to decide what, if any, information in those documents to redact before publishing. There are three reasons for redaction: to continue protecting your source, to protect the privacy of others involved, or to protect government or corporate information that should justifiably remain secret.

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Protecting Your Source

If your dataset includes archives of a private website or databases that your source was logged into, you'll want to redact their username or any other identifying information before publishing. In addition, make sure you don't accidentally publish metadata that could reveal your source. This book won't describe the many ways that could happen, but here are two common examples: Word documents often include the name of the author, and photos often include GPS coordinates and the type of camera that was used.

In 2012, John McAfee, the controversial millionaire software executive, was on the run. Police raided his home in Belize, and he fled the country. In a blog post, he wrote, "I am currently safe and in the company of two intrepid journalist [*sic*] from Vice Magazine . . . We are not in Belize, but not quite out of the woods yet." That day, *Vice* published its article about McAfee, which included a photograph. According to the photo's metadata, it was taken on an iPhone 4S and included GPS coordinates to a specific house in Guatemala. By not stripping the photo of metadata, *Vice* accidentally published his exact location. If *Vice* had simply taken a screenshot of the image and published that instead, the magazine would have erased the metadata and kept the location secret.

In 2017, when President Donald Trump constantly called the accusations that Russia interfered in the US elections "fake news," NSA whistleblower Reality Winner anonymously mailed a top-secret document to The Intercept with evidence that the NSA had, in fact, witnessed a Russian cyberattack against local election officials. The Intercept published the document, and a short time later Reality Winner was arrested. The published document included a type of metadata called *printer dots*, nearly invisible yellow dots that printers add to paper that include the serial number of the printer and the timestamp of when it was printed. While there's no evidence that leak investigators even noticed them until after Reality Winner was arrested (she was one of six people who had printed this document, and the only one who had written an email to The Intercept), the printer dots could have outed her as well. The Intercept could have mitigated this by re-creating the document (retyping it and re-creating the artwork) and publishing that instead of a scanned version of the original.

Protecting Personal Information in Datasets

Many datasets include names, email addresses, usernames, phone numbers, home addresses, passwords, and other similar personal identifiable information of people who aren't public figures. Many government and corporate documents include PII for random employees that won't add anything to your story, but could make these people targets of harassment. Even when dealing with public figures, in most cases it's still responsible to redact their PII unless publishing it adds value to your report. For example, if the focus of your investigation is a lavish mansion owned by a billionaire, it might be reasonable to publish the address of that mansion. If you're

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writing an unrelated story about that billionaire, however, there's no reason to include their home address.

Even if you believe the targets of your investigation are jerks, it's better to redact their PII if including it doesn't add to your report. Even jerks have privacy rights, and needlessly publishing PII could be used to discredit your report regardless of the revelations it contains.

The exception to this rule is if publicly outing someone is an important part of your story and could keep other people safe. For example, it's ethical to name someone who is abusive in a workplace or industry, or to out someone as a member of a hate group. Even when you're publicly outing someone, though, don't publish unnecessary PII about them, like their home address. If you do, you might be accused of harassment, which could distract the conversation from the wrongdoing you're trying to expose.

Protecting Legitimate Secrets

Occasionally, governments and companies do in fact have legitimate reasons to keep secrets. In my experience, this is rare—the US government has a severe overclassification problem. This is one reason it's important to ask related parties for comment before you publish your story, though: a government agency or company may give you context that could make you decide not to publicize the data. For example, I was once part of a decision to redact details from a top-secret US government document related to another country's nuclear weapons program.

Making Requests for Comment

Always give the people or companies on which you're reporting a chance to tell their side of the story. Even if you're confident that they won't respond truthfully or at all, you should still attempt to contact them, explain what you're going to publish, and give them a chance to defend themselves. If they do respond, quote their response in your published report (and if you know they aren't telling the truth, explain that alongside their quote). If they don't respond or they decline to comment, include that in your report as well.

For example, in 2017, I reported on leaked chat logs from neo-Nazis, which I cover in Chapter 14. In my article, I named a member of the pro-slavery hate group League of the South who was arrested during the deadly Charlottesville, Virginia, Unite the Right protest for carrying a concealed handgun. He had posted messages in a chat room saying that he had "scores to settle" with local antifascists because they had gotten him fired from his job. Using public records, I tracked down his phone number. I set up a new virtual phone number using Google Voice and called him with that, since I didn't want to give him my private number. I left messages, but he never responded.

If your investigation is adversarial—that is, the people you're looking into aren't going to be happy about it—wait until shortly before you publish your report to contact them and tip your hand. It's polite to give them at least 24 hours to respond, while giving them less time to sabotage your story. They might leak your story to a friendly publication to publish first with a positive spin, announce to their followers that a hit piece is coming, or attempt to use legal means to stop you from publishing. I've been involved in investigations where all of those scenarios have happened.

Chances are, you're not an expert in all aspects of what you're reporting on, so it's often a good idea to consult outside experts (university professors, authors, scientists, and so on) and include quotes from them in your published reports. In my own reporting, I've interviewed cryptography professors, disinformation researchers, medical doctors, and civil rights advocates who work for nonprofits. Even if you're an expert on the topic of your investigation, providing outside voices often adds to your story, helping you make stronger arguments.

As long as you trust the experts you're talking with, it's fine to contact them early in the reporting process. It's also common to share confidential documents with them, so long as they agree to keep them secret until you publish. In the case of highly sensitive documents, you might need to arrange for outside experts to visit you in person and view the files on your air-gapped computer. Sometimes these experts can point you in research directions that you wouldn't think to go yourself.

Now that you've seen how to protect your sources and authenticate the information they give you, let's go over some ways to secure your computer and online accounts to keep your datasets and other sensitive records safe.

Password Managers

Most people's passwords aren't unique, meaning they're reused in multiple places. This is a very bad idea, since any duplicate password is only as secure as the least secure place you've used it. Go to *https://haveibeenpwned.com*, search for your email address or phone number, and you'll see a list of data breaches that you're included in. If your LinkedIn password was exposed in a data breach a few years ago but it's the same password you use for your Twitter account, to log into your laptop, or to unlock your encrypted USB disk full of sensitive datasets, you may be in trouble.

The solution is to make all your passwords unique as well as strong, which really just means long and random enough that they're impossible to predict. Unfortunately, strong passwords are hard to memorize, and it's impossible for humans to memorize hundreds of passwords that are both strong and unique. Yet we're required to use hundreds of passwords in our daily lives.

Fortunately, we can have computers memorize most of our passwords for us. Password managers are programs that keep track of an encrypted database of passwords that you unlock using a master password, the only one you have to memorize. Password managers often allow you to sync your password database to the cloud, which is fine so long as you're using a strong master password. If a hacker steals your encrypted password database, or if your password manager company hands it to the FBI or other authorities, they won't be able to unlock it without your master password. An encrypted password database is completely inaccessible to anyone without the master password. If your master password is strong, it will be literally impossible for them to guess it, and your other passwords will be safe. Encryption is cool like that.

DONALD TRUMP'S TWITTER PASSWORD

I learned from an episode of the excellent podcast *Darknet Diaries*, hosted by Jack Rhysider, that Donald Trump's LinkedIn password was exposed in a 2012 data breach. His password, `yourefired`, was his signature phrase from *The Apprentice*, the reality TV show he hosted. While he was running for president in 2016, three Dutch hackers, Victor, Edwin, and Matt, who are part of a group called the Guild of the Grumpy Old Hackers, discovered his LinkedIn password in the dataset from that breach. They tried it on Trump's @realDonaldTrump Twitter account and . . . it worked.

You might be thinking, "Isn't using a password manager just putting all my eggs in one basket? If it gets hacked, doesn't that give the hacker access to *everything*?" This is true—it's very important to secure your password manager—but not using one at all is like trying to hold hundreds of eggs with just your hands, without using a basket, and without breaking any of them. If you try that, you're bound to drop a lot of your eggs eventually. You also always have the option of using multiple password managers (multiple baskets) for different projects so that if one gets hacked, the others remain secure.

There are several good password managers available, and if you already know of one you like, by all means use it. Here are three that I recommend:

Bitwarden This manager is free and open source, and it syncs passwords between your computers and phone. It has browser extensions to fill in passwords automatically when you log into websites. It's a good choice for a day-to-day password manager. Download it at *https://bitwarden.com*.

1Password Like Bitwarden, 1Password syncs passwords between your computer and phone and has a browser extension. It's also a good choice for a day-to-day password manager. It costs money, but 1Password gives free licenses to journalists. Download it at *https://1password.com*, or see *https://1password.com/for-journalism/* for more information about the free license program.

KeePassXC This software is great for high-security situations. Unlike Bitwarden and 1Password, KeePassXC doesn't sync your encrypted password database to the cloud, which makes it less convenient but

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potentially more secure. It works well on air-gapped computers. Download it at *https://keepasscx.org*.

If you'd like to use Bitwarden, 1Password, or a similar password manager that syncs between devices, follow the installation instructions on its website to install the program on your computer, your phone, and as an extension in your web browser. If you're using a local-only password manager like KeePassXC, just install it on your computer.

When you first set up your password manager, it's extremely important that you not forget your master password. Unlike most website passwords, a master password can't be reset. If you forget it, you're locked out of your password manager forever and you lose all your passwords. Write the master password on a piece of paper until you've memorized it, and then destroy the paper.

The best master passwords are *passphrases*, a sequence of words picked at random from a dictionary. They're also easier to remember than completely random passwords. An example of a good passphrase is movie-flanked-census6-casino-change. It has no meaning at all, but with practice it's not too hard to memorize.

Once you've set up your password manager account, add your other passwords to the manager. Start by adding the passwords you use the most: perhaps your email password or passwords to social media accounts. If you've ever reused these passwords, take this opportunity to *change them* and make them better. Whenever you create a new password, use your password manager's password generator, a tool included to help you create strong passwords. Typically, password generators have settings that let you choose whether it should generate a password or a passphrase, whether it should contain numbers or special characters, how long it should be, and so on.

Bitwarden, for example, can create both passwords or passphrases. Figure 1-2 shows Bitwarden's password generator, which is configured to create a passphrase with five words, separated by dashes, capitalized, and including a number.

Bitwarden can also make strong passwords, such as Frz6ioX4o@cCY. All of your passwords should either be strong passphrases or passwords like this.

The password generators included in 1Password, KeePassXC, and other password managers all include similar features. While Bitwarden allows you to open the password generator tool independently, some password managers require you to add a new item in your password database or edit an existing one to access the generator.

When you need to come up with a new password, it doesn't matter if you choose to use a password or a passphrase so long as it's strong and unique. However, passphrases tend to be easier to memorize and to enter. For this reason, I tend to use passwords to log into websites (my password manager fills them in for me) and passphrases for anything that I might need to memorize or enter, such as a disk encryption passphrase or the passphrase to log into my computer.

Every time you create a new account or log into an existing one, add the password to your password manager.

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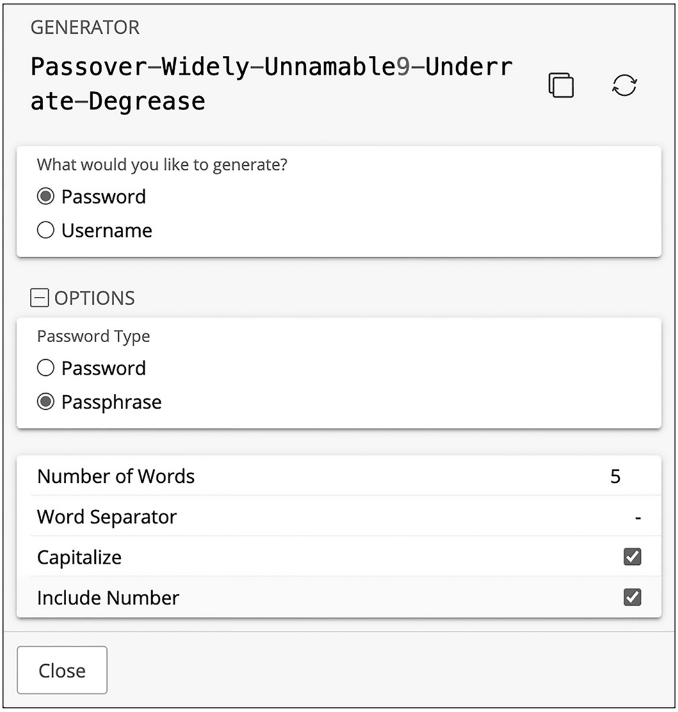

Figure 1-2: Bitwarden's password generator

Disk Encryption

Disk encryption allows you to protect your data from people who have physical access to your phone, laptop, or USB disk. It prevents anyone from accessing data on a device if you lose it, someone steals it, it gets confiscated at a border crossing or checkpoint, or your home or office is raided. For example, when the internal disk in your laptop isn't encrypted, anyone with physical access to it can unscrew your laptop's case, remove the disk, and plug it into their own computer, accessing all of the data without needing to know any of your passwords. But when your disk is encrypted, all of this data is completely inaccessible to anyone who doesn't have the right key. If disk encryption is enabled, they'll need to first unlock the disk, typically using a password, a PIN, or biometrics like a fingerprint or face scan. You'll learn how to encrypt your internal disk and your 1TB USB disk in this chapter's exercises.

Although disk encryption is an important part of protecting your data, it doesn't protect against remote attacks. For example, if your laptop is encrypted but someone tricks you into opening a malicious Word document that attacks your computer, disk encryption won't stop them from accessing your files. Disk encryption also won't help much if the attackers get access to your device while it's unlocked—for example, if you step away from your laptop at a coffee shop without locking your screen, or if attackers can easily unlock your phone by forcing you to use biometrics. For instance, after arresting you, a cop might wave your phone in front of your face to unlock it with a face scan.

You, of course, won't be relying on disk encryption to commit crimes, but the story of Ross Ulbricht, the creator of the darknet market website Silk Road, is a good illustration of how it can fail you. In 2013, Ulbricht was using his encrypted laptop at the San Francisco Public Library when two undercover FBI agents distracted him by pretending to be lovers in a fight. Making sure his screen was unlocked, they quickly arrested him, then copied important files off of his computer. If his screen had been locked and he'd had a strong password, the disk encryption might have prevented them from accessing his data at all. Ulbricht was charged with money laundering, hacking, drug trafficking, and other crimes.

Encrypting your laptop's internal disk is a basic security measure that everyone should take. It's quick and easy to set up, doesn't require you to do any extra work on a regular basis, and protects your privacy if you lose your device. You can think of it like wearing a seatbelt: there's really no good reason not to do it. Encrypting your laptop's internal disk is especially important if you're going to be working with sensitive data.

Exercise 1-1: Encrypt Your Internal Disk

This exercise shows you how to encrypt the internal disk in your computer, whether you have a Windows, Mac, or Linux machine. Skip to the appropriate section for your operating system.

Windows

Different Windows versions and PC models have support for different types of disk encryption. Pro editions of Windows include BitLocker, Microsoft's disk encryption technology, and Home editions include device encryption, which is basically BitLocker with limited features. These features work only if your PC is new enough, though. If your computer came with at least Windows 10 when it was new, it should support disk encryption, but if it came with an earlier version of Windows, it might not. I go over options for how to proceed in this case at the end of this section.

BitLocker

To find out whether your computer includes BitLocker, click **Start** (the Windows icon in the bottom left of your computer), search for **bitlocker**, and open **Manage BitLocker**. If your version of Windows supports it, the window should show whether BitLocker is enabled on your *C:* system drive, and you should have the option to enable it. If so, do that now.

When you enable BitLocker, it makes you save a recovery key to either your Microsoft account, a file on a nonencrypted USB disk, or a printed document. Saving your recovery key to your Microsoft account is the simplest option, but it does mean that Microsoft or anyone with access to your Microsoft account can access the key needed to unlock your disk. If you'd

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prefer to not give Microsoft this access, print the recovery key. You should also save your key in your password manager. If your computer breaks, you'll need your recovery key to access any of the data on your encrypted disk.

Device Encryption

If your version of Windows doesn't include BitLocker, try device encryption. Click **Start**, then navigate to **Settings ▸ Update & Security** (or **Privacy & Security**, depending on your Windows version). Then go to the Device encryption tab to check whether it's enabled; if not, enable it.

If you see no Device encryption tab, your PC doesn't support device encryption, unfortunately. You have a few options. The easiest option is to upgrade to the Pro version of Windows, which typically costs about $100, and then use BitLocker. Alternatively, use VeraCrypt.

VeraCrypt

VeraCrypt is free and open source disk encryption software. To begin, download VeraCrypt from *https://veracrypt.fr*, install it on your computer, and open it.

Click **Create Volume** to open the VeraCrypt Volume Creation Wizard. VeraCrypt lets you choose from three types of encrypted volumes. Select **Encrypt the System Partition or Entire System Drive** and click **Next**.

On the Type of System Encryption page, choose **Normal** and click **Next**. On the Area to Encrypt page, choose **Encrypt the Windows System Partition** and click **Next**. On the Number of Operating Systems page, choose **Single-Boot** and click **Next** (unless you have multiple operating systems on your computer, in which case choose **Multi-boot**). On the Encryption Options page, use the default settings and click **Next**.

The next page is the Password page. You'll need to come up with a strong passphrase that you'll have to enter each time you boot up Windows. If that password is weak, your disk encryption will be weak. I recommend generating a strong passphrase and saving it in your password manager—this way, if you forget it the next time you reboot your computer, you can look it up in your password manager on your phone. Enter the passphrase twice and click **Next**.

The next page is called Collecting Random Data. VeraCrypt includes a feature where you move your mouse around the window randomly so that it can collect information from your mouse movements to make the encryption more secure. Move your mouse around until the bar at the bottom of the screen is green, and then click **Next**. Click **Next** again on the Keys Generated page.

The Rescue Disk page prompts you to create a VeraCrypt Rescue Disk, which you can use in the event that your disk gets damaged and you have issues booting Windows. Creating a rescue disk is outside the scope of this book, so check **Skip Rescue Disk Verification** and click **Next**. On the Rescue Disk Created page, click **Next** again.

On the Wipe Mode page, select **None (Fastest)** as the Wipe mode and click **Next**. On the System Encryption Pretest page, click **Test** to test that disk encryption will work properly on your computer—this will reboot your computer, and you'll need to enter your VeraCrypt passphrase to boot up.

When you reboot your computer it should boot up to the VeraCrypt bootloader, and you'll need to enter the VeraCrypt passphrase to proceed. Under PIM, just press ENTER. If all goes well, it will succeed, Windows will boot up, and VeraCrypt will open on the Pretest Completed page again after you log in. Click **Encrypt** to begin encrypting your internal disk with VeraCrypt. From now on, you'll need to enter your VeraCrypt passphrase each time you boot your computer, but all of your data will also be protected with this passphrase.

macOS

Apple's disk encryption technology is called FileVault. If you're using macOS Ventura or newer, open the **System Settings** app, click **Privacy & Security** on the left, and scroll down to the FileVault section. (If you're using a version of macOS older than Ventura, open the **System Preferences** app, click **Security & Privacy**, and make sure you're on the FileVault tab.) If FileVault is turned off, turn it on.

The password that unlocks your Mac's disk is the password you use to log into your account. Make sure your Mac password is strong; if it's weak, your disk encryption is weak.

When you enable FileVault, it makes you save a recovery key. Save that key in your password manager. If you forget your Mac password, you'll need the recovery key to access any of your data. If you're using a local password manager that doesn't sync to the cloud, like KeePassXC, store a copy of your recovery key somewhere else as well, such as on a piece of paper kept in a secure location.

Linux

Linux uses technology called LUKS for disk encryption. You can check the Disks program (in most versions of Linux, press the Windows key to open this program, type **disks**, and press ENTER) to see whether your internal disk is encrypted. The program shows you all of the disks attached to your computer and allows you to format them (see Figure 1-3). If your internal disk has an unlocked partition with LUKS encryption, disk encryption is enabled.

In this case, my internal disk is the 500GB Samsung SSD listed on the left. My disk is partitioned into four parts, and the last part (Partition 4) is 499GB and is encrypted with LUKS. Your disk might look different from mine, but you'll know it's encrypted if the main partition says LUKS.

Unfortunately, you can't just turn LUKS on or off. If your disk isn't encrypted, the only way to encrypt it is to reinstall Linux, this time making sure to encrypt the disk. When you're installing Linux, one of the first steps in the installation process will be to partition your disk; make sure to enable encryption during that step. If you're going to reinstall Linux, always back up your data first. After choosing your encryption passphrase, save a copy of it in your password manager; you'll need it every time you boot up your computer.

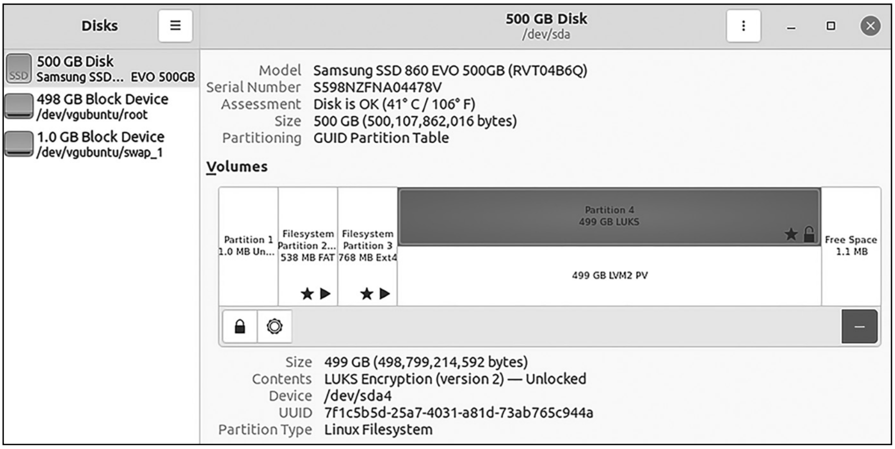

Figure 1-3: Managing disks and partitions using Disks in Linux

Exercise 1-2: Encrypt a USB Disk

Your internal disk alone likely isn't large enough to store all of the datasets you'll need to work with. As mentioned in the book's introduction, in order to complete the exercises in this book and work with the massive datasets, you need a USB disk that's *at least 1TB*. To encrypt that USB disk, you also need to format it, which deletes any data already on it. This exercise shows you how to do that for whichever operating system you're using.

Before you get started, let's go over some background on how mass storage devices (like hard disks, SD cards, and so on) work. Storage devices are typically split into one or more *partitions*, also called *volumes*, with each partition using a format called a *filesystem*. You can think of partitions as cabinets that use different shelving systems (filesystems) to organize data. Different operating systems use different filesystems. Windows often uses a filesystem called NTFS, macOS often uses APFS, and Linux often uses ext4. There are also filesystems that all three operating systems can use, such as ExFAT.

When you erase a storage device, you delete all of the partitions on it so that it contains unallocated space. You can then create a new partition—with USB disks, you'll typically create a single partition that takes up all of the unallocated space—and format it using the filesystem that matches your operating system.

Whether you're working in Windows, macOS, or Linux, begin by plugging your USB disk into your computer. Open your password manager and save a new strong passphrase, created using your password manager's password generator. Name the password something like **datasets USB disk encryption**.

To begin encrypting your disk, skip to the appropriate subsection for your operating system.

Windows

Windows users with BitLocker should work through the following subsection; if you don't have BitLocker, skip to the VeraCrypt section.

BitLocker

If you have a Windows computer with BitLocker, use that to encrypt your USB. First, make sure to format the USB disk as NTFS. To do so, click **Start**, search for **disk management**, and open **Create and Format Hard Disk Partitions**. This opens the Windows Disk Management app, as shown in Figure 1-4, which lists all of the disks connected to the PC and lets you format them.

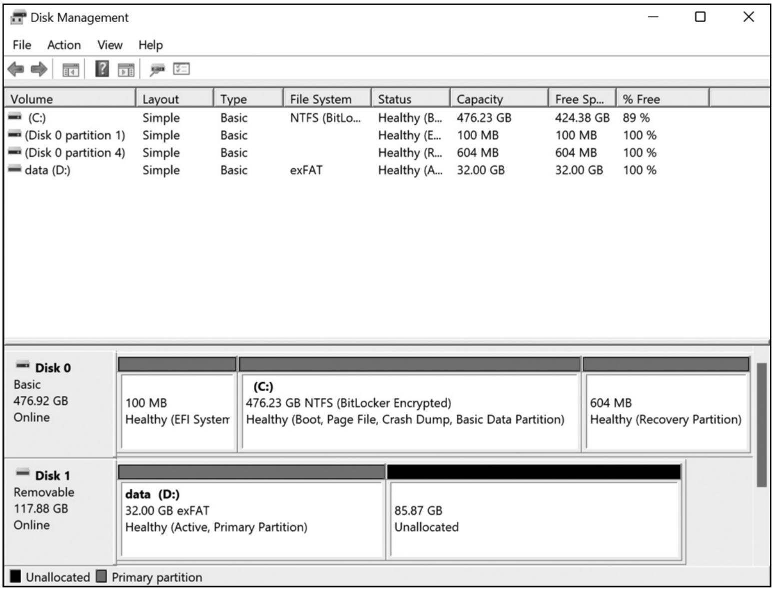

Figure 1-4: The Disk Management app in Windows

The bottom part of the window in the screenshot shows each disk attached to your computer and how they're separated into partitions. Disk 0 is my internal hard disk (as you can see, one of the partitions is *C:*), and Disk 1 is a USB disk (one of those partitions is *D:*). On my computer, Disk 1 has a single 32GB partition, as well as about 86GB of unallocated space.

Find the USB disk you need to format. Right-click on every partition and choose **Delete Volume** until you've deleted all the partitions on the disk. Then right-click on the unallocated space in your disk and choose **New Simple Volume**, which should open a wizard to help you create the volume. Choose the full amount of disk space and format it as NTFS. The wizard will ask you for a *volume label*, which is just a name for your partition; in Figure 1-4, the label for *D:* is *data*. I recommend calling this disk *datasets*.

Once the disk is formatted, click **Start**, search for **bitlocker**, and open **Manage BitLocker**. You should now see your USB disk and have the option to turn on BitLocker. When you enable BitLocker on your USB disk, a window should pop up asking how you would like to unlock this drive. Choose **Use a Password to Unlock the Drive**, then copy and paste your USB disk encryption passphrase from your password manager into the password field. You'll need to paste it into the field to re-enter the password as well. When you enable BitLocker, you'll be required to save a recovery key to a file. Since you're saving the passphrase in a password manager, however, you don't need your recovery key, and you can delete the file.

VeraCrypt

If you use Windows Home and don't have BitLocker available on your computer, use VeraCrypt to encrypt your USB disk.

If you don't already have VeraCrypt, download it from *https://veracrypt.fr*, install it on your computer, and open it. Click **Create Volume** to open the VeraCrypt Volume Creation Wizard. On the first page of the wizard, VeraCrypt lets you choose from three types of encrypted volumes. Select **Encrypt a Non-system Partition/Drive** and click **Next**.

On the Volume Type page, VeraCrypt asks if you want a standard volume or a hidden one. Select **Standard VeraCrypt Volume** and click **Next**. On the Volume Location page, click **Select Device**, choose the USB disk you want to encrypt, and click **Next**. On the Volume Creation Mode page, select **Create Encrypted Volume and Format It** and click **Next**. On the Encryption Options page, use the default settings and click **Next**. You can't do anything on the Volume Size page, since you're encrypting a whole partition rather than creating an encrypted file container, so just click **Next**.

On the Volume Password page, copy and paste your USB disk encryption passphrase from your password manager into the Password field, and paste it again into the Confirm field. Then click **Next**. On the Large Files page, VeraCrypt asks if you intend to store files larger than 4GB in your VeraCrypt volume. Select **Yes** and click **Next**. On the Volume Format page, under the Filesystem drop-down menu, select **exFAT** and check the box next to **Quick Format**. VeraCrypt also includes a feature where you move your mouse around the window randomly so that it can collect information from your mouse movements to make the encryption more secure. Move your mouse around until the bar at the bottom of the screen is green, and then click **Format**.

A window should pop up, warning you that all of the data on your USB disk will be erased and asking if you're sure you want to proceed. Click **Yes**, and then wait while VeraCrypt creates an encrypted partition on your USB disk. As long as you selected Quick Format on the previous page, this should only take a few seconds. On the Volume Created page, click **Exit** to exit the wizard and get back to the main VeraCrypt window.

After you encrypt a USB disk with VeraCrypt, you need to use VeraCrypt to *mount* it, or make it available on your computer as a drive letter. In the main VeraCrypt window, select an available drive letter (such as *F:*), click **Select Device**, select your VeraCrypt-encrypted USB disk, and click **OK**, then **Mount**. After you provide the encryption passphrase to unlock it, VeraCrypt will mount your encrypted USB disk so you can use it. Now any files that you save to this drive will be stored encrypted on disk.

Before unplugging your USB disk, unmount it by selecting the drive letter in VeraCrypt and clicking **Dismount**.

NOTE *VeraCrypt also comes in handy if you need to access the same encrypted disk across operating systems—for example, if you need to use it on both a Windows PC and a Mac. However, for the purposes of this book, only Windows users who don't have BitLocker should use VeraCrypt. In general, you'll have fewer headaches if you stick with the disk encryption software built into your operating system.*

macOS

Open the Disk Utility app, which you can find in the *Applications/Utilities* folder. This app lists all of the disks attached to your computer and lets you format them.

In Disk Utility, select the USB disk you plugged in and click the **Erase** button. Name the disk *datasets* and choose **APFS (Encrypted)** for format. You will then be prompted for the password to unlock the encrypted disk. Copy and paste the USB disk encryption passphrase that you created at the beginning of this exercise from your password manager into Disk Utility. Disk Utility will also prompt you for a password hint, but because you're saving this passphrase in your password manager and not bothering to memorize it anyway, you can leave the password hint blank.

Linux

Open the Disks app as you did in Exercise 1-1. Select your USB disk in the list of disks on the left, then click the menu button and choose **Format Disk**. This will delete all of the data on the USB.

Click the + button to add a new partition and set the partition size to the largest option. Name your disk *datasets*, choose **Internal Disk for Use with Linux Systems Only**, and check the box **Password Protect Volume (LUKS)**. It will prompt you to enter a password. Copy and paste the USB disk encryption passphrase that you created at the beginning of this exercise from your password manager into Disks.

Protecting Yourself from Malicious Documents

Before you start working with any datasets on your encrypted USB disk, you should know how to protect yourself from potentially malicious documents they contain.

Have you ever been told to avoid opening email attachments from unknown senders? This is solid computer security advice, but unfortunately for researchers, journalists, activists, and many other people, it's impossible to follow. In these lines of work, it's often your *job* to open documents from strangers, including leaked or hacked datasets.

Opening documents you don't trust is dangerous because it may allow others to hack your computer. PDFs and Microsoft Office or LibreOffice documents are incredibly complex. They can be made to automatically load an image from a remote server, tracking when a document is opened and from what IP address. They can contain JavaScript or macros that, depending on how your software is configured, could automatically execute code when opened, potentially taking over your computer. And like all software, the programs you use to open documents, like Microsoft Office and Adobe Reader, have bugs, which can sometimes be exploited to take over your computer.

This is exactly what Russian military intelligence did during the 2016 US election, for example. First, the Main Directorate of the General Staff of the Armed Forces of the Russian Federation (GRU) hacked a US election vendor known as VR Systems and got its client list of election workers in swing states. It then sent 122 email messages to VR Systems' clients from the email address *vrelections@gmail.com*, with the attachment *New EViD User Guides.docm*. If any of the election workers who got this email opened the attachment using a vulnerable version of Microsoft Word in Windows, the malware would have created a backdoor into their computer for the Russian hackers. (We don't know for sure whether any of the targets opened the malicious attachment.)

Sending malicious email to specific targets in this way as part of a hacking operation is called *spearphishing*. Figure 1-5 shows a spearphishing email message targeting an election worker in North Carolina, which The Intercept obtained using a public records request.

In 2017, Reality Winner leaked a classified document describing this spearphishing attack to The Intercept. Thanks to her whistleblowing, the public knows considerably more about Russia's attacks on the US election in 2016 than it otherwise would. In fact, US states like North Carolina learned that they were under attack by Russian hackers only by *reading The Intercept*. In 2022, two former election officials told *60 Minutes* that Reality Winner's disclosure helped secure the 2018 midterm elections against similar hacking attempts.

To make it safer to untrusted open documents, I developed an open source app called Dangerzone. When you open an untrusted document in Dangerzone, the app converts it into a *known-safe* PDF—one that you can be confident is safe. Using technology called *Linux containers*—which are like quick, small, self-contained Linux computers running inside your normal computer—it converts the original document into a PDF if it's not already one, splits the PDF into different pages, and converts each page into raw pixel data. Then, in another Linux container, it converts the pixel data back into a PDF. You can also ask Dangerzone to use *optical character recognition (OCR)* technology, software that looks at an image of text and figures out what the characters are, to add a text layer back to the PDF so you can still search the text.

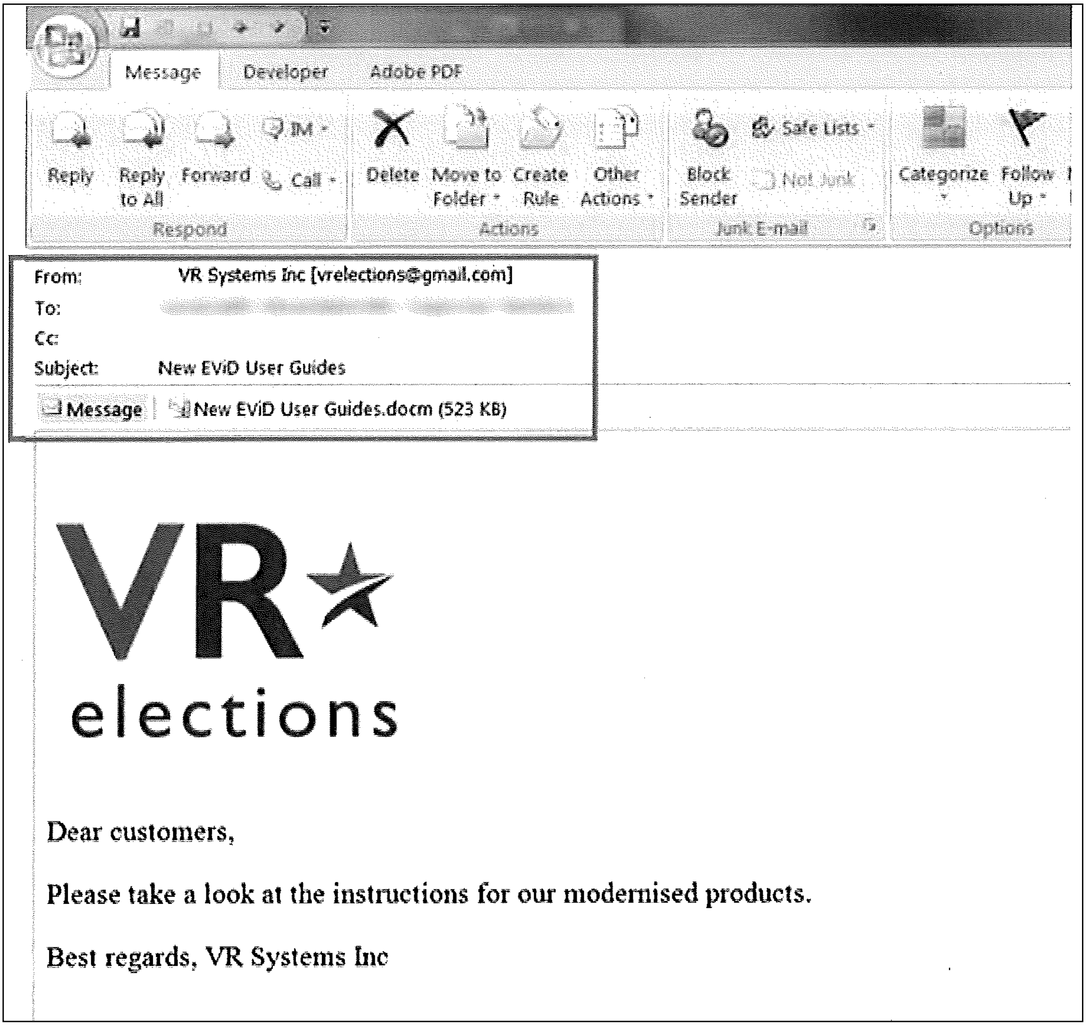

Figure 1-5: A spearphishing email targeting an election worker

Dangerzone is essentially the digital equivalent of printing out a document and rescanning it, stripping anything malicious from it and removing the original document's digital metadata. If you opened the malicious *New EViD User Guides.docm* document using Dangerzone, it would create a new document called *New EViD User Guides-safe.pdf*. You could then safely open this PDF without risk. As an added benefit, you don't need internet access to use Dangerzone, so it works well on air-gapped computers.

You'll learn more about Dangerzone and Linux containers in Chapter 5, which covers how to make datasets searchable. In the meantime, Exercise 1-3 will show you how to get started with it.

Exercise 1-3: Install and Use Dangerzone

In this exercise, you'll install Dangerzone and use it to convert documents into known-safe versions. Figure 1-6 shows a screenshot of Dangerzone in action, in this case converting the untrusted document *D&D 5e - Players Handbook.pdf* to a known-safe version called *D&D 5e - Players Handbook-safe.pdf*, which is also OCR'd and searchable.

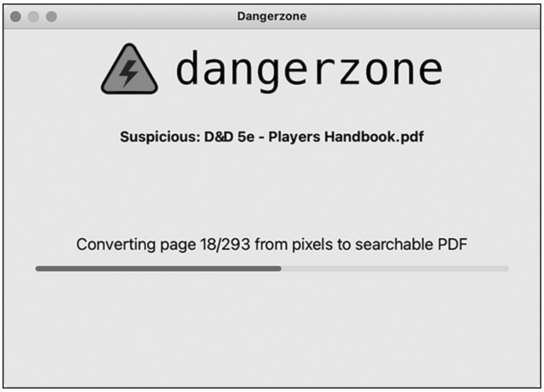

Figure 1-6: Dangerzone in action

Download and install Dangerzone from *https://dangerzone.rocks*. Dangerzone relies on Linux containers. If you're working on a Windows or macOS machine, the easiest way to get containers running is to use software called Docker Desktop, which you'll be prompted to install the first time you open Dangerzone. (You don't need to do anything with Docker Desktop for now; simply install and open it. You'll learn more about Docker in Chapter 5.)

Now that Dangerzone is installed, try it out. Open any PDF, Microsoft Office document, LibreOffice document, or image on your computer in Dangerzone and convert it to a safe PDF. If someone attaches a document to an email and you don't trust it, download a copy of it first, open Dangerzone, and click **Select Suspicious Documents**. Then browse for the document you downloaded and use Dangerzone to convert it into a known-safe version.

VIRTUAL MACHINES

Another option, which is a bit more complicated, is setting up a *virtual machine (VM)*. VMs are like a stronger version of Linux containers. They isolate the software running inside the VM more than Linux containers can, and they can run on any operating system. If you choose this option, make sure to disable

(continued)

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internet access in your VM before opening documents. This way, if the document is malicious, it won't let any attackers know the document was opened.

Giving detailed instructions on using VMs is outside the scope of this book. However, if you want to try them on your own, the easiest way to get started is to use the free and open source virtualization software VirtualBox (*https://www.virtualbox.org*). VirtualBox works for Intel-based Macs, Linux, and Windows computers. At the time of writing, there's a beta version of VirtualBox that supports Apple Silicon Macs, but it has issues. If you have an Apple Silicon Mac, I recommend you try Paralells (*https://www.parallels.com*) or VMware Fusion (*https://www.vmware.com/products/fusion.html*) instead; note, however, that neither is free.

Dangerzone works great with PDFs and Word documents, but not so great with spreadsheets. No matter what type of file you open in Dangerzone, you always end up with a safe PDF, and spreadsheets really aren't meant to be read in that format.

If Dangerzone doesn't do a good enough job with a document you'd like to read, you can open it a few other ways while containing the damage. If you don't believe the document is sensitive, upload it to Google Drive and open it there, using Google's web interface. This way, technically Google is opening the malicious document on its computers instead of you opening it on yours.

Summary

In this chapter, you've learned how to think about source protection in today's world of widespread digital surveillance. You've also learned about securely storing datasets, depending on their sensitivity; verifying that your datasets are authentic; and redacting information from documents before you publish your final report. You started using a password manager to keep your passwords safe, and you encrypted your internal disk and set up your encrypted *datasets* USB disk. Finally, you practiced turning potentially malicious documents into ones you know are safe to open using Dangerzone.

In the next chapter, you'll put your *datasets* disk to good use by downloading your first hacked dataset.

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2

ACQUIRING DATASETS

In early January 2010, 22-year-old Chelsea Manning sat at a Windows computer in a temporary Sensitive Compartmented Information Facility (SCIF)—an enclosed area or room suitable for working with secret documents—in eastern Baghdad. She was downloading half a million secret "significant activity" reports from the military network SIPRNet, a Department of Defense computer network used for transmitting classified information.

As an intelligence analyst working for the US Army, Manning needed regular access to these databases, so she downloaded them for work purposes. Having a local copy would be useful in a war zone where network access can be unreliable. It wasn't until later that month that she decided to leak them to the public, after realizing they documented American war crimes in Iraq and Afghanistan. They would soon become some of the most significant public datasets of the 21st century. "I believe that if the general

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public, especially the American public, had access to the information contained within the [Iraq War Logs and Afghan War Logs], this could spark a domestic debate on the role of the military and our foreign policy in general," she later said at her court martial hearing.

At the SCIF computer, Manning compressed the files using a program called WinRAR, burned them to a rewritable CD, and left them in the SCIF for easy reference. A few weeks later, at the end of her shift on a Friday night, she slipped the CD into her cargo pocket and headed to her dorm, where she copied the data to her laptop. Eventually, she copied it to the SD card in her digital camera, and on January 23 she flew into the Reagan National Airport just outside of Washington, DC, with the SD card in hand.

In 2010, massive leaks like this were unprecedented. Today, they happen all the time. Back then, WikiLeaks was the only place for sources to go—traditional newsrooms weren't prepared to handle leaks like this. Now, however, there are lots of options: sources can send documents to a transparency collective like Distributed Denial of Secrets (DDoSecrets), they can contact journalists directly using tools like Signal and OnionShare, or they can get in touch with a newsroom by following instructions on its public tips page.

In this chapter, you'll learn best practices for safely acquiring public and private datasets. You'll learn more about the history of WikiLeaks and DDoSecrets, then use a technology called BitTorrent to obtain your own copy of the BlueLeaks dataset from DDoSecrets. You'll download the Signal instant messaging app to securely communicate with sources and learn about PGP encryption, an alternative method of securing messages. You'll practice sending data anonymously with Tor and OnionShare, then read the story of how I communicated with a source using several of these tools. Finally, I'll outline several more ways to securely receive data from sources, including techniques appropriate for professional newsrooms rather than individual reporters.

The End of WikiLeaks

After deciding she wanted to leak the War Logs, Manning first called a reporter at the *Washington Post*, but she didn't feel like they took her seriously. She tried the *New York Times* but managed only to leave a voicemail, and the paper never returned her call. Finally, she settled on WikiLeaks, a leak site founded in 2006 by Australian information activist Julian Assange. This turned out to be a great choice at the time. In addition to publishing the documents, WikiLeaks worked in partnership with newspapers across the world, including the *New York Times*, the *Guardian*, and *Der Spiegel*, to break major stories about US imperialism. Along with the dataset of 250,000 State Department cables known as Cablegate, the two datasets that Manning leaked were a catalyst for the Arab Spring, the 2011 pro-democracy movement that led to the toppling of governments in the Middle East and North Africa, including the authoritarian regimes in Egypt and Tunisia.

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Back then, WikiLeaks was revolutionary, initiating the document-based transparency movement by making massive datasets accessible to the public. The documents that Manning leaked were its first major releases with international consequences, making WikiLeaks a proof-of-concept for sites that allow anyone to anonymously submit leaked documents. Today, nearly every major newsroom in the US and many throughout the world have this capability using open source software like SecureDrop, though news organizations rarely publish raw datasets like WikiLeaks did.

Manning sent these datasets to WikiLeaks several years before the transparency group and its editor, Assange, shifted from a journalism outfit based on the premise that "information wants to be free" to an ethically dubious political organization working to get Donald Trump elected president in 2016. During that US election, WikiLeaks and Assange went off the rails. The group published a dataset full of hacked Democratic National Committee (DNC) and Clinton campaign email messages just in time to distract the news cycle from the infamous *Access Hollywood* audio clip of Trump bragging about committing sexual assault. Assange lied to the public about his source for this data (it was Russian military intelligence), boosting the conspiracy theory that Seth Rich, an unrelated Democratic Party staffer who was murdered in Washington DC, was his real source. WikiLeaks also promoted the Pizzagate conspiracy theory claiming that high-ranking Democratic Party officials were involved in a child sex-trafficking ring run out of a pizza shop in DC.

Today, WikiLeaks is little more than a Twitter account. Its document submission systems have stopped working and its website is no longer maintained. The loss of WikiLeaks to the online fever swamp was tragic for investigative journalism around the world, but a new and better organization has grown to take its place: DDoSecrets.

Distributed Denial of Secrets

Distributed Denial of Secrets, or DDoSecrets, is a nonprofit transparency collective in the US founded by Emma Best in 2018. It's similar to WikiLeaks, but without the toxic ego of Julian Assange and with considerably more transparency around the group's decision-making, and it's largely run by queer people.

DDoSecrets hosts data previously published by WikiLeaks, like the DNC Emails dataset, as well as those WikiLeaks declined to publish, like the Dark Side of the Kremlin dataset, which contains over 100GB of documents and emails from Russian oligarchs and politicians. Notably, it also hosts a great deal of data leaked in the months following Russia's invasion of Ukraine in February 2022. At that time, hackers—mostly claiming to be hacktivists, many identifying with the Anonymous hacktivist movement—bombarded Russia with cyberattacks. They hacked dozens of Russian organizations, including government agencies, oil and gas companies, and finance institutions, and submitted tens of terabytes of data to DDoSecrets to distribute to the public and to journalists.

NOTE *I work closely with DDoSecrets as an adviser and sometimes volunteer.*

Anyone can download the following datasets from DDoSecrets:

BlueLeaks

BlueLeaks is a collection of 270GB of documents from hundreds of US law enforcement and police fusion center websites, released during the height of 2020's Black Lives Matter uprising. You'll know this dataset well by the end of this book, and you'll download a copy of it in this chapter's first exercise.

Parler

The Parler dataset contains 32TB (yes, terabytes) of video scraped from the right-wing social network Parler, including many from the January 6, 2021, anti-democracy riot at the US Capitol. Many of these videos were used as evidence in Donald Trump's second impeachment inquiry. You'll learn more about this dataset in Chapter 11.

Epik Fail

The Epik Fail dataset includes 10 years of domain name registrar data from Epik, a company that's notorious for hosting domain names and websites for neo-Nazis and other extremist groups. You'll explore this dataset in Chapter 12.

In addition to public datasets like these, DDoSecrets hosts many private datasets available only to journalists and researchers who request access. Datasets containing large quantities of PII, like names, email addresses, birth dates, or passwords, are often kept private. For example, the Oath Keepers dataset includes gigabytes of data from the American far-right paramilitary organization, including spreadsheets full of the group's member and donor records. That part of the release is limited only to journalists and researchers who request access, but another part, 5GB of email and chat logs, is available to the public. You'll download part of this release in Chapter 4 and work with it in Chapter 6.

DDoSecrets publishes many more datasets than these, and it continues to release new ones all the time. For an inventory of all of those available, as well as instructions on how to request access to the limited-distribution datasets, visit *https://ddosecrets.com*.

NOTE *You won't be able to share that DDoSecrets link on Twitter. Shortly after DDoSecrets released BlueLeaks, Twitter permanently suspended the @DDoSecrets account and censored all links to* https://ddosecrets.com*, citing its selectively enforced policy against posting hacked data. Twitter prevents tweets or even DMs including DDoSecrets links from going through, though WikiLeaks has faced no such censorship.*

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DDoSecrets distributes public datasets using a protocol called BitTorrent. To download datasets, you'll need to learn how to use it.

Downloading Datasets with BitTorrent

At the turn of the 21st century, long before services like Netflix and Spotify made online entertainment cheap and accessible to the public, peer-to-peer file sharing services like Napster, LimeWire, and Kazaa enjoyed immense popularity because they made downloading pirated media and software so easy. The copyright industry quickly shut down these centralized services with lawsuits, but decentralized technologies rose from their ashes. The most popular of these is *BitTorrent*. In addition to piracy, BitTorrent is also frequently used to legally distribute large files like Linux operating systems, as well as massive datasets.

BitTorrent works well for sharing controversial data like BlueLeaks, because no one—not the US government, police departments, tech companies, internet service providers, or anyone else—can easily censor it. Traditionally, one computer on the internet hosts data (on a website, for example), and all other computers connect to that host to download it. If someone wants to censor that data, they only have to bring down that single host. With BitTorrent, however, data is hosted in *swarms*, a collection of computers currently sharing a specific set of files. If you want to download some data, you join the swarm by opening a link to the data, called a *torrent*, in your BitTorrent software, and become a *peer*. Your BitTorrent software downloads pieces of the data that you need from other peers in the swarm, and in return, you upload pieces of data you already have to peers who need it. Once you have all of the data you need, you can remain in the swarm and continue sharing with peers as long as you keep your BitTorrent software open, making you a *seed*. If you have the internet bandwidth and are allowed to share the files, it's generally good practice to keep seeding, especially if there are few other seeds.

Every BitTorrent swarm needs to have at least one seed in order to enable the peers to finish downloading all the data. The more popular the data, the bigger the swarm, the faster the downloads—and the more difficult censorship becomes. It's hard to block access to every peer in a swarm (swarms can grow to have tens of thousands of peers), and nothing stops more peers from joining. There's no single entity to sue or pressure financially. Swarms often consist of computers distributed around the world, so national laws also can't achieve the censorship they might otherwise aim for.

There is nothing illegal about using BitTorrent to share files that you're legally allowed to share. Blizzard Entertainment has even adopted the technology itself to distribute large video games like *World of Warcraft* to its users, and the Internet Archive, the nonprofit digital library at *https://archive.org*, uses BitTorrent to distribute large files like radio and TV shows. The structure of BitTorrent hosting makes for faster downloads, and bandwidth costs are shared throughout the swarm.

Most publicly available DDoSecrets datasets are distributed through BitTorrent. In order to download something with BitTorrent, you'll need the following:

- A program installed in your computer called a *BitTorrent client*. You can use whatever client you prefer, including a command line version, but I like one called Transmission. It's free and open source and works great in Windows, macOS, and Linux.
- Either a *.torrent* file that you can open in your BitTorrent client or a *magnet link*, a type of URL that starts with *magnet:* and tells your BitTorrent client where to find the full *.torrent* file.
- Roughly 1TB of storage space, at least if you want to download the datasets used in this book. I recommend downloading to the encrypted *datasets* USB disk that you set up in Exercise 1-2.

In a moment, you'll use BitTorrent to download a copy of the BlueLeaks dataset, but first let's take a look at where that data originated.

The Origins of BlueLeaks

The disparate surveillance systems of local, state, and federal law enforcement agencies in the United States collected enough intelligence to learn critical clues about the September 11, 2001, terrorist attack before it happened. However, each agency kept this information to itself, failing to prevent the attack. Afterward, the US government decided these agencies needed to improve how they share information with each other. Congress directed the newly formed Department of Homeland Security (DHS) to create *fusion centers* across the country, collaborations between federal agencies like the DHS and FBI with state and local police departments, to share intelligence and prevent future terrorist attacks. These fusion centers are the source of much of the BlueLeaks data.

According to a 2012 Senate report, these fusion centers have "not produced useful intelligence to support Federal counterterrorism efforts," and the intelligence reports they produced were "oftentimes shoddy, rarely timely, sometimes endangering citizens' civil liberties and Privacy Act protections, occasionally taken from already-published public sources, and more often than not unrelated to terrorism." Fusion centers had also been caught infiltrating and spying on anti-war activists, and in 2008, the American Civil Liberties Union published a report about fusion center abuses, including spying on religious groups in violation of the First Amendment.

In June 2020, a hacktivist self-identifying with the Anonymous movement hacked 251 law enforcement websites, most of them fusion centers and related organizations. The hacked data, known as BlueLeaks, includes thousands of police documents and spreadsheets with over 16 million rows of data. The data spans from 2007 to June 14, 2020, when the Black Lives Matter uprising triggered by the police murder of George Floyd was in full swing.

While the hacktivist from Anonymous violated the law when they broke into these police websites and stole all this data, in the US it's legal for you to download BlueLeaks, investigate it, and publish your findings.

Exercise 2-1: Download the BlueLeaks Dataset

In this exercise, you'll download a local copy of the BlueLeaks dataset onto the 1TB USB disk you encrypted in the previous chapter. You'll be investigating the contents of this dataset later in the book.

Download Transmission (*https://transmissionbt.com*) or any other BitTorrent client of your choice and install it on your computer following the instructions for your operating system. Load the BlueLeaks page on the DDoSecrets website at *https://ddosecrets.com/wiki/BlueLeaks*. From there, find the magnet link for the BlueLeaks torrent and copy that to your clipboard.

Next, open Transmission. Click **File ▸ Open Torrent Address**, paste the magnet link, and click **Open** to start downloading the data. When you first add this torrent to your client, it will ask where you want to save it. Save it to your *datasets* USB disk, then sit back and watch BitTorrent do its thing. It should connect you to the swarm, start downloading chunks of BlueLeaks from other peers (while possibly uploading chunks to other peers as well), and alert you when it's done downloading. When the download completes, you'll be seeding the BlueLeaks torrent and letting others download from you, until you remove the torrent from Transmission.

The 269GB download might take several hours, or even days if you have a slow internet connection. While you're waiting, read on.

Communicating with Encrypted Messaging Apps

Most ways you communicate online aren't very secure, even when you send messages that are ostensibly private. This is fine if you're discussing non-sensitive information over Slack, SMS messages, or DMs on social media. However, when communicating with a confidential source who might face retaliation for talking with you, you should always use an encrypted messaging app.

Among encrypted messaging apps like WhatsApp and iMessage, Signal stands out as the best choice for source communications. Unlike other apps, Signal can't be forced to share most information about its users with law enforcement or leak investigators, because it can't access that user data in the first place. The only information the company can retrieve is the date that a user created their Signal account, and the date that account most recently connected to Signal. Not even those who might typically be able to spy on your communications, like the messaging app's employees, cloud hosting provider, or internet monitoring agencies, can access your Signal messages. Signal is the primary app I use for sensitive work communication, as well as for personal messaging. If I start out chatting with people on other platforms—SMS, DMs on social media, or anything else—I tend to move the conversation to Signal as soon as possible.

In more detail, here's how Signal ensures that it has as little information about its users as possible:

- Since messages and calls are *end-to-end encrypted*, the Signal service can't access their contents. This means if you type a Signal message to me on your phone (your end) and hit send, the Signal app will encrypt it for me or create a totally scrambled version of the message so that it's impossible for anyone but me to unscramble it. The encrypted message then goes to Signal's servers, which forward it to my phone (my end). Once it's on my phone, the Signal app can then decrypt it so I can read the original message. Signal's servers themselves never have access to the original message, only the encrypted version, and they never have the ability to decrypt it—only message recipients do.
- Signal servers don't store metadata, the records of when you send messages and to whom. They also can't access your list of contacts, or even the name and avatar associated with your own phone number.
- Signal invented a technology called *sealed sender,* which uses cryptography to prevent anyone besides you and the recipient of your message from knowing who you're communicating with. Even if Signal secretly wanted to store your metadata (or if someone hacked Signal's servers to monitor for metadata), they still wouldn't have access to it.
- Signal doesn't know which phone numbers are part of which Signal groups, or any metadata about the group, such as its name or avatar.

Signal's code is open source, which lets experts inspect it for flaws and backdoors, and its encryption protocol has been peer reviewed by cryptography experts.

Signal's security protocols stand in stark contrast to those of other encrypted messaging apps. WhatsApp, for example, routinely shares metadata with law enforcement, like exactly which phone numbers a surveillance target communicates with and when the target has used them. WhatsApp can even share this data in real time, allowing it to be used as evidence against whistleblowers like Treasury Department employee Natalie Mayflower Sours Edwards, mentioned in Chapter 1. When she was indicted in 2018 and accused of sharing a secret dataset to BuzzFeed journalist Jason Leopold, the evidence against her included real-time metadata from an encrypted messaging app. The metadata showed Edwards and Leopold exchanging hundreds of messages right as Leopold published multiple articles based on this dataset. Edwards and Leopold would have been better off if they had used Signal.

NOTE *The web page* https://signal.org/bigbrother/ *lists the handful of times that Signal has been ordered to share data with law enforcement and how they responded. In all cases, Signal either didn't share any data (because, as the organization says, "It's impossible to turn over data that we never had access to in the first place") or shared only the date that the target Signal account was created and the date that it most recently connected to the service.*

For additional security, you can compare Signal *safety numbers* with another Signal user, allowing you to verify that the end-to-end encryption with that person is secure and isn't being actively tampered with by the Signal service, your internet service provider, or anyone else. From a Signal conversation, you can tap on the name of the person you're talking to at the top, then tap View Safety Number. This should show you your safety number, both as a number and as a QR code. If your safety number is the same as the other person's, you can be sure that the end-to-end encryption is secure. If you're physically in the same room, you can both use the safety number screen to scan each other's QR codes to confirm. To confirm remotely, you can copy the safety number and paste it into a different messaging app (not Signal), then send it to the same person. If you confirm that your safety number matches, tap Mark as Verified. Once you've verified your safety number with a contact, Signal will make it clear that it's verified and warn you if it ever changes—this could mean the encryption is under attack, but more likely it just means the person you're talking to got a new phone, and you'll have to verify them again.

Once Signal messages are on your device, they're only as safe as your phone itself. Leak investigators searching your phone or your source's phone will have access to all the messages on each device. To protect against device searches, always use Signal's disappearing messages feature, which automatically deletes messages a set amount of time after you view them, unless you have a good reason to retain messages for a specific conversation. You can choose to delete messages anywhere between 30 seconds and 4 weeks after viewing, or set a custom time. I typically set disappearing messages to 4 weeks, change it to an hour or so if I'm sending secret information like a password, and then change it back to 4 weeks. In your Signal privacy settings, I recommend choosing to make all new conversations start with disappearing messages. You should also take steps to lock down your phone itself, like using a strong random passcode so that no one but you can easily unlock your device.

Signal is not only very secure but also very easy to use. Any two people with the app installed can send each other encrypted text messages, share encrypted files, and make encrypted voice and video calls or group chats for multiple users.

Exercise 2-2: Install and Practice Using Signal

In this exercise, you'll install Signal on your phone and computer and practice using it.

Start with your phone: open the iPhone App Store or the Android Play Store and download the Signal Private Messenger app. After you open the app, you'll need to verify your phone number and set a PIN (save this PIN in your password manager). Signal will also request some permissions. In my opinion, it's perfectly safe to grant all of them. Signal uses the Contacts permission to discover which of your contacts also use the app, but in

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such a way that it can't access your contact list itself. (If you grant access to your contacts, the app will notify you when one of them creates a Signal account.)

Next, download Signal on your computer from *https://signal.org*. After installing it, you'll need to scan a QR code from your phone to set up your computer as a linked device. Keep in mind that your Signal messages will now be copied to both devices, so make sure to keep them both secure.

To practice sending encrypted messages, get some friends to install Signal too. Send them messages, play with disappearing messages, and try out encrypted voice calls and video calls. If you have enough friends on Signal, start a Signal group.

Encrypting Messages with PGP

In addition to communicating via secure messaging apps, you can also encrypt messages with PGP ("pretty good privacy") encryption. This encryption method was first developed in 1991 to encrypt email. It has historically been very important in securely communicating with sources and other journalists; I used it extensively while reporting on the Snowden archive. Compared to modern encrypted messaging apps like Signal, PGP is complicated and error-prone, so I recommend that you avoid it if you can and choose one of the better alternatives instead. However, you may find it useful in future investigations if one of your sources uses it.

PGP works like this: a user creates a file on their computer called a *PGP key*, which can be split into two parts, a *public key* and a *secret key*. If you have a copy of this user's public key, you can use it to encrypt a message so that it can be decrypted only with that secret key. You can then email this scrambled message to the PGP user with the secret key. If anyone else gets access to that email, the message is scrambled and they can't read it. When the person with the secret key checks it, though, they can decrypt it and read the original message.

People sometimes still send me PGP-encrypted email, and I use PGP to respond to them securely. You can find my PGP public key on my personal website, *https://micahflee.com*. I keep my PGP secret key on a USB device called a YubiKey, which looks kind of like a USB stick with a button on it. YubiKeys (and other security keys) are mainly used to lock down online accounts. Even if a hacker knows the username and password to my Google account, for example, they won't be able to log in without first physically stealing my YubiKey, plugging it into their computer, and pressing its button while they try to log in. YubiKeys can also be used to securely store PGP secret keys.

Staying Anonymous Online with Tor and OnionShare

Tor and OnionShare are both important tools for working with sources who want to send you data anonymously, and for conducting investigations where you need to remain anonymous yourself.

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Tor is a decentralized network of volunteer servers called *nodes*. It keeps you anonymous online by bouncing your internet connection through a series of these nodes. Tor Browser is a web browser that sends all web traffic through the Tor network. Using Tor Browser works much like using Chrome or Firefox. Let's say you want to anonymously visit the Organized Crime and Corruption Reporting Project's (OCCRP) website at *https://www.occrp.org*. You simply open Tor Browser (which you can download from *https://www.torproject.org*), wait for it to connect to the Tor network, type **occrp.org** in the address bar, and hit ENTER, and the page will load.

NOTE *I've been a volunteer in the Tor community for a long time, attending the nonprofit's physical gatherings around the world, sometimes running Tor nodes to contribute to the network, and developing software related to Tor.*

Tor Browser operates more slowly than a normal browser, because it bounces your web traffic between three random Tor nodes around the world before sending it to the OCCRP website. No single node knows both your real IP address, which would reveal your location, and what website you're visiting. This means you don't need to trust the nodes to use them. Even if a Tor node is run by criminals or spies, they won't be able to de-anonymize you, at least not without exploiting a vulnerability in the Tor network itself. When you close Tor Browser, everything about your browsing session gets deleted without leaving a trace on your local computer.

Since Tor allows users to be anonymous online, people routinely use it for hacking websites, creating accounts to spam or phish people, or engaging in similar activities. For this reason, plenty of websites (including Google) are often extremely suspicious of Tor traffic, and make Tor users jump through additional hurdles like filling out CAPTCHAs or even block them altogether. Unfortunately, this is the price of online anonymity.

In addition to allowing internet users to remain anonymous, Tor can keep servers themselves anonymous. These servers are called Tor *onion services* (sometimes referred to as the *dark web*) and have domain names ending in *.onion*. You can load onion services only by using Tor. Like Tor Browser, onion services also pick three random Tor nodes to route their traffic through. When a user loads an onion site in Tor Browser, it actually requires six hops through the Tor network: three on the Tor Browser side and three on the onion service side.

NOTE *The* .onion *domain name is derived from a cryptographic fingerprint of the public key that belongs to the onion service. The Tor protocol ensures that no one else can use that same name without knowing that onion service's secret key.*

OnionShare, which I first developed in 2014 and have been adding features to ever since, is software that makes it easy for anyone to run onion services, allowing them to anonymously and securely send and receive files. It runs a web server directly on your computer, makes that server accessible to others as an onion service, and shows you a *.onion* address to send to someone else. When you start an OnionShare service, you can choose between Share

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mode, which allows others to download specific files from your computer, or Receive mode, which allows others to upload files to your computer.

OnionShare also supports other modes. With Chat mode, for instance, you can spin up an anonymous chat room. It doesn't have as many features as a Signal group, but it keeps you significantly more anonymous. With Website mode, you can quickly host a *static website*—a simple website made up of HTML files and resources like images and JavaScript, but without any databases or code running on the server—as an onion service. If someone loads that address in Tor Browser, their connection bounces through the Tor network until it reaches your computer, then loads the website hosted by OnionShare.

Figure 2-1 shows the OnionShare software configured as an anonymous dropbox, allowing my URL recipient (such as a source) to anonymously and securely upload files directly to my computer.

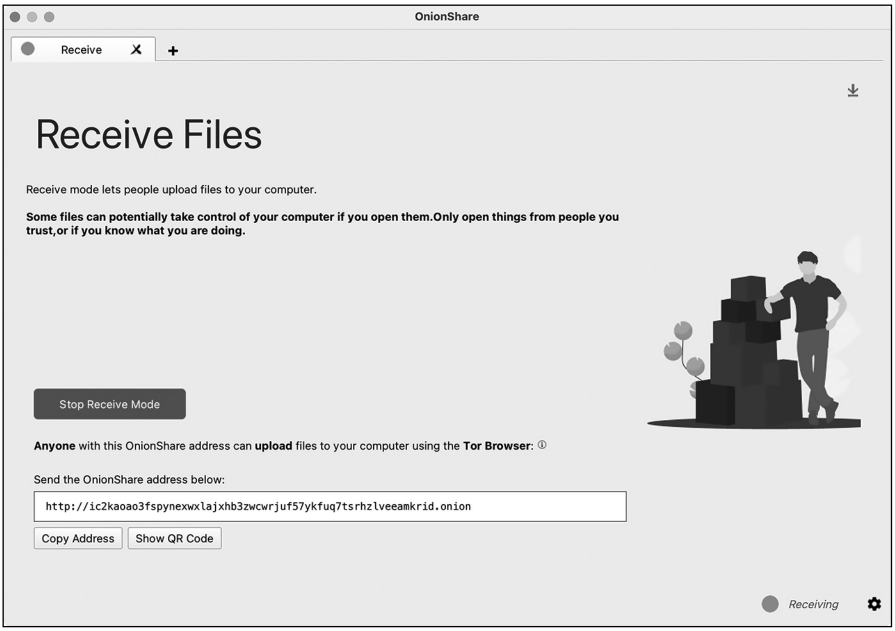

Figure 2-1: OnionShare in Receive mode

For example, to use OnionShare to let a source send me data, I'd open OnionShare on my computer, connect to the Tor network, click Receive Files, and then click Start Receive Mode. The service would give me a URL like *http://ic2kaoao3fspynexwxlajxhb3zwcwrjuf57ykfuq7tsrhzlveeamkrid.onion*. I would send that URL to my source and wait. My source would then open Tor Browser; load that URL, which would load a website hosted directly on my computer; and then upload their files. Because OnionShare uses Tor, I'd have no way of learning my source's IP address, and my source would have no way of learning mine.

Figure 2-2 shows what that web page would look like for my source.

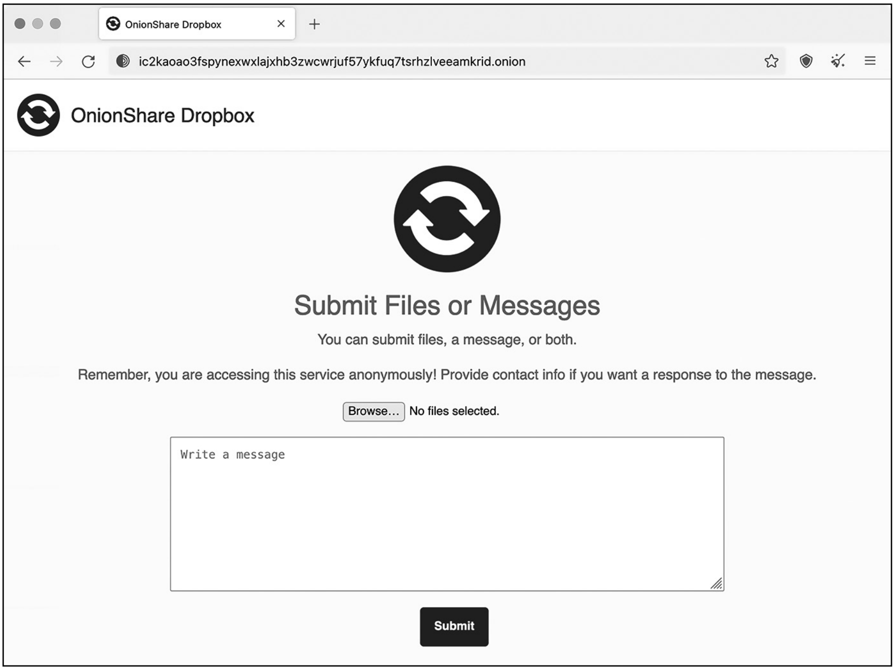

Figure 2-2: Using Tor Browser to access the OnionShare Receive mode site shown in Figure 2-1

The URL I sent to my source starts with *http://* and not *https://*. HTTPS encrypts traffic between the web browser and the web server; normally, with just plain HTTP, anyone monitoring the network can spy on exactly what you're doing, what files your uploading, and what passwords you're submitting into forms. Onion services are an exception to this rule, though, since the connection between Tor Browser and an onion service is already end-to-end encrypted. It's possible to add HTTPS to an onion service, but doing so would be redundant and unnecessary. Also notice that the domain name part of the URL in Figure 2-2 is 56 random-looking letters and numbers followed by *.onion*. Unlike with normal domain names, you don't get to choose onion service names. They all look like this.

OnionShare runs a web server directly on your computer. This means third-party companies don't have access to any of the files that are shared in it, but also that you have to time things right. If I sent that OnionShare link and then closed my laptop so it went to sleep, my source wouldn't be able to load the website until I woke my computer up again. OnionShare works best when you're working with people in real time. However, because it uses the Tor network, it's really slow. It might take many hours or even days to transfer gigabytes of data. To transfer especially large datasets, consider using a non-Tor method like those described later in this chapter.

NOTE *For more information, read the detailed documentation for OnionShare at* https://docs.onionshare.org.

If you're using OnionShare to send sensitive data, I recommend that you share OnionShare URLs only using encrypted messaging apps like Signal and avoid sending them over insecure communication channels like email or social media DM. This will prevent anyone who has access to those insecure channels from loading the OnionShare URL first, or from modifying the OnionShare URL to trick your source into uploading documents to them, for example.

Exercise 2-3: Play with Tor and OnionShare

In this exercise, you'll install Tor Browser and OnionShare on your computer and practice using them. Download OnionShare from *https://onionshare.org* and Tor Browser from *https://www.torproject.org*, and follow the instructions for your operating system.

Open Tor Browser, search for anything you like, and visit various websites to see how the online experience differs. The default Tor Browser search engine is DuckDuckGo, which works great over Tor. However, you'll find that it's frustrating to use Google, because it constantly forces you to prove you're not a robot by filling out CAPTCHAs. Several websites have both *clearnet* versions (those accessible using normal web browsers) and *.onion* versions. If you're using Tor Browser and visit a website that supports both, like *https://freedom.press*, you'll see a ".onion available" button in the top right of the address bar. Clicking it should bring you to the onion version of that site.

Figure 2-3 shows the Freedom of the Press Foundation's website in Tor Browser with the ".onion available" button.

Figure 2-3: The Freedom of the Press Foundation's home page

Next, try using OnionShare. Open a Share Files tab, browse for some files on your computer, and start the service. Then open Tor Browser, load the OnionShare URL, and download those files. Test out small files, large files, and different settings. Then try setting up an anonymous dropbox to receive files: open OnionShare, open a Receive Files tab, and start the service. In Tor Browser, load the OnionShare URL and upload files to your computer. Again, test out small files, large files, and different settings.

Communicating with My Tea Party Patriots Source

This section describes a real-world example of how I gathered data from an anonymous source using several tools you've seen so far: Twitter DMs, a PGP-encrypted message, communicating via Signal, and receiving a dataset through OnionShare.

In the summer of 2021, a journalist sent me a DM on Twitter, passing along a note from someone else. The journalist had no idea what the note said, because it was PGP-encrypted. The note looked something like this:

```
-----BEGIN PGP MESSAGE----

[lots of scrambled letters and numbers]
-----END PGP MESSAGE----
```

I plugged in my YubiKey and used it to decrypt the PGP message. It simply said:

> interested in data?
> signal: *[redacted phone number]*

At the time, I didn't publish my phone number directly on my social media bios or in my staff profile page on The Intercept's website. If I had, this source could have just contacted me directly on Signal, which would have been much simpler. Nevertheless, using PGP ensured that all communication between us was end-to-end encrypted, and even though Twitter DMs were involved, Twitter didn't have any communication metadata between my source and me.

I opened Signal Desktop on my computer, typed in the phone number I'd found in the PGP-encrypted message, and turned on disappearing messages for the conversation. I said hello and that I was interested in data. At this point I had a secure communication channel with my new source.

The source told me that they had hacked the Tea Party Patriots, a major US conservative organization that bills itself as one of the largest grassroots groups on the right. They wanted to send me a dataset that included membership lists, donation history, and petition data, and asked how they should send it. I sent them an OnionShare link to upload the dataset directly to my computer.

I later learned from this dataset that the Tea Party Patriots organization isn't nearly as grassroots as it claims: three ultra-wealthy donors, two of them billionaires, provided the bulk of the group's donations. I also learned that the group's claim of being a network of "over 3 million patriots" was wildly exaggerated: only 144,000 members were marked "active" in the hacked database. (Read my analysis of this dataset at *https://theintercept.com/2021/08/05/tea-party-patriots-hacked-billionaire-donors*.)

Other Options for Acquiring Datasets from Sources

In this section, you'll learn a couple more ways to communicate with sources when the skills you've learned so far don't fit your needs.

Sending Encrypted USB Drives

Some of your future sources may want to send you more data than is feasible to transfer over Tor. In that case, you can consider sending an encrypted USB drive through postal mail.

First, your source encrypts a USB hard drive or a small USB stick using a strong passphrase, via the technologies covered in Chapter 1, and then copies the dataset to the drive. Then they physically mail the USB drive to you. To remain anonymous, they can write your address on the package or envelope but leave the return address blank (at least in the US), attach the right amount of postage, and drop it in a public mailbox. Using an encrypted messaging app like Signal, your source can send you the encryption passphrase. When you receive the drive in the mail, you can use the passphrase to unlock the drive and access the dataset.

If the drive gets intercepted in the mail, the data is encrypted and impossible to access without the passphrase. However, the postal service will know exactly which public mailbox it was mailed from, and if your source isn't careful they might leave handwriting, fingerprints, DNA, or other clues to their identity in the package.

Keep in mind that sending an encrypted drive costs money, since you need to buy a hard drive and pay for postage, and the package might take a long time to arrive, so this isn't the best option for time-sensitive data.

SENDING ENCRYPTED DATA VIA PUBLIC FILE-SHARING SERVICES

Rather than using an encrypted USB, your source can encrypt their data and upload it to a public file-sharing service like Mega or WeTransfer, if they have the technical skill to do so. The exact process is outside the scope of this book, but here's the gist:

First, your source would need to encrypt the dataset, using one of the following methods:

- Compress the dataset in a password-protected ZIP file, using a strong passphrase. This protects only the file contents, not the filenames themselves, meaning your source may not want to use this method if the filenames in the dataset are sensitive.
- Use software like VeraCrypt (discussed in Chapter 1) to create an encrypted container that's locked with a strong passphrase.
- Use some other disk encryption software that you and the source agree upon. For example, if you both use Macs, you can create an encrypted DMG file using macOS's built-in Disk Utility instead of VeraCrypt.

Once they've encrypted the dataset, the source uploads it to a public file-sharing service. Depending on which service they use, they may need to create an account. If they want to remain anonymous to that service, they might create a temporary email address just for this task and take steps to protect their IP address with a VPN service or Tor Browser. (Uploading a huge dataset to a file-sharing service over Tor is still faster than uploading it to an onion service, because the data takes fewer hops over the Tor network.) Once the encrypted dataset is uploaded, the source sends you a link to it, along with the dataset's passphrase. After you download the dataset, use the passphrase to decrypt it.

If anyone else gets access to the data stored on the file-sharing service—such as an employee of the service, or law enforcement after sending a subpoena demanding that the service hand over data—it will be impossible for them to decrypt the dataset without knowing the passphrase.

Using Virtual Private Servers

A *virtual private server (VPS)* is a virtual computer on the internet, hosted by a company like Amazon Web Services (AWS) or DigitalOcean and normally running the Linux operating system, that your source can use to share their data. You'll learn the details of how to set up and work with a VPS in Chapter 4, but here we'll discuss when they might be appropriate for a given investigation.

The VPS option has a few downsides: it works only if your source has the necessary technical skills, it costs a small amount of money, and it's easy for your source to make mistakes if they're trying to remain anonymous. On the upside, a VPS allows your source to use extremely reliable tools to transfer large amounts of data. These tools also support resuming the transfer if it fails midway, and you can even use a VPS anonymously over Tor.

It costs just a few dollars a month to rent a VPS—if you need to use it for only a day or two it's even cheaper—and you can specify how big its hard disk needs to be depending on how much data your source wants to send you. You can then enable your source to upload data to the server remotely using a technology called *SSH*, which stands for *Secure Shell*. Your source could encrypt the dataset before uploading it if they feel it's sensitive.

Throughout this chapter, you've learned ways individual journalists can receive data from their sources. In the next section, I'll introduce additional tools and techniques appropriate for established newsrooms.

Whistleblower Submission Systems

As mentioned earlier, when Chelsea Manning tried to contact the *Washington Post* and the *New York Times* to leak the War Logs to the public, neither paper was receptive or even really prepared to accept leaked datasets. Today that's no longer the case. Dozens of major newsrooms now run

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their own whistleblower submission systems, making it simple to securely and anonymously submit leaked datasets or other tips.

Go to your favorite news site and see if you can find its tips page, which explains to potential sources and whistleblowers how to contact the newsroom securely. Here are a few examples:

- The Intercept: *https://theintercept.com/source/*
- *Washington Post*: *https://www.washingtonpost.com/anonymous-news-tips/*
- *New York Times*: *https://www.nytimes.com/tips*
- *ProPublica*: *https://www.propublica.org/tips/*
- CNN: *https://www.cnn.com/tips/*
- *Guardian*: *https://www.theguardian.com/securedrop*
- *Globe and Mail*: *https://sec.theglobeandmail.com/securedrop/*

The guidelines on these tips pages are all similar, instructing sources to securely contact the newsroom by either sending a message to a dedicated Signal phone number, physically mailing their documents using the postal service, or reaching out over the open source whistleblower submission software called *SecureDrop*.

The late information activist Aaron Swartz, along with journalist Kevin Poulsen, developed a platform in 2013 called DeadDrop for sources to securely communicate with and send documents to journalists. After Swartz's death, Poulsen handed the project over to Freedom of the Press Foundation, which renamed it to SecureDrop. At the time, I was the chief technology officer for Freedom of the Press Foundation and contributed a significant amount of code to the project.

Like OnionShare, SecureDrop turns computers into anonymous dropboxes (also powered by Tor onion services) to enable file sharing. However, it's designed for professional newsrooms. It runs on a dedicated server that's always online and available for sources to use, and it forces more secure and paranoid behavior than OnionShare does—for example, it's designed so that you can open documents sent through SecureDrop only in an air-gapped environment.

SecureDrop's increased security protects sources who are potentially risking their lives, but that security comes at a cost. The platform requires a significant amount of work to set up and maintain, including the ongoing daily work of checking it for new submissions. I spent years checking SecureDrop for The Intercept, and I know that it can be frustrating jumping through security hoops when the vast majority of submissions are nonsense or could have been sent in an email. But the effort is worth it if it protects just one genuine whistleblower.

If you work with a newsroom or an organization that wants to accept datasets from sources or whistleblowers, create a tips page on your website and look into SecureDrop. You can learn more about the SecureDrop project at *https://securedrop.org* and read detailed documentation at *https://docs.securedrop.org*.

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Summary

In this chapter, you learned about the demise of WikiLeaks and the genesis of DDoSecrets and you downloaded a copy of the BlueLeaks dataset using BitTorrent. You've seen some common tools for securely communicating with sources, like Signal, Tor, and OnionShare. You've also learned about a few other techniques for securely and anonymously transferring large amounts of data, as well as about tips pages and SecureDrop.

The next chapter marks the beginning of Part II, where you'll learn how to use the command line interface, a powerful text-based method of controlling your computer. This will prove essential for digging into datasets like BlueLeaks.

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PART II

TOOLS OF THE TRADE

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3

THE COMMAND LINE INTERFACE

Back in the days of the command-line interface, users were all Morlocks who had to convert their thoughts into alphanumeric symbols and type them in, a grindingly tedious process that stripped away all ambiguity, laid bare all hidden assumptions, and cruelly punished laziness and imprecision.

—Neal Stephenson, *In the Beginning . . . Was the Command Line*

If you're like most people, you interface with your computer primarily via its graphical desktop environment: you move the pointer with your mouse or trackpad and click icons to run programs and open documents. Programs open in windows that you can resize, maximize, minimize, and drag around the screen. You can run various programs at once in separate windows and switch between them. However, there's an alternative, incredibly powerful interface you can use to communicate with your computer and give it instructions: the *command line interface (CLI)*.

Command line interfaces are text-based, rather than graphical, interfaces to interact with your computer. Instead of clicking on icons, you enter commands to run programs in a *terminal emulator* (normally referred to just

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as a *terminal*). After running a command, you'll typically see text-based output displayed in the terminal.

In this chapter, you'll learn the basic command line skills you need to follow along with the rest of this book. Whether you're using Windows, macOS, or Linux, you'll learn how to install and uninstall software via the command line, how filepaths work, how to navigate around the folders on your computer, and how to use text editors. You'll also write your first *shell script*, a file containing a series of CLI commands.

Introducing the Command Line

To prepare you to start working on the command line, this section explains some fundamentals: what shells are, how users and paths work in different operating systems, and the concept of privilege escalation.

The Shell

The *shell* is the program that lets you run text-based commands, while the terminal is the graphical program that runs your shell. When you open a terminal and see a blinking text cursor waiting for commands, you're using a shell. When hackers try to break into a computer, their initial goal is to "pop a shell," or access the text-based interface that allows them to run whatever commands they want.

All operating systems, even mobile ones like Android and iOS, have shells. This book focuses on Unix shells, the kind that come with macOS and Linux (but Windows users can also use them). Most versions of Linux use a shell called bash, and macOS uses one called zsh. These shells are very similar, and for the purposes of this book you can think of them as interchangeable.

Windows, on the other hand, comes with two shells: an older one called Command Prompt (or *cmd.exe*) and a newer one called PowerShell. The *syntax*—rules that define what different commands mean—used by Windows shells is very different from that used by Unix shells. If you're a Windows user, you'll primarily work in a Unix shell for the examples in this book. Setting up your computer to run Linux directly in Windows will be this chapter's first exercise.

To make your shell do something, such as run a program, you carefully enter the desired command and then press ENTER (or RETURN on Mac keyboards). To quit the shell, enter **`exit`** and press ENTER. Shells are finicky: you need to enter commands using the correct capitalization, punctuation, and spacing, or they won't work. Typos usually result in nothing more serious than error messages, however, and it's easy to go back and fix a mistake in a command. I'll explain how to do so in the "Editing Commands" section later in the chapter.

Users and Paths

Although operating systems like Windows, macOS, and Linux are different in some ways, they all share basic building blocks, including users and paths.

All operating systems have *users*, separate accounts that different people use to log into the same computer. Users generally have home folders, also known as home directories, where their files live. Figure 3-1 shows my terminal in Ubuntu, a popular Linux distribution.

Figure 3-1: My Ubuntu terminal

My username is *micah* and the name of my Ubuntu computer is *rogue*. Your terminal will look different depending on your operating system, username, and computer name.

All operating systems also have filesystems, the collection of files and folders available on the computer (you got a brief introduction to filesystems in Chapter 1 while encrypting your USB disk). In a filesystem, each file and folder has a *path*, which you can think of like the location, or address, of that file. For example, if your username is *alice*, the path of your home folder in different operating systems would look as follows:

- Windows: *C:\Users\alice*
- macOS: */Users/alice*
- Linux: */home/alice*

Windows filesystems operate differently from macOS or Linux filesystems in a few key ways. First, in Windows, disks are labeled with letters. The main disk, where Windows itself is installed, is the *C: drive*. Other disks, like USB disks, are assigned other letters. In Windows, folders in a path are separated with a backslash (\), while other operating systems use forward slashes (/). In macOS and Linux, paths are case sensitive, but not in Windows. For example, in macOS you can store one file called *Document.pdf* and another called *document.pdf* in the same folder. If you try to do the same in Windows, saving the second file overwrites the first.

Let's look at some example paths. If your username is *alice* and you download a file called *Meeting Notes.docx* into the *Downloads* folder, here's what that path would look like:

- Windows: *C:\Users\alice\Downloads\Meeting Notes.docx*
- macOS: */Users/alice/Downloads/Meeting Notes.docx*
- Linux: */home/alice/Downloads/Meeting Notes.docx*

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When you plug in a USB disk, it's mounted to different paths for different operating systems. If your disk is labeled *datasets*, the path representing the location of that disk might look as follows:

- Windows: *D:* (or whatever drive letter Windows decides to mount the disk to)
- macOS: */Volumes/datasets*
- Linux: */media/alice/datasets*

It's important to understand how to read paths, since you'll need to include the location of your dataset or files it contains in the commands you run.

User Privileges

Most users have limited privileges in an operating system. However, the *root user* in Linux and macOS and the *administrator user* in Windows have absolute power. While *alice* may not be able to save files into *bob*'s home folder, for example, the root user has permissions to save files anywhere on the computer. When a Mac asks you to enter your user password to change system preferences or install software, or when a Windows machine asks if you want to allow a program to make changes to your computer, the operating system is asking for your consent before switching from your unprivileged user account to the root or administrator user account.

Most of the time when you're working in a terminal, you run commands as an unprivileged user. To run a command that requires root (or administrative) privileges in Linux and macOS, such as to install a new program, just put `sudo` in front of it and press ENTER, and you'll be prompted to enter the password for your regular user account.

As an example, the `whoami` command tells you which user just ran a command. On my computer, if I enter `whoami` without `sudo`, the output is `micah`. However, if I enter `sudo whoami`, which requires me to type my password, the output is `root`:

```
micah@rogue:~$ whoami
micah
micah@rogue:~$ sudo whoami
[sudo] password for micah:
root
```

If you recently ran `sudo`, you can run it again for a few minutes without having to re-enter your password.

WARNING *Be very careful when running commands as root, since running the wrong commands as the root user can accidentally delete all of your data or break your operating system. Before using* `sudo`*, make sure you have a clear understanding of what you're about to do.*

You can use sudo to gain root access only if your current user has administrator access. If you're the only user on your computer, you're probably an administrator. To find out, try using sudo and see whether you get a "permission denied" error.

Figure 3-2 shows a comic by Randall Munroe from his XKCD website that succinctly demonstrates the power of sudo.

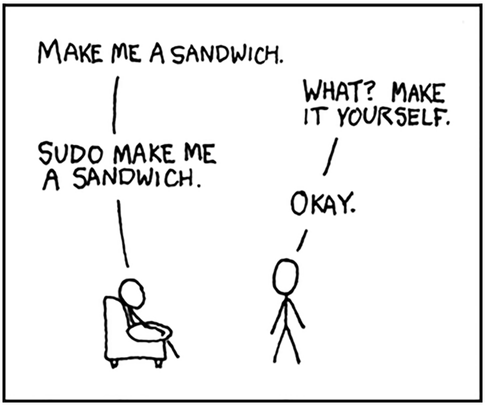

Figure 3-2: Demanding a sandwich with sudo

Before learning more command line code, Windows users must install Ubuntu (see Exercise 3-1). Mac or Linux users can skip to the "Basic Command Line Usage" section on page XX.

Exercise 3-1: Install Ubuntu in Windows

To work with Ubuntu on a Windows machine, you could install both Windows and Linux or use a virtual machine within Windows, as mentioned in Chapter 1. However, for this book's purposes, it's simplest to use the *Windows Subsystem for Linux (WSL)*, a Microsoft technology that lets you run Linux programs directly in Windows. Opening an Ubuntu window in WSL will, in turn, open a bash shell and let you install and run Ubuntu software. (Technically, WSL does use a VM, but it's fast, managed by Windows, and unobtrusive, running entirely behind the scenes.)

To install WSL, open a PowerShell window as an administrator: click **Start**, search for **powershell**, right-click **Windows PowerShell**, choose **Run as Administrator**, and click **Yes**. Figure 3-3 shows this process, which may look slightly different depending on your version of Windows.

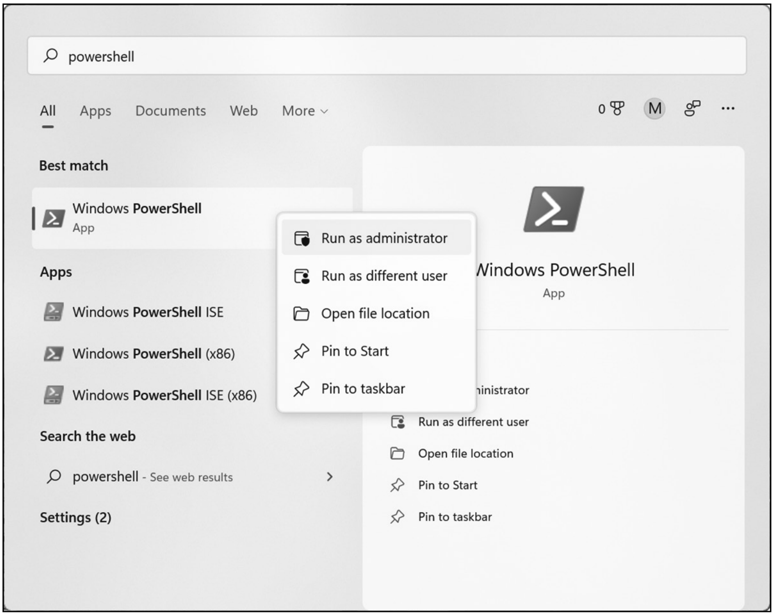

Figure 3-3: Running PowerShell as an administrator in Windows

In your administrator PowerShell window, enter the following command and press ENTER:

```
wsl --install -d Ubuntu
```

This installs the Windows Subsystem for Linux, then downloads and installs Ubuntu Linux on your computer.

Your screen should now look something like this:

```
PS C :\Windows\system32> wsl --install -d Ubuntu
Installing: Windows Subsystem for Linux
Windows Subsystem for Linux has been installed.
Downloading: WSL Kernel
Installing: WSL Kernel
WSL Kernel has been installed.
Downloading: GUI App Support
Installing: GUI App Support
GUI App Support has been installed.
Downloading: Ubuntu
The requested operation is succession. Changes will not be effective until the
system is rebooted.
PS C:\Windows\system32>
```

The final line of this output tells you to reboot your computer. Enter **exit** and press ENTER (or just close the window) to quit PowerShell, then reboot. After you log into Windows again, you should see an Ubuntu window informing you that the installation may take a few more minutes to

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complete. Then the window should present you with a prompt asking you to create a new user:

```
Please create a default UNIX user account. The username does not need to match
your Windows username.
For more information visit: https://aka.ms/wslusers
Enter new UNIX username:
```

Ubuntu needs to keep track of its own users rather than the existing users on your Windows computer.

With the Ubuntu terminal window in focus, enter a username and press ENTER. The terminal should then prompt you to create a password:

```
New password:
```

Either use the same password you use to log into your Windows account or create a new one and save it in your password manager. Enter your password and press ENTER. While you're typing, nothing will appear in the Ubuntu terminal.

The terminal should now prompt you to re-enter your new password; do so and press ENTER, which should drop you into an Ubuntu shell with a prompt and a blinking cursor. My prompt says `micah@cloak:~$` because my username is *micah* and the name of my Windows computer is *cloak*:

```
New password:
Retype new password:
passwd: password updated successfully
Installation successful!
--snip--
micah@cloak:~$
```

You can now open Ubuntu in your Windows computer. From this point on, when instructed to open a terminal or run some command line code, use an Ubuntu terminal window unless I specify otherwise.

From within your Ubuntu shell, you can access your Windows disks in the */mnt* folder. For example, you can access the *C:* drive in */mnt/c* and the *D:* drive in */mnt/d*. Suppose I download a document using my web browser and want to access it from Ubuntu. The path to my *Downloads* folder in Windows is */mnt/c/Users/micah/Downloads*, so the document would be in that folder. If I want to access the BlueLeaks data that I downloaded to my USB disk from Ubuntu, then assuming that *D:* is the USB disk's drive, the path would be */mnt/d/BlueLeaks*.

For more details on using Windows and WSL, including information on common problems related to using USB disks in WSL, as well as disk performance issues and various ways to deal with them, check out Appendix A. Wait until you've worked through at least Chapter 4 to start implementing these solutions, since the instructions involve more advanced command line concepts introduced in that chapter.

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Basic Command Line Usage

In this section, you'll learn to use the command line to explore files and folders on your computer. This is a prerequisite to working with datasets, which are just folders full of files and other folders. You'll learn how to open a terminal, list files in any folder, distinguish between relative and absolute paths, switch to different folders in your shell, and look up documentation on commands from within your terminal.

NOTE *When learning command line skills, you can always look things up if you run into problems—I still do this every day. You're likely not the first person to encounter any given command line issue, so with a few well-worded internet searches, you can find someone else's solution.*

Opening a Terminal

To get started, skip to the subsection for your operating system to learn how to open a terminal. Throughout this chapter, keep a terminal open while you're reading to test all the commands.

The Windows Terminal

If you're using Windows, open the Ubuntu app by clicking **Start** in the bottom-left corner of the screen, searching for **ubuntu**, and clicking **Ubuntu**.

You'll use Ubuntu most often for this book, but you may need to open the native Windows terminals occasionally as well. You can likewise open PowerShell and Command Prompt by clicking Start and searching for them. Check out the Microsoft program Windows Terminal (*https://aka.ms/terminal*), which lets you open different terminals in different tabs, choosing between PowerShell, Command Prompt, Ubuntu, and others. If you choose to install it, you can open it the same way.

Pin the Ubuntu app or Windows Terminal app to your taskbar so you can quickly open it in the future: right-click its icon and select **Pin to Taskbar**.

The macOS Terminal

On macOS, open the Terminal app by opening Finder, going to the *Applications* folder, double-clicking the *Utilities* folder, and double-clicking **Terminal**. Figure 3-4 shows my macOS terminal running zsh, the default macOS shell. My username is *micah*, and the name of my Mac is *trapdoor*.

Figure 3-4: My macOS terminal

Snap the Terminal app to your dock so you can quickly open it in the future. To do so, after you open Terminal, press CTRL and click the Terminal icon on your dock, then choose **Options ▸ Keep in Dock**.

The Linux Terminal

If you're using Linux, open the Terminal app. In most Linux distributions, you can do so by pressing the Windows key, typing **terminal**, and pressing ENTER. If you're running Ubuntu (or any other Linux distribution that uses the GNOME graphical environment), pin the Terminal app to your dock so you can quickly open it in the future. To so so, right-click the Terminal icon and select **Add to Favorites**.

Clearing Your Screen and Exiting the Shell

As you practice using the terminal in the following sections, you'll sometimes want to start fresh, without having to see all the previous commands you ran or their output or error messages. Run this simple command to declutter your terminal:

```
clear
```

This clears everything off the screen, leaving you with nothing but a blank command prompt. Make sure to do this only if you no longer need to see the output of your previous commands. (In the Windows Command Prompt and PowerShell, use `cls` instead of `clear`.)

When you're done using the CLI, exit your shell by running this command:

```
exit
```

You can also close the terminal window to exit. If you're running a program when you close the terminal, that program will quit as well.

Exploring Files and Directories

When you open a terminal, your shell starts out in your user's home folder, represented as a tilde (~). The folder you're currently in is your *current working directory*, or just *working directory*. If you ever forget what directory you're in, run the `pwd` command (short for "print working directory") to find out.

Running the `ls` command in your terminal lists all of the files in your working directory. You can use this command to check the contents of folders you're working with. If there are no files or only hidden files, `ls` won't list anything. To check for hidden files, modify the `ls` command using `-a` (short for `--all`):

```
ls -a
```

When you add anything to the end of a command, like `-a`, you're using a *command line argument*. Think of arguments as settings that change how the program you're running will act—in this case, by showing hidden files instead of hiding them.

By default, the `ls` command displays files in a format intended to take up as few lines in your terminal as possible. However, you may want to display one file per line for easier reading and to get more information about each file, such as its size, when it was last modified, permissions, and whether it's a folder. Using the `-l` argument (short for `--format=long`) formats the output as a list.

You can use both `-a` and `-l` at the same time like so:

```
ls -al
```

Running this command on my Mac gives me the following output:

```
total 8
drwxr-x---+ 13 micah  staff   416 Nov 25 11:34 .
drwxr-xr-x   6 root   admin   192 Nov  9 15:51 ..
-rw-------   1 micah  staff     3 Nov  6 15:30 .CFUserTextEncoding
-rw-------   1 micah  staff  2773 Nov 25 11:33 .zsh_history
drwx------   5 micah  staff   160 Nov  6 15:31 .zsh_sessions
drwx------+  3 micah  staff    96 Nov  6 15:30 Desktop
drwx------+  3 micah  staff    96 Nov  6 15:30 Documents
drwx------+  3 micah  staff    96 Nov  6 15:30 Downloads
drwx------+ 31 micah  staff   992 Nov  6 15:31 Library
drwx------   3 micah  staff    96 Nov  6 15:30 Movies
drwx------+  3 micah  staff    96 Nov  6 15:30 Music
drwx------+  3 micah  staff    96 Nov  6 15:30 Pictures
drwxr-xr-x+  4 micah  staff   128 Nov  6 15:30 Public
```

The first column of this output describes the type of file—whether it's a *directory* (another name for a folder) or an ordinary file—as well as the file's permissions. Directories start with `d`, and ordinary files start with a hyphen (`-`). The second column represents the number of links in the file, which isn't relevant for the purposes of this book.

The third and fourth columns represent the user and the *group* that owns the file. In addition to users, operating systems have groups of users that can have their own permissions. For example, in Linux, all users allowed to use `sudo` are in the *sudo* group. If you create or download a file, its user and group are normally your username. The fifth column is the file size in bytes. For example, in the file called *.zsh_history*, my output is 2,773 bytes.

The next three columns of the output represent the time and date when the file was last modified, and the final column shows the filename.

To see a listing of files in a folder other than the working directory, add the path to that folder to the end of the `ls` command. For example, this is how I'd create a listing of files in my *code/hacks-leaks-and-revelations* folder, which contains the files released with this book:

```
micah@trapdoor ~ % ls -la code/hacks-leaks-and-revelations
```

I'd get the following output:

```
total 120
drwxr-xr-x  22 micah  staff   704 Dec 21 14:11 .
drwxr-xr-x  73 micah  staff  2336 Dec  6 16:45 ..
-rw-r--r--@  1 micah  staff  8196 Dec  9 16:12 .DS_Store
```

```
drwxr-xr-x  15 micah  staff    480 Dec 21 14:41 .git
-rw-r--r--   1 micah  staff     30 Dec 21 14:22 .gitignore
-rw-r--r--   1 micah  staff  35149 Sep 23 14:54 LICENSE
-rw-r--r--   1 micah  staff   6717 Dec 21 14:17 README.md
drwxr-xr-x   4 micah  staff    128 Sep 23 14:54 appendix-a
drwxr-xr-x   8 micah  staff    256 Dec  9 16:18 appendix-b
drwxr-xr-x   6 micah  staff    192 Dec 21 14:23 chapter-1
drwxr-xr-x   5 micah  staff    160 Dec 21 14:35 chapter-10
drwxr-xr-x  12 micah  staff    384 Dec 21 14:35 chapter-11
drwxr-xr-x  12 micah  staff    384 Dec 21 14:39 chapter-12
drwxr-xr-x   8 micah  staff    256 Nov 23 18:51 chapter-13
drwxr-xr-x   4 micah  staff    128 Dec 21 14:23 chapter-2
drwxr-xr-x  10 micah  staff    320 Dec 21 14:24 chapter-3
drwxr-xr-x  13 micah  staff    416 Dec 21 14:25 chapter-4
drwxr-xr-x  13 micah  staff    416 Dec 21 14:26 chapter-5
drwxr-xr-x  10 micah  staff    320 Dec 21 14:28 chapter-6
drwxr-xr-x  13 micah  staff    416 Dec 21 14:30 chapter-7
drwxr-xr-x  18 micah  staff    576 Dec 21 14:32 chapter-8
drwxr-xr-x  15 micah  staff    480 Dec 21 14:34 chapter-9
```

You'll download your own copy of these files in Exercise 3-7.

Navigating Relative and Absolute Paths

Programs often require you to provide paths to files or folders, usually when you run a program that works with specific files on your computer. The path that I passed into `ls` in the previous section, *code/hacks-leaks-and-revelations*, is a *relative* path, meaning it's relative to the current working directory, my home folder. Relative paths can change. For example, if I change my working directory from my home folder (*/Users/micah*) to just */Users*, the relative path to that folder changes to *micah/code/hacks-leaks-and-revelations*.

The *absolute* path to the *code/hacks-leaks-and-revelations* folder is */Users/micah/code/hacks-leaks-and-revelations*, which always provides the location of that folder regardless of my working directory. Absolute paths start with a forward slash (/), which is also known as the root path.

You can use two keywords to access relative paths to specific folders: `.` (dot), which represents a relative path to the current folder, and `..` (dot dot), which represents a relative path to the *parent folder* (the folder that contains the current folder).

Changing Directories

The `cd` command (which stands for "change directory") allows you to change to a different folder. To change your working directory to the folder, run:

```
cd path
```

For *path*, substitute the path to the folder to which you'd like to move. You can use either a relative or an absolute path.

Suppose I'm using macOS and have downloaded BlueLeaks to a *datasets* USB disk plugged into my machine. After opening a terminal, I can run the

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following command to change my working directory to the *BlueLeaks* folder, using the absolute path to the folder:

```
cd /Volumes/datasets/BlueLeaks
```

Alternatively, I can use a relative path to the folder, running the following command from my home folder:

```
cd ../../Volumes/datasets/BlueLeaks
```

Why does the relative path start with `../..` in this example? When I open the terminal, the working directory is my home folder, which in macOS is */Users/micah*. The relative path .. would be its parent folder, */Users*; the relative path ../.. would be /; the relative path *../../Volumes* would be */Volumes*; and so on.

As noted earlier, the tilde symbol (~) represents your home folder. No matter what your working directory is, you can run the following to go back to your home folder:

```
cd ~
```

Use the following syntax to move to a folder inside your home folder:

```
cd ~/folder_name
```

For example, the following command would move you to your *Documents* folder:

```
cd ~/Documents
```

If you run `ls` again after a `cd` command, the output should show you the files in the folder to which you just moved.

Using the help Argument

Most commands let you use the argument `-h`, or `--help`, which displays detailed instructions explaining what the command does and how to use it. For example, try running the following:

```
unzip --help
```

This command should show instructions on all of the different arguments that are available to you when using the `unzip` command, which is used to extract compressed ZIP files.

Here's the output I got when I ran that command on my Mac:

```
UnZip 6.00 of 20 April 2009, by Info-ZIP.  Maintained by C. Spieler.  Send
bug reports using http://www.info-zip.org/zip-bug.html; see README for details.
--snip--
```

```
  -p  extract files to pipe, no messages     -l  list files (short format)
  -f  freshen existing files, create none    -t  test compressed archive data
  -u  update files, create if necessary      -z  display archive comment only
  -v  list verbosely/show version info       -T  timestamp archive to latest
  -x  exclude files that follow (in xlist)   -d  extract files into exdir
--snip--
```

This output briefly describes what each argument for the `unzip` command does. For example, if you use the `-l` argument, the command shows a list of all of the files and folders inside the ZIP file without actually unzipping it.

Accessing Man Pages

Many commands also have manuals, otherwise known as *man pages*, which give more detail about how to use those commands. Run the following to access a command's man page:

```
man command_name
```

For example, to read the manual for the `unzip` command, run:

```
man unzip
```

The output should display a longer explanation of how to use the `unzip` command and its arguments.

Use the up and down arrows and the page up and page down keys to scroll through the man pages, or press / and enter a term to search. For example, to learn more details about how the `unzip` command's `-l` argument works, press / and enter **`-l`**, then press ENTER. This should bring you to the first time `-l` appears on the man page. Press **`n`** to move on to the next occurrence of your search term.

When you're finished, press **`q`** to quit the man page.

Tips for Navigating the Terminal

This section introduces ways to make working on the command line more convenient and efficient, along with tips for avoiding and fixing errors. It also shows how to handle problematic filenames, such as those with spaces, quotes, or other special characters. A basic understanding of these concepts will save you a lot of time in the future.

Entering Commands with Tab Completion

Shells have a feature called *tab completion* that saves time and prevents errors: enter the first few letters of a command or a path, then press the TAB key. Your shell will fill in the rest if possible.

For example, both macOS and Ubuntu come with a program called `hexdump`. In a terminal, enter **`hexd`** and press TAB. This should automatically fill in the rest of the `hexdump` command. Tab completion also works for paths. For example, Unix-like operating systems use the */tmp* folder to store temporary files. Enter **`ls /tm`** and press TAB. Your shell should add the `p` to finish typing out the full command.

If you enter only the first couple letters of a command or a path, there may be more than one way for your shell to complete your line of code. Assuming that you have both *Downloads* and *Documents* folders in your home folder, type **`ls ~/Do`** and press TAB. You'll hear a quiet beep, meaning that the shell doesn't know how to proceed. Press TAB one more time, and it should display the options, like this:

```
Documents/  Downloads/
```

If you enter a `c` so that your command so far is `ls ~/Doc` and press TAB, the command should complete to `ls ~/Documents/`. If you enter a `w` so that your command so far is `ls ~/Dow` and press TAB, it should complete to `ls ~/Downloads/`.

If you've already typed out the path of a folder, you can also press TAB to list files in that folder, or to automatically complete the filename if there's only one file in the folder. For example, say I have my *datasets* USB disk, on which I've downloaded BlueLeaks, plugged into my Ubuntu computer. If I want to change to my *BlueLeaks* folder, I can enter the following and press TAB:

```
cd /Vo
```

This completes the command as follows:

```
cd /Volumes/
```

I press TAB again, and my computer beeps and lists the folders in */Volumes*, which in my case are *Macintosh HD* and *datasets*. I enter `d`, so my command is `cd /Volumes/d`, and press TAB, and the shell completes the command as follows:

```
cd /Volumes/datasets/
```

I press TAB again. My computer beeps again and lists all of the files and folders in my *datasets* USB disk. I enter `B` (the first letter of BlueLeaks) and press TAB, which gives me:

```
cd /Volumes/datasets/BlueLeaks/
```

Finally, I press ENTER to change to that folder.

Editing Commands

You can also edit commands. When you start typing a command, you can press the left and right arrow keys to move the cursor, allowing you to edit

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the command before running it. You can also press the HOME and END keys—or, if you're using a Mac keyboard, CONTROL-A and CONTROL-E—to go to the beginning and end of a line, respectively. You can also cycle between commands you've already run using the up and down arrows. If you just ran a command and want to run it again, or to modify it and then run it, press the up arrow to return to it. Once you find the command you're looking for, use the arrow keys to move your cursor to the correct position, edit it, and then press ENTER to run it again.

For example, I frequently get "permission denied" errors when I accidentally run commands as my unprivileged user when I should have run them as root. When this happens, I press the up arrow, then CONTROL-A to go to the beginning of the line, add `sudo`, and press ENTER to successfully run the command.

Dealing with Spaces in Filenames

Sometimes filenames contain multiple words separated by spaces. If you don't explicitly tell your shell that a space is part of a filename, the shell assumes that the space is there to separate parts of your command. For example, this command lists the files in the *Documents* folder:

```
ls -lh ~/Documents
```

Under the hood, your shell takes this string of characters and splits it into a list of parts that are separated by spaces: `ls`, `-lh`, and `~/Documents`. The first part, `ls`, is the command to run. The rest of the parts are the command's arguments. The `-lh` argument tells the program to display the output as a list and make the file sizes human-readable. That is, it will convert the file sizes into units that are easier to read, like kilobytes, megabytes, and gigabytes, rather than a large number of bytes. The `~/Documents` argument means you want to list the files in that folder.

Suppose you want to use the same command to list the files in a folder with a space in its name, like *~/My Documents*. You'll run into problems if you enter this command:

```
ls -lh ~/My Documents
```

When your shell tries to separate this command into parts, it will come up with `ls`, `-lh`, `~/My`, and `Documents`; that is, it sees *~/My Documents* as two separate arguments, `~/My` and `Documents`. It will try to list the files in the folder *~/My* (which doesn't exist), then also list files in the folder *Documents*, which isn't what you intended.

To solve this problem, put the name of the folder in quotes:

```
ls -lh "~/My Documents"
```

The shell sees anything within quotes as a single entity. In this case, `ls` is the command and its arguments are `-lh` followed by `~/My Documents`.

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Alternatively, you can use a backslash (\) to *escape* the space:

```
ls -lh ~/My\ Documents
```

In the Unix family of operating systems, the backslash is called the *escape character*. When the shell parses that string of characters, it treats an *escaped space* (\ followed by a space) as a part of the name. Again, the shell reads ls as the command and -lh and ~/My Documents as its arguments.

Using Single Quotes Around Double Quotes

You can use the escape character to escape more than spaces. Suppose you want to delete a filename that has a space *and* quotes in it, like *Say "Hello".txt*. You can use the rm command to delete files, but the following syntax won't work:

```
rm Say "Hello".txt
```

Your shell will split this command into the words rm, Say, and Hello.txt. You might think you could solve this by simply adding more quotes

```
rm "Say "Hello".txt"
```

but that won't work either, since you're quoting something that contains quotes already. Instead, surround the argument with single quotes ('), like this:

```
rm 'Say "Hello".txt'
```

When your shell sees an escaped quote (\"), it won't treat it as a normal quote. It will read the command as rm and the argument as Say "Hello".txt, exactly as you intended.

Avoid putting spaces, quotes, or other troublesome characters in filenames whenever possible. Sometimes you can't avoid them, especially when working with datasets full of someone else's files. Tab completion helps in those cases, allowing you to enter just enough of the filename so that when you press TAB, your shell will fill out the rest for you. To delete a file in your working directory called *Say "Hello".txt*, for example, entering rm Sa<TAB> completes the command to rm Say\ \"Hello\".txt with the correct escape characters included, so you don't have to provide the proper syntax yourself.

Installing and Uninstalling Software with Package Managers

Of the many powerful command line tools that let you quickly work with datasets, only some come preinstalled; you'll need to install the rest yourself. While you're likely used to installing software by downloading an installer from a website and then running it, the command line uses *package*

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managers, programs that let you install, uninstall, and update software. Nearly all CLI software is free and open source, so Linux operating systems come with large collections of software that you can easily install or uninstall with a single command. Package management projects are also available for macOS (Homebrew) and Windows (Chocolately).

If you're using Linux, you likely use a package manager called apt. This is what the popular Linux operating systems like Ubuntu and Debian use, as well as all of the Linux distributions based on them (including Ubuntu in WSL). If your Linux distribution doesn't use apt, you'll need to look up the package manager documentation for your operating system.

PACKAGE MANAGEMENT FOR NON-UBUNTU LINUX USERS

You should be able to follow along with this book no matter what version of Linux you're using. Several other Debian-based Linux distributions also rely on apt, like Linux Mint, Pop! OS, and others. If you're using one of these, the apt commands in this book should work, though the names of software packages may be slightly different. If you encounter that issue, run `apt search` *`software_name`* to find the name of the package that you should be installing for your operating system.

If you're using a version of Linux that doesn't use apt as its package manager, you'll need to slightly modify this book's commands to use your Linux distribution's package manager. For example, if you're running Fedora, Red Hat, CentOS, or other similar Linux distributions, you'll use a package manager called DNF (for older versions of these distributions, the package manager is called yum). See Fedora's documentation at *https://docs.fedoraproject.org/en-US/quick-docs/dnf/* for more details on using DNF. Arch Linux uses a package manager called pacman (*https://wiki.archlinux.org/title/Pacman*).

If you're using a Linux distribution not mentioned here, read your operating system's package management documentation and learn how to search for, install, uninstall, and update software from the terminal. When you come across an apt command in this book, use your operating system's package manager software instead. Other Linux commands covered in this book should be the same regardless of your distribution.

If you're using a Mac, start with Exercise 3-2 to learn how to use Homebrew. If you're using Linux or Windows with WSL, skip to Exercise 3-3 to learn how to use apt. This book mostly uses Unix shells and doesn't cover Chocolately, which installs Windows software instead of Linux software.

Exercise 3-2: Manage Packages with Homebrew on macOS

To install Homebrew, macOS's package manager, open a browser and go to Homebrew's website at *https://brew.sh*, where you should find the command to install the tool. Copy and paste the installation command into your terminal and press ENTER:

```
/bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"
```

This command uses a program called cURL, which I'll discuss later in this chapter, to download a shell script from GitHub. It then runs that script using the bash shell. The script itself uses `sudo`, meaning that if you enter your password, it will run commands as root on your computer.

This is what the output looks like on my Mac:

```
==> Checking for 'sudo' access (which may request your password)...
Password:
```

Enter the password you use to log into your Mac and press ENTER to change your status from unprivileged user to root. No characters will appear in the terminal while you're typing.

After you enter your password, Homebrew should show you a list of paths for files that it will install. The output should end with the following message:

```
Press RETURN to continue or any other key to abort:
```

Press ENTER and wait for Homebrew to finish installing. If any problems arise, Homebrew will fail and show you an error message.

WARNING *Copying and pasting commands into your terminal can be dangerous: if a hacker tricks you into running the wrong shell script, they could hack your computer. Copy and paste commands in your terminal only from sources you trust.*

Now that you've installed Homebrew, you have access to the `brew` command, which you can use to install more software. To check whether Homebrew has a certain program available to install, run:

```
brew search program_name
```

For example, Neofetch is a CLI program that displays information about your computer. To see if it's available in Homebrew, run:

```
brew search neofetch
```

The output should list the packages that have *neofetch* in their names or descriptions; in this case, Neofetch should be listed. Similarly combine `brew search` with other program names to check whether they're available to install.

When you find a package you want to install, run:

```
brew install program_name
```

For example, to install Neofetch, run:

```
brew install neofetch
```

This should download and install the `neofetch` tool. Try running it:

```
neofetch
```

Figure 3-5 shows Neofetch running on my Mac. The figure is black-and-white in print, but if you run the command on your computer, you should see a rainbow of colors.

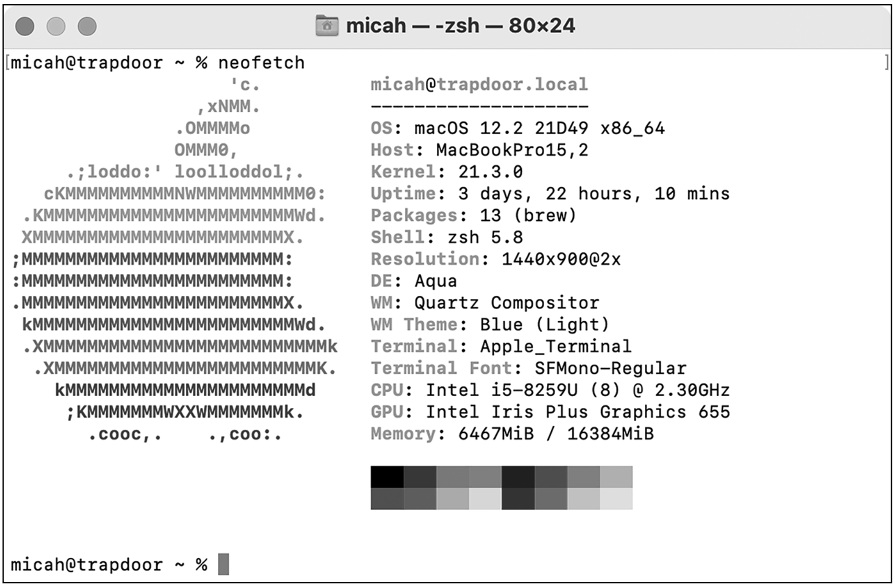

Figure 3-5: Running Neofetch on my Mac

Uninstall programs with the `brew uninstall` command. For example, run the following to uninstall Neofetch:

```
brew uninstall neofetch
```

To update all programs you've installed with Homebrew to their latest versions, run:

```
brew update
```

Run **brew help** to see some examples of how to use this command.

Now that you have a package manager installed, you'll practice using the command line in Exercise 3-4.

Exercise 3-3: Manage Packages with apt on Windows or Linux

You must run most apt commands as root. Before installing or updating software, make sure your operating system has an up-to-date list of available software by opening a terminal and running the following:

```
sudo apt update
```

When I run that command on my Linux computer, I get this output:

```
Hit:1 http://us.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:3 http://us.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://us.archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
178 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

This tells me I have 178 packages that can be upgraded. Run the following to upgrade your own software:

```
sudo apt upgrade
```

Here's the output when I run that command:

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
--snip--
178 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
64 standard security updates
Need to get 365 MB of archives.
After this operation, 2,455 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Type **Y** and press ENTER to install the updates.

You're now ready to install new software. To check whether the package manager has a certain program available to install, run:

```
apt search program_name
```

You don't need to use `sudo` with this search command because it's not installing or uninstalling anything. However, once you find a package you want to install, run:

```
sudo apt install program_name
```

For example, Neofetch is a CLI program that displays information about your computer. To see if Neofetch is available in your package manager, run:

```
apt search neofetch
```

The output should show a list of packages that have *neofetch* in their names or descriptions—in this case, Neofetch should be listed.

To install the `neofetch` tool, run:

```
sudo apt install neofetch
```

You should see a list of packages that you must install in order to use Neofetch. Press **Y** and then ENTER to download and install them all.

Once installation is complete, try running Neofetch:

```
neofetch
```

Figure 3-6 shows Neofetch running on my Ubuntu computer. The figure is black-and-white in print, but if you run the command on your computer, the output should appear in several different colors.

Figure 3-6: Running Neofetch on my Ubuntu computer

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Uninstall packages with the `sudo apt remove` command. For example, to uninstall Neofetch, run:

```
sudo apt remove neofetch
```

Now that you have a package manager installed, you'll practice using the command line in Exercise 3-4.

Exercise 3-4: Practice Using the Command Line with cURL

In this exercise, you'll learn how to determine whether you have a command installed, download web pages, save the output from a file using redirection, and view the contents of files directly from the terminal.

The cURL program is a common way to load web pages from the command line. To load all of the HTML code for the website *https://www.torproject.org*, for example, run the following command:

```
curl https://www.torproject.org
```

To see if cURL is installed, use the `which` command:

```
which curl
```

If cURL is installed, the output should show you the path where the program is installed on your computer (something like */usr/bin/curl*). If not, the output should return you to the shell prompt.

If you don't have cURL, use your package manager to install it. Enter **`sudo apt install curl`** for Windows with WSL and Linux machines, or **`brew install curl`** for Macs. Then run **`which curl`** again, and you should see the path to the cURL program.

Download a Web Page with cURL

When you load a web page, your web browser renders a human-readable version of its content based on the page's HTML, CSS, and JavaScript code. To see the raw HTML content from the web page hosted at *https://example.com*, run the following command in your terminal:

```
curl example.com
```

If you load that site in a browser and then view the HTML source by pressing CTRL-U in Windows or Linux, or ⌘-U in macOS, you should see the same HTML code that this command displays in your terminal.

Some websites are designed to show you text that's easy to read in a terminal when you access them through cURL, as opposed to showing you HTML. For example, *https://ifconfig.co* will tell you your IP address, geolocate

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it, and tell you what country and city it thinks you're in. Try running the following command:

```
curl https://ifconfig.co
```

This should display your IP address. Next, run the following:

```
curl https://ifconfig.co/country
```

When I run this command, my output is `United States`. You can try connecting to a VPN server in another country and then run it again; it should detect your web traffic as coming from that other country.

Save a Web Page to a File

Run the following commands to load *https://example.com* and save it to a file:

```
cd /tmp
curl example.com > example.html
```

The first line of code changes your working directory to */tmp*, a temporary folder where files you store get deleted automatically. The second line loads *https://example.com*, but instead of displaying the site's contents for you in the terminal, it redirects them into the file *example.html* and doesn't display anything in the terminal.

The > character takes the output of the command to its left and saves it into the filename to its right. This is called *redirection*. Since you changed to the */tmp* folder before running the `curl` command, and the filename you provided was a relative path, it saved to the file */tmp/example.html*.

Run a directory listing to make sure you've stored the file correctly:

```
ls -lh
```

This should list all the files in */tmp*, which should include a file called *example.html*. Try displaying the contents of that file in your terminal using the `cat` command:

```
cat /tmp/example.html
```

The terminal isn't always a good place to view a file's contents. For example, long lines will wrap, which may make them difficult to comprehend. In the following section, you'll learn more about the different types of files and how to work with them more easily in the command line.

Text Files vs. Binary Files

There are many different types of files, but they all fit into one of two categories: *text files* and *binary files*.

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Text files are made up of letters, numbers, punctuation, and a few special characters. Source code, like Python scripts (discussed in Chapters 7 and 8); shell scripts; and HTML, CSS, and JavaScript files are all examples of text files. Spreadsheets in CSV (comma-separated value) format and JSON files (discussed in Chapters 9 and 11, respectively) are also text files. These files are relatively simple to work with. You can use the `cat` command to display text files, as you did in the previous exercise.

Binary files are made up of data that's more than just letters, numbers, and punctuation. They're designed for computers programs, not humans, to understand. If you try to view the contents of a binary file using the `cat` command, you'll just see gibberish. Instead, you must use specialized programs that understand those binary formats. Office documents like PDFs, Word documents, and Excel spreadsheets are binary files, as are images (like PNG and JPEG files), videos (like MP4 and MOV files), and compressed data like ZIP files.

NOTE *The term* binary file *is technically a misnomer, because all files are represented by computers as binary—strings of ones and zeros.*

Text files aren't always easy to understand (if you're not familiar with HTML, viewing it might look like gibberish), but it's at least possible to display them in a terminal. This isn't true for binary files. For example, if you try using `cat` to display the contents of binary files like PNG images in your terminal, the output will look something like this:

```
?PNG

IHDR?L??
?D?ᮁ???? Pd@?????Y????????u???+?2???ｙ???@?!N???? ^?K??E?(??U?N????E??ɨ??.?Ɠ?u_??|?????g?s?,{?@;?
?sQ
 ?x?)b?hK'?/??L???t?+???eC????+?@????L??????/@c@뾞7?qĶ?F
                                                     ?L????N??4Ḩ4???!?????
--snip--
```

Your terminal can't display all of the characters that make up PNG images, so those characters just don't get displayed. If you want to see the information stored in a PNG, you need to open it in software that's designed to view images.

To work with the files in datasets or write shell scripts and Python code, you'll need a *text editor*, a program designed to edit text files. You'll install a text editor in Exercise 3-5 to prepare for writing your first shell script.

Exercise 3-5: Install the VS Code Text Editor

In this exercise, you'll download the free and open source text editor Visual Studio Code (VS Code) and practice using it to view a file. Download VS Code from *https://code.visualstudio.com* and install it. (If you're already familiar with another text editor, feel free to keep using that one instead.)

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VS Code comes with a command called `code` that makes it easy to open files in VS Code directly from your terminal. Once VS Code is finished installing, run the following commands:

```
curl example.com > /tmp/example.html
code /tmp/example.html
```

The first line of code saves the HTML from *example.com* in the file */tmp/example.html*, just like you did in Exercise 3-4. The second line opens this file in VS Code.

When you open new files and folders in VS Code, it asks whether you trust each file's author, giving you the option to open the file in Restricted Mode. For the exercises in this book, you can open files without using Restricted Mode.

When you open *example.html*, it should look something like this:

```
<!doctype html>
<html>
<head>
    <title>Example Domain</title>

    <meta charset="utf-8" />
    <meta http-equiv="Content-type" content="text/html; charset=utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <style type="text/css">
    body {
        background-color: #f0f0f2;
        margin: 0;
        padding: 0;
        font-family: -apple-system, system-ui, BlinkMacSystemFont, "Segoe UI", "Open Sans",
"Helvetica Neue", Helvetica, Arial, sans-serif;

    }
--snip--
```

The output shows the same HTML code that you saw in your terminal when you ran `cat/tmp/example.html` in Exercise 3-4, but this time it should be much easier to read. VS Code and many other text editors have a feature called *syntax highlighting*, where different parts of the file appear in different colors. This makes it far quicker and easier for your brain to interpret source code, and also for you to catch mistakes in syntax.

VS Code is highly customizable and includes a wide variety of extensions that add extra functionality and make the program more pleasant to use. When you open new types of files, for instance, VS Code might ask if you'd like to install extensions to better support those files.

NOTE *To learn more about VS Code's other features, including when to use Restricted Mode, check out the documentation at* https://code.visualstudio.com/docs.

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Now that you have some experience running commands in a shell and have set up a text editor, you'll write your first shell script in Exercise 3-6.

Exercise 3-6: Write Your First Shell Script

As mentioned earlier, a shell script is a text file that contains a list of shell commands. When you tell your shell to run the script, it runs those commands one at a time. Many commands are themselves shell scripts, such as the `man` command you used earlier in this chapter.

Navigate to Your USB Disk

Make sure your *datasets* USB disk is plugged in and mounted, and open up a terminal. To change your working directory to the *datasets* disk, skip to the subsection for your operating system.

Windows

After mounting your USB disk, open File Explorer by clicking **This PC** on the left. This page will show all of your connected drives and their drive letters. Note your USB disk's drive letter, then change your working directory to the disk by running the following command, substituting *d* for the correct drive letter:

```
cd /mnt/d/
```

Your shell's working directory should now be your *datasets* USB disk. To check, run **`ls`** to view the files on this disk.

macOS

After mounting your *datasets* USB disk, open a terminal and change your working directory to the disk by running the following command:

```
cd /Volumes/datasets
```

Your shell's working directory should now be your *datasets* USB disk. To check, run **`ls`** to view the files on this disk.

Linux

After mounting your *datasets* USB disk, open a terminal and change your working directory to the disk. In Linux, the path to your disk is probably something like */media/<username>/datasets*. For example, my username is *micah*, so I would run this command:

```
cd /media/micah/datasets
```

Your shell's working directory should now be your *datasets* USB disk. To check, run **ls** to view the files on this disk.

Create an Exercises Folder

The `mkdir` command creates a new folder. Now that you're in your USB disk drive in your terminal, run the following commands to create a new folder called *exercises*, and then switch to it:

```
mkdir exercises
cd exercises
```

Now make a folder for your Chapter 3 homework:

```
mkdir chapter-3
```

Next, you'll open the *exercises* folder in VS Code.

Open a VS Code Workspace

Each VS Code window is called a *workspace*. You can add folders to your workspace, which allows you to easily open any files in that folder or create new ones. To open a VS Code workspace for your *exercises* folder, run the following command:

```
code .
```

If the argument that you pass into `code` is a folder, like `.` (the current working directory), VS Code will add that folder to your workspace. If the path is a file, like in Exercise 3-5 when you opened */tmp/example.html*, it will open just that file.

Next, create a new file in the *chapter-3* folder. To do this, right-click the *chapter-3* folder, choose **New File**, name your file *exercise-3-6.sh*, and press ENTER. This should create a new file that you can edit. Since the file extension is *.sh*, VS Code should correctly guess that it's a shell script and use the right type of syntax highlighting.

Figure 3-7 shows a VS Code workspace with the *exercises* folder added and the empty file *exercise-3-6.sh* created.

The VS Code window is split into two main parts. The Explorer panel on the left shows the contents of all of the folders added to your workspace. In this case, it shows *exercises* and everything it contains: a *chapter-3* folder and the *exercise-3-6.sh* file you just created. The right side of the window is the editor, where you'll enter your shell script.

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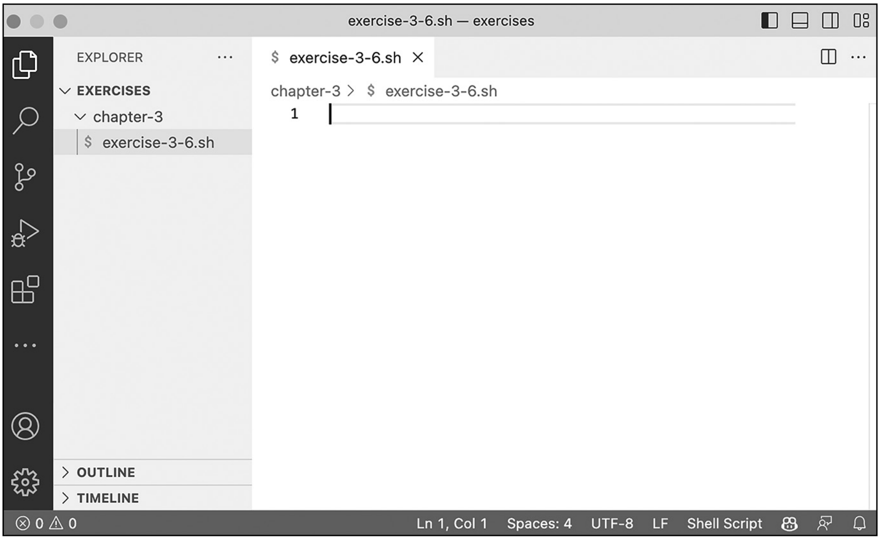

Figure 3-7: VS Code with the exercises folder open in a workspace

Write the Shell Script

Enter the following text into *exercise-3-6.sh* in VS Code and save the file:

```
#!/bin/bash
echo "Hello world! This is my first shell script."
# Display the current user
echo "The current user is:"
whoami
# Display the current working directory
echo "The current working directory is:"
pwd
```

The first line that starts with `#!` is called the *shebang*, and it tells the shell which *interpreter*—the program that opens and runs the script—to use. In this case, the shell will use `/bin/bash`, meaning you're writing a bash script. In this book, you'll add that same shebang to the top of all of your shell scripts. Even if you're working from a shell besides bash, this shebang tells your computer to run the current script using bash.

In shell scripts, lines that start with the hash character (`#`) are called *comments*, and they don't affect how the code itself works; if you removed the comments from this script, it would run the same way. The first character of the shebang is a hash character, which means that it's technically a comment in bash and zsh.

Comments like `# Display the current user` work as notes to remind you what your code does when you come back to a script you wrote months or years earlier. Anyone else who works with your code, perhaps trying to fix something or add features, will appreciate your comments for the same reason.

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The `echo` command displays text to the terminal. The `whoami` command displays the name of the user running the script. The `pwd` command displays the current working directory.

Run the Shell Script

Before you can run a script, you need to make it *executable* by giving it permission to run as a program. The `chmod` command lets you change permissions on files with the following syntax:

```
chmod permissions filename
```

To mark a file as executable, use `+x` as the *permissions* argument. Run the following command in your terminal (from within your *exercises* folder):

```
chmod +x ./chapter-3/exercise-3-6.sh
```

You can now run the script by entering either its absolute path or its relative path:

```
./chapter-3/exercise-3-6.sh
```

Starting your command with `./` tells your shell that you're entering the relative path to a script.

Here's the output I get when I run this script on my Mac:

```
Hello world! This is my first shell script.
The current user is:
micah
The current working directory is:
/Volumes/datasets/exercises
```

The current user is *micah* and the current working directory is */Volumes/datasets/exercises*.

This script shows you different output depending on your working directory. To demonstrate the differences, here's what happens when I switch to my home folder and then run it again:

```
micah@trapdoor exercises % cd ~
micah@trapdoor ~ % /Volumes/datasets/exercises/chapter-3/exercise-3-6.sh
Hello world! This is my first shell script.
The current user is:
micah
The current working directory is:
/Users/micah
```

This time, the current working directory in the output has changed to */Users/micah*. Try switching to your own home folder with **`cd ~`** and running the script again.

The script also shows different output depending on which user is running it. So far I've been running it as *micah*, but here's what the output looks like when I run it as root:

```
micah@trapdoor ~ % sudo /Volumes/datasets/exercises/chapter-3/exercise-3-6.sh
Password:
Hello world! This is my first shell script.
The current user is:
root
The current working directory is:
/Users/micah
```

This time, the output lists the current user as `root`. Try running the script as root on your own computer.

You'll write many more scripts throughout this book. I've included a copy of the code for every exercise in this book's online resources. In Exercise 3-7, you'll download a copy of all of this code.

Exercise 3-7: Clone the Book's GitHub Repository

Programmers store source code in *git repositories* (or *git repos* for short), which are composed of a collection of files (usually source code) and the history of how they have changed over time. By storing your scripts this way, you can host them on GitHub, a popular website for hosting git repos. Git repos help you share your code with others, and they make it easier for multiple people to write code for the same project. When you *clone* a git repo, you download a copy of it to your computer.

This book comes with a git repo at *https://github.com/micahflee/hacks-leaks-and-revelations* containing the code for every exercise and case study in this book, along with additional instructions and source code related to the book's appendixes. In this assignment, you'll clone this repo and store the copy locally on your computer.

First, check whether the `git` program is installed on your machine:

```
which git
```

If git is installed, you'll see its path in the output, like */usr/bin/git*. If it's not installed, this command won't display anything in the terminal. In that case, install git by entering the appropriate command for your operating system: **`brew install git`** for macOS users, or **`sudo apt install git`** for Linux and WSL users.

Next, in your terminal, change to your USB disk folder. On my macOS computer, I do this with the following command:

```
cd /Volumes/datasets
```

If necessary, replace the path in my command with the appropriate path to your *datasets* USB disk for your operating system.

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Once you're in the *datasets* disk, run this command to clone the repo:

```
git clone https://github.com/micahflee/hacks-leaks-and-revelations.git
```

This should create a new folder called *hacks-leaks-and-revelations* containing all of the code from the book's repo.

Finally, add the book's git repo folder to your VS Code workspace. In VS Code, click **File ▸ Add Folder to Workspace**, then browse for the *hacks-leaks-and-revelations* folder on your USB disk. This will add the book's code to your VS Code workspace so you can easily browse through all of the files.

You now have access to solutions for all future exercises! In the following chapters, I'll walk you through the process in all of the programming exercises, but you can also run the complete scripts taken from the git repo or copy and paste their code into your own programs.

Summary

In this chapter, you've learned the basics of command line theory, including how to use the shell in a terminal, run various shell commands, and navigate the shell using features like tab completion. You installed software directly in the terminal using a package manager, and you wrote your first simple shell script.

In the next chapters, you'll put these techniques into practice to explore hundreds of gigabytes of data, make datasets searchable, convert email from a proprietary format to an open format, and write Python code. You'll start in the following chapter by taking a deeper dive into the BlueLeaks dataset.

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4

EXPLORING DATASETS IN THE TERMINAL

In this chapter, you'll build on the command line skills you've learned so far and begin investigating real datasets. You'll use `for` loops to unzip the BlueLeaks files, then search the files to determine which fusion centers have the most data and which documents contain the keywords *antifa* and *Black Lives Matter*. I'll also give an overview of the mysterious encrypted data in the dataset and describe my hypothesis of how the hacker collected the data.

You'll also learn to create Linux cloud servers and connect to them securely for faster internet and extra disk space. As practice, you'll use a remote server to download and briefly examine hacked data from the Oath Keepers militia, a far-right extremist group that participated in the January 6, 2021, US Capitol insurrection.

Introducing for Loops

The BlueLeaks torrent you downloaded in Exercise 2-1 is 269GB and contains 168 different ZIP files ranging from 49GB to half a kilobyte each. In theory, you could manually unzip these 168 files one at a time to access the data. However, this slow, tedious process becomes impractical with even larger datasets (imagine individually extracting 10,000 ZIP files). In this section, you'll learn to speed up this task by automating it with `for` loops.

A `for` loop is a type of command that runs a piece of code once for every item in a list. Each time the code loops, it stores the current item in a *variable*, which you can think of as a placeholder for some value. Code variables are similar to those in math, where the value of *x* might be different for different problems, but in shell scripting, the values can be text or numbers. Even though each loop runs the same code, the results may be different, because the value of the variable changes with each loop.

For example, the following `for` loop displays the numbers 1, 2, and 3:

```
for NUMBER in 1 2 3
do
  echo $NUMBER
done
```

This `for` loop starts with the syntax `for` *`variable_name`* `in` *`list_of_items`*, followed by `do`, followed by the commands to run for each item in the list, followed by `done`. In this case, *`variable_name`* is `NUMBER` and *`list_of_items`* is `1 2 3`. The value of the `NUMBER` variable will be `1` the first time the code loops, `2` during the second loop, and `3` during the third loop.

The `echo` command displays something to the terminal, in this case `$NUMBER`. The dollar sign (`$`) means the code should display the value of the `NUMBER` variable, rather than the word `NUMBER`.

NOTE *Using all caps is a common convention for variable names, but it's not required. For example, you could call the variable* `number` *instead of* `NUMBER` *and display it with* `echo $number` *instead of* `echo $NUMBER`*. Variable names are case sensitive.*

When you run the previous `for` loop in your terminal, you should see the following output:

```
1
2
3
```

You can also use a `for` loop to loop through the output of another shell command, as shown in the following code:

```
for FILENAME in $(ls *.zip)
do
    echo "ZIP filename: $FILENAME"
done
```

The variable name in this code is `FILENAME`. Next, `$(ls *.zip)` tells your machine to run the `ls *.zip` command. This command outputs a list of all of the ZIP files in the current folder, producing a list of filenames. The `for` loop cycles through that list and runs the code between `do` and `done` for each filename. In this case, the `echo` command prints the filenames to the terminal in `ZIP filename: `*`filename`* format.

For example, here's what it looks like when I run this code in the *BlueLeaks* folder in my terminal on macOS:

```
micah@trapdoor BlueLeaks % for FILENAME in $(ls *.zip)
for> do
for>     echo "ZIP filename: $FILENAME"
for> done
ZIP filename: 211sfbay.zip
ZIP filename: Securitypartnership.zip
ZIP filename: acprlea.zip
--snip--
```

Each loop, the value of `FILENAME` is the name of one of the ZIP files. When the `echo` command runs, it displays those filenames, one after another.

Exercise 4-1: Unzip the BlueLeaks Dataset

In this exercise, you'll write a script to unzip all the ZIP files in BlueLeaks so you can work with the data they contain. Once unzipped, the files will take 271GB of additional space on your *datasets* USB.

If you're using macOS or Linux, follow the instructions in "Unzip Files on macOS or Linux" next. If you're using Windows, read that subsection to learn how to write `for` loops in bash since you'll need that skill later in the book, but you won't need to follow along until "Unzip Files on Windows" on page XX.

Unzip Files on macOS or Linux

Open a terminal and navigate to your *BlueLeaks* folder by running the following command, replacing *`blueleaks_path`* with your own folder path:

```
cd blueleaks_path
```

On Linux, I'd use this command (your path will be different):

```
cd /media/micah/datasets/BlueLeaks
```

On macOS, I'd use the following (again, your path will vary):

```
cd /Volumes/datasets/BlueLeaks
```

Run **`ls`** to see the list of files in this folder and **`ls -lh`** to see detailed information about these files, like their sizes.

To unzip single files, you use the following syntax:

```
unzip filename
```

For example, run this command to unzip the first file in BlueLeaks:

```
unzip 211sfbay.zip
```

This should extract the 2.6GB *211sfbay.zip* file into the folder called *211sfbay*. Run **`ls`** again and you should see the new folder containing all of the hacked data from one of the BlueLeaks sites.

However, you want to unzip *all* of the BlueLeaks files. Delete the *211sfbay* folder:

```
rm -r 211sfbay
```

The `rm` command on its own deletes files; to delete entire folders, you include `-r` (short for `--recursive`). The `-r` option deletes all the files in that folder, and all the files in folders in that folder, and so on, before finally deleting the target folder.

Navigate to your text editor, create a new folder in your *exercises* folder called *chapter-4*, and create a new file in the *chapter-4* folder called *exercise-4-1-unzip.sh*. (Storing your script in a separate folder prevents you from polluting the dataset with your own files.) In your new file, enter the following code:

```
#!/bin/bash
for FILENAME in $(ls *.zip)
do
    echo "Unzipping $FILENAME..."
    unzip -o $FILENAME
done
```

Since *exercise-4-1-unzip.sh* is a shell script, it begins with the same `#!/bin/bash` shebang as the script in Chapter 3. After you define this `for` loop, the script starts it with `do` and ends it with `done`, running the `echo "Unzipping $FILENAME..."` and `unzip -o $FILENAME` commands over and over. The `echo` command displays the value of the `FILENAME` variable, which changes to a new filename with each loop, and the `unzip` command unzips that file. The `-o` argument tells `unzip` to *overwrite* files if necessary, meaning that if any file being unzipped already exists, the script will replace it with the newer version.

For example, when you run this code on BlueLeaks, the value of `FILENAME` during the first loop is `211sfbay.zip`. The code that runs in this loop is equivalent to the following commands:

```
echo "Unzipping 211sfbay.zip..."
unzip -o 211sfbay.zip
```

The second time the code loops, it runs the same code with `acprlea.zip` as the `FILENAME` value, and so on.

Change to your *BlueLeaks* folder. On my Mac, I do this by running the following command:

```
cd /Volumes/datasets/BlueLeaks
```

Next, make this shell script executable and run it as follows:

```
chmod +x ../exercises/chapter-4/exercise-4-1-unzip.sh
../exercises/chapter-4/exercise-4-1-unzip.sh
```

These commands assume that your *exercises* folder is in the same folder as the *BlueLeaks* folder. The relative path to your *exercises* folder is *../exercises*, and the relative path to the shell script you just saved is *../exercises/chapter-4/exercise-4-1-unzip.sh*.

After you run these commands, your script should begin unzipping all 168 BlueLeaks files. Sit back, relax, and perhaps enjoy a beverage while you wait for it to finish, which could take hours.

LOOPING THROUGH FILENAMES WITH SPACES

Looping over the output of `ls` as you've just done works only if the filenames don't contain spaces. If they did, your script would fail due to invalid filenames. For example, if you had a file called *Work Documents.zip* in the folder, the `for` loop would consider it two files, *Work* and *Documents.zip*, as discussed in Chapter 3.

The output of the `ls` command is a *string*—that is, a list of characters—with each filename separated by a newline character (\n), which represents a line break. If you have two files in a folder, *readme.txt* and *Work Documents.zip*, the `ls` command outputs a string like `readme.txt\nWork Documents.zip`.

The bash shell includes an environment variable called `IFS` (short for "internal field separator"), which the shell uses to figure out how to split strings in a `for` loop. By default, strings are split by any whitespace: spaces, tabs, or newlines. This is why, if you loop through the string `1 2 3`, you get three smaller strings—`1`, `2`, and `3`—separated with spaces. Likewise, looping through the string `readme.txt\nWork Documents.zip` results in the smaller strings `readme.txt`, `Work`, and `Documents.zip`, separated with a newline character and a space.

To work with filenames with spaces, you change the value of the `IFS` variable so that it splits strings only on newline characters, but not on spaces or tabs. Then you change it back after the loop. Here's an example:

(continued)

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```
#!/bin/bash
ORIGINAL_IFS=$IFS
IFS=$(echo -n "\n")
for FILENAME in $(ls)
do
    echo "$FILENAME"
done
IFS=$ORIGINAL_IFS
```

Inside the `for` loop, the `FILENAME` variable will contain the full filename, even if it includes spaces. You can use code like this to unzip files (as long as they're all ZIP files) or open them using any other CLI program.

None of the ZIP filenames in the BlueLeaks data have spaces, but you may need to use this script on filenames with spaces for future projects.

If you're not using Windows, skip ahead to the "Organize Your Files" subsection on page XX. Otherwise, read on.

Unzip Files on Windows

Unzipping files in WSL from a USB disk formatted for Windows might be *very* slow, due to WSL performance problems. Fortunately, there's a much faster way to unzip all 168 files in BlueLeaks, using PowerShell and a program called 7-Zip.

Install 7-Zip

The open source Windows archiving program 7-Zip lets you extract various types of compressed files. Download and install 7-Zip from *https://www.7-zip.org*. You'll receive a warning saying that the program is made by an unknown publisher, but it's safe to install as long as you've downloaded it from the official website.

After you install 7-Zip, you can use its *7z.exe* program to extract files directly from PowerShell. By default, *7z.exe* should be located in *C:\Program Files\7-Zip\7z.exe*. However, to run the program from any directory, add *C:\Program Files\7-Zip* to your `Path` environment variable.

Environment variables are variables that already exist when you open your shell, as opposed to ones that you create in a `for` loop or by other methods. The `Path` environment variable is a list of folders that contain programs. It contains some folders by default, but you can also add your own. When you run `7z`, PowerShell looks in each folder listed in `Path` and checks for a file called *7z.exe*, then runs that program for you.

To add *7z.exe* to `Path`, click **Start**, search for **environment variables**, and click **Edit the System Environment Variables**. In the window that opens, click **Environment Variables**, and you should see a window with lists of user variables and system variables. Double-click **Path** in the User Variables box, which should show you all of the folders stored in `Path`. Click **New**, add

C:\Program Files\7-Zip, and click **OK** to save. If you have a PowerShell window open, close PowerShell and open it again, forcing the shell to use the new changes to the `Path` environment variable.

You can now use the `7z` command to run 7-Zip.

Unzip in PowerShell with 7-Zip

In a PowerShell terminal, change to the *BlueLeaks* folder on your *datasets* USB disk. For example, on my computer, I run:

```
cd D:\BlueLeaks
```

Next, run the following PowerShell commands (this is the PowerShell version of the *exercise-4-1-unzip.sh* shell script in the previous subsection):

```
$ZipFiles = Get-ChildItem -Path . -Filter "*.zip"
foreach ($ZipFile in $ZipFiles) {
    7z x $ZipFile.FullName
}
```

The first line sets the PowerShell variable `$ZipFiles` to the list of ZIP files it finds in the current folder, represented by the dot (`.`). This is followed by a `foreach` loop, which loops through this list, setting the variable `$ZipFile` to the name of each file. The `7z` command runs over and over again for each different filename, unzipping each file.

When I run these commands in my PowerShell terminal, I get the following output:

```
Scanning the drive for archives:
1 file, 2579740749 bytes (2461 MiB)

Extracting archive: D:\BlueLeaks\211sfbay.zip
--
Path = D:\BlueLeaks\211sfbay.zip
Type = zip
Physical Size = 2579740749
--snip--
```

Your PowerShell window should likewise begin unzipping all 168 BlueLeaks files.

NOTE *Once you're finished with this chapter, read Appendix A and implement one of the solutions it describes for avoiding WSL performance problems to make it easier to work with big datasets like BlueLeaks in Windows going forward. You'll use WSL for the remainder of the book, so you'll need a plan to resolve any issues you encounter.*

Organize Your Files

Your *BlueLeaks* folder should now be full of both ZIP files and extracted folders. Now you'll make a separate *BlueLeaks-extracted* folder for the extracted data and keep the ZIP files themselves in the *BlueLeaks* folder so that you can continue to seed the torrent with them if you like.

Open a terminal (if you're in Windows, switch to a WSL Ubuntu terminal again), change folders to your *datasets* USB disk, and run the following commands:

```
mv BlueLeaks BlueLeaks-extracted
mkdir BlueLeaks
mv BlueLeaks-extracted/*.zip BlueLeaks
```

The `mv` command moves or renames files. On the first line, it renames the *BlueLeaks* folder *BlueLeaks-extracted*. The `mkdir` command, which you used in Chapter 3, creates a new empty folder called *BlueLeaks*. The third command moves all of the ZIP files in the *BlueLeaks-extracted* folder into the newly created *BlueLeaks* folder.

Your *datasets* USB disk should now contain a folder called *BlueLeaks* with 250GB of ZIP files, along with another folder called *BlueLeaks-extracted* with 269GB of extracted hacked police data.

How the Hacker Obtained the BlueLeaks Data

We don't know how the hacker hacked and leaked the BlueLeaks files, but we can make an educated guess based on clues from the dataset.

Imagine that it's June 6, 2020, less than two weeks after Minneapolis cop Derek Chauvin murdered George Floyd by kneeling on his neck for over nine minutes while Floyd struggled to breathe, triggering the summer's Black Lives Matter uprising against police violence. Millions of people took to the streets to demand police accountability and the end of racist police violence in what was "the largest movement in the country's history," according to the *New York Times*.

Now imagine you're a hacktivist. In addition to confronting police in the streets, you're confronting them on the internet. Using OSINT, you've discovered that hundreds of police websites use the same shoddy web application developed by the Texas web development firm Netsential. All these sites run on Windows, use Microsoft's Internet Information Services (IIS) web server software, and are programmed using Microsoft's web framework ASP.NET. They're also all hosted from IP addresses in the same data center in Texas.

After you spend some time poking around one of these sites, the Arizona High Intensity Drug Trafficking Area (AZHIDTA), you find what you were looking for: a *remote code execution vulnerability*, a type of bug that lets you run commands on a remote server, like the Windows server running the AZHIDTA website. (My guess is that the vulnerability started with SQL injection, a technology beyond the scope of this book.)

To open a shell on this web server, you use a *web shell*, a web page that, when you submit a form with a command in it, runs that command on the web server and responds with its output. Using the vulnerability you discovered, you save a web shell into a file called *blug.aspx* on the web server's disk.

Loading *https://www.azhidta.org/blug.aspx* in your browser allows you to run whatever commands you want on the server.

WARNING *Don't actually try loading that URL in your browser, because it might be illegal. It appears to be the location of the web shell left behind by the hacker, and attempting to access someone else's hacking tools is definitely a legal gray area.*

The web shell *blug.aspx* is included in the BlueLeaks dataset. In order to understand how this web shell works, I set up a Windows virtual machine with an IIS server to test it, as shown in Figure 4-1. The left side of the screenshot is the shell (in which I ran the command `dir c:\`). The right side let me browse the server's filesystem and upload new files.

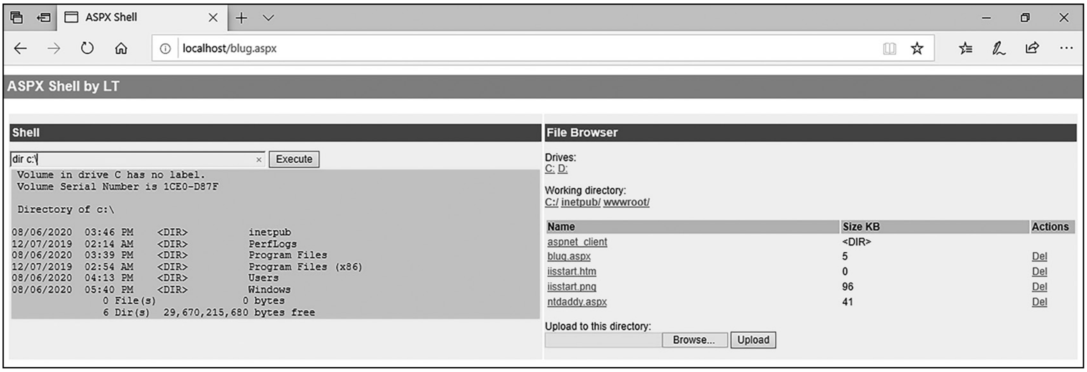

Figure 4-1: Testing the blug.aspx web shell in a Windows VM

I don't know for sure if this is how the BlueLeaks hack happened, but I think it's very likely. While researching BlueLeaks, I found the following web shell files, all timestamped late on June 6, 2020, making them the among the most recently created files in the dataset:

azhidta/ntdaddy.aspx The Classic ASP web shell NTDaddy, developed around 2001 by a hacker named obzerve

azhidta/blug.aspx The ASP.NET web shell called ASPX Shell, developed in 2007 by a hacker named LT

azhidta/pscp64.exe A program that comes with PuTTY, a popular Windows tool for securely logging into and copying files to remote servers

icefishx/7z.exe A copy of the 7-Zip compression and extraction program

My guess is that the hacktivist first tried to create a *ntdaddy.aspx* web shell, but found that it didn't work because it was developed using an earlier version of ASP called Classic ASP, while the BlueLeaks site used the modern version, ASP.NET. They then created the *blug.aspx* web shell instead, used that shell to upload *pscp64.exe* and *7z.exe*, used *7z.exe* to compress all of the files for a given police website, and uploaded that data to their own server with *pscp64.exe*.

After manually hacking one of the BlueLeaks sites, the hacker likely automated the process for the rest of the BlueLeaks sites. Perhaps they created a shell script that used cURL instead of a web browser to perform the same steps. They could have run that script in a `for` loop targeting all 251 websites, uploading hundreds of gigabytes of data to themselves, in a single Saturday evening. They then likely forgot to delete the *blug.aspx*, *pscp64.exe*, *7z.exe*, and *ntdaddy.aspx* files before submitting the dataset to DDoSecrets.

Exercise 4-2: Explore BlueLeaks on the Command Line

In this exercise, you'll start exploring the contents of your unzipped BlueLeaks files, using commands and advanced shell features that let you quickly measure file and folder size and sort and count lines of output.

Calculate How Much Disk Space Folders Use

The `du` command (short for "disk usage") is a powerful tool for assessing a new dataset. Linux and macOS come with slightly different versions of `du`. The Linux version, which is part of a software package called GNU coreutils, is better and more up-to-date at the time of writing, so you'll use it for this exercise.

Users of Linux and Windows with WSL should already have the correct built-in `du` tool. If you're using macOS, run **`brew install coreutils`** in the terminal to install coreutils. After this, the `du` command will run the macOS version of the tool, while the `gdu` command will run the coreutils version that you just installed. In the following commands, macOS users should replace `du` with `gdu`.

To find out how much space the extracted BlueLeaks dataset takes, open your terminal and run this command, using the path to the *BlueLeaks-extracted* folder on your computer:

```
du -sh --apparent-size /media/micah/datasets/BlueLeaks-extracted
```

The `-s` argument in this command (short for `--summarize`) displays the total disk space of a folder rather than how much space each file inside it takes up. The `-h` argument (short for `--human-readable`) shows file sizes in units like kilobytes, megabytes, or gigabytes, rather than in terms of system blocks (a unit that changes depending on how your disk is set up). Finally, the `--apparent-size` argument shows you how big the files actually are, as opposed to how much space they take up on your disk.

The command checks the size of every file in BlueLeaks and adds them all together, so it takes a while to run. When it's done, it should tell you that the *BlueLeaks-extracted* folder takes up 269GB.

NOTE *In addition to using `-h` to generate human-readable units, you can specify which units you want to use. The `-b` argument, short for `--bytes`, shows file sizes in bytes, `-k` shows them in kilobytes, and `-m` shows them in megabytes.*

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Next, you'll measure the size of an individual folder in BlueLeaks. Change to your *BlueLeaks-extracted* folder; for example, I'd run `cd /media/micah/datasets/BlueLeaks-extracted` on my Linux computer. From there, run the following command to measure the size of the *ncric* folder, which contains documents from the Northern California Regional Intelligence Center (NCRIC), the fusion center I've spent the most time researching:

```
du -sh --apparent-size ncric
```

The output should tell you that the *ncric* folder takes 19GB.

To find out the size of each folder in BlueLeaks, you could run the `du -sh --apparent-size path` command for each folder, but it's quicker to use another `for` loop. Run the following code in the terminal:

```
for FOLDER in $(ls); do du -sh --apparent-size $FOLDER; done
```

As shown here, you can run multiple commands on the same line by separating them with semicolons (`;`). This one-liner loops through the output of the `ls` command, which, since you're currently in the *BlueLeaks-extracted* folder, is the name of each BlueLeaks folder. The code stores these names in the `FOLDER` variable and then, inside each iteration of the loop, runs the `du -sh --apparent-size $FOLDER` command.

Here are the first few lines of output:

```
2.8G    211sfbay
29M     Securitypartnership
216M    acprlea
65M     acticaz
748M    akorca
--snip--
```

This shows you how much disk space each folder uses.

Use Pipes and Sort Output

You now know the size of each folder in the BlueLeaks dataset. Next, you'll sort the 168 folders in order of disk space. By determining which folders are the largest, you can quickly tell which fusion centers have the most data and therefore are probably the biggest or most active.

To sort this list of folders by the smallest file size to the largest, use the `sort` command, which takes a list of text lines and, by default, sorts them *alphanumerically*; that is, text is sorted alphabetically and numbers are sorted by their first numeral. For example, the list `file1`, `file10`, `file2`,`...`, `file9` is sorted alphanumerically: since text lines are sorted one character at a time, and since `1` is less than `2`, `file10` comes before `file2`.

To sort your BlueLeaks files by file size, modify the command with the `-h` (`--human-numeric-sort`) argument. This argument pays attention to the *value* of numbers, not just characters, so it correctly places smaller numerical values before larger ones. It also takes file size units into account, meaning it will place 2MB before 1GB, even though 2 is numerically greater than 1.

In shell scripting, the *pipe* operator (|) lets you take the output of a command to the left of the operator and pipe it into the command on the right. When you pipe input into the `sort` command, it outputs a sorted version of that input. Run the `for` loop from the previous subsection, this time piping the output into `sort`:

```
for FOLDER in $(ls); do du -sh –apparent-size $FOLDER; done | sort -h
```

This line first runs the `for` loop that measures the space each BlueLeaks folder takes up. The output of this code is a list of lines of text, where each line starts with the human-readable size of a folder. Piping those lines of text as input into the `sort -h` command sorts those lines numerically while paying attention to the file size units.

Your output should look like this:

```
256     miacxold
256     ncric-history-good
256     ncricSteveBackup
259K    terrorismtip
548K    oaktac
625K    sccpca
--snip--
13G     lacleartraining
14G     jric
19G     ncric
36G     miacx
46G     repo
```

The folders that have the least data should be at the top: *miacxold*, *ncric-history-good*, and *ncricSteveBackup* contain only empty subfolders. The *repo* folder, the largest folder in BlueLeaks, should appear at the bottom of the list, right after *miacx*, the second largest folder.

FILE SIZE UNITS AND CONVERSIONS

You're likely familiar with file size units like megabytes and gigabytes, and might have a mental model of how much information those units can hold: office documents are often a few megabytes, a two-hour video file might be a gigabyte or two, and a video game might be hundreds of gigabytes. Being able to convert between the different units of disk space is an important skill for working with large datasets.

Units like kilobyte, megabyte, gigabyte, and terabyte sound metric, but they're not. For instance, the *kilo-* prefix denotes a factor of 1,000, but there are 1,024 bytes in a kilobyte. Here's a list of common conversions:

1 byte (B) is 8 bits, or eight ones and zeros in binary

- 1 kilobyte (KB): 1,024 bytes
- 1 megabyte (MB): 1,024 kilobytes
- 1 gigabyte (GB): 1,024 megabytes
- 1 terabyte (TB): 1,024 gigabytes
- 1 petabyte (PB): 1,024 terabytes

As an example, the *ncric* folder in BlueLeaks is 20,008,051,852 bytes, which is 19,539,113.1KB, or 19,081.2MB, or 18.6GB—about 160 billion bits.

Create an Inventory of Filenames in a Dataset

When you're working with an enormous dataset like BlueLeaks, it's helpful to create an inventory of all of the files it contains by listing them in a text file. This way you can easily count the number of files in the dataset or search for filenames without having to go through the much slower process of looping through the dataset itself.

You can create this inventory with the `find` command, which outputs a list of files and folders in a folder. From within the *BlueLeaks-extracted* folder, run the following command to list all of the files in BlueLeaks:

```
find . -type f
```

The first argument after `find` is the folder whose contents you want to list. This command uses a dot to find files in the current folder, but you could use any relative or absolute path. The `-type f` arguments filters the list so it includes only files. (To include only folders, add the `-type d` arguments.)

When you run this command, the names of the many files in BlueLeaks should start rapidly scrolling across your terminal. To make the output more manageable, run the command again, this time redirecting the output into the file *../BlueLeaks-filenames.txt*:

```
find . -type f > ../BlueLeaks-filenames.txt
```

As discussed in Chapter 3, redirection tells your shell to take the output from the left side of the redirection operator (>) and save it into the file at the path you specify on the right. In this case, the shell sends the list of filenames from the `find` command to the *BlueLeaks-filenames.txt* file on your *datasets* USB disk, rather than displaying the filenames across your terminal.

To read through these filenames at your leisure, open *BlueLeaks-filenames.txt* in VS Code by running this command:

```
code ../BlueLeaks-filenames.txt
```

It's easier to slowly scroll through these files in your text editor, but there are too many to count with the naked eye.

Count the Files in a Dataset

The wc command takes some input and tells you how many characters, words, or lines it contains. When used with the -l (or --lines) argument, it counts the number of lines. To count the lines in the *BlueLeaks-filenames.txt* file you created, and by extension count the number of files in BlueLeaks, run the following command:

```
cat ../BlueLeaks-filenames.txt | wc -l
```

The cat command outputs the contents of a file—in this case, *BlueLeaks-filenames.txt*. Instead of displaying it, the command pipes the output into wc to count the number of lines that it contains. It should tell you that there are just over *one million* files in BlueLeaks.

Another way to get the same result is to run the find command from the previous section again, and pipe its output into wc, like this:

```
find . -type f | wc -l
```

That command takes longer to run, though, since it searches through the whole dataset again (press CTRL-C to cancel this command before it finishes).

Exercise 4-3: Find Revelations in BlueLeaks with grep

In the summer of 2020, while American society was going through a long-due reckoning about the scale of racist police killings, right-wing media (and police) instead focused on the dangers of the protesters themselves. They lumped the modern civil rights movement into two categories: "Black Lives Matter" and "antifa," the latter a label used by antifascist activists since the 1930s. The modern American antifa movement grew in response to the 2016 election of Donald Trump and the mainstreaming of white supremacy in the US.

The grep command will filter input for keywords, letting you search the content of datasets for newsworthy information. In this exercise, you'll use grep to find out what police had to say about antifa during the protests.

Filter for Documents Mentioning Antifa

You'll start by grepping your list of filenames to find any that include the word *antifa*. From the *BlueLeaks-extracted* folder, search the *BlueLeaks-filenames.txt* file that you created in Exercise 4-2 by running the following command:

```
cat ../BlueLeaks-filenames.txt | grep antifa
```

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This command pipes the output of `cat ../BlueLeaks-filenames.txt`, which is a list of a million filenames, into `grep antifa`. This should filter the huge list of filenames to show you only those that include the word *antifa*. However, it returns no results.

Since the `grep` command is case sensitive, try again using the `-i` (or `--ignore-case`) argument:

```
cat ../BlueLeaks-filenames.txt | grep -i antifa
```

When I run this command on my macOS computer, I get the following output:

```
./ociac/files/EBAT1/U-FOUO_CFIX__OCIAC_JRA_DVE Use of Social Media_ANTIFA_ANTI-ANTIFA MOVEMENTS
.pdf
./arictexas/files/DDF/ARIC-LES - Situational Awareness - Antifa Activity.pdf
./arictexas/files/DDF/SWTFC-LES - Situational Awareness - ANTIFA Event Notification.pdf
./arictexas/files/DPI/ARIC-LES - Situational Awareness - Antifa Activity.png
./arictexas/files/DPI/SWTFC-LES - Situational Awareness - ANTIFA Event Notification.png
./dediac/files/DDF/ANTIFA - Fighting in the Streets.pdf
./dediac/files/DDF/ANTIFA Sub Groups and Indicators - LES.pdf
./dediac/files/DDF/FBI_PH_SIR_Tactics_and_Targets_Identified_for_4_November_2017_ANTIFA_Rally_in_
Philadelphia_PA-2
.pdf
./dediac/files/EBAT1/ANTIFA - Fighting in the Streets.pdf
./dediac/files/EBAT1/ANTIFA Sub Groups and Indicators - LES.pdf
./dediac/files/DPI/ANTIFA - Fighting in the Streets.png
./dediac/files/DPI/FBI_PH_SIR_Tactics_and_Targets_Identified_for_4_November_2017_ANTIFA_Rally_in_
Philadelphia_PA-2
.png
```

This command returns 12 results, all files that have the term *antifa* in their filenames. The `grep` command might highlight your search terms in each line of output by coloring them differently; I've highlighted them here in bold. Open a few of the documents in this list to see what they contain.

NOTE *You can run BlueLeaks documents through Dangerzone if you like, but the risks are low with this dataset. These documents are now all public, so if any have tracking technology that lets the original file owner know someone is looking at the document, it doesn't matter much. Given that these are hacked documents from police fusion centers, not attachments on phishing email or something similar, they're also unlikely to be malicious.*

I often combine `find` and `grep` to make lists of filenames and filter those lists down, which allows me to locate files on my computer more quickly and precisely than with my operating system's graphical file search tools. For example, suppose you're looking into the *azhidta* folder for the Arizona High Intensity Drug Trafficking Area site. To quickly find any documents that have the word *marijuana* in their filename, you could run `find azhidta | grep -i marijuana`. To count the number of files with *marijuana* in the filenames, you could pipe all of that into the `wc -l` command.

Filter for Certain Types of Files

In addition to searching for keywords like *antifa* or *marijuana*, `grep` can help you filter a list of filenames to include only certain file types. Grep for Microsoft Word documents, filenames that end in *.docx*, by running the following command:

```
cat ../BlueLeaks-filenames.txt | grep -i .docx
```

This command uses `cat` to display the list of filenames in BlueLeaks, then filters it down for those that contain *.docx*. You should see thousands of filenames scroll by. To learn exactly how many, run the command again, this time piping the output into `wc -l`:

```
cat ../BlueLeaks-filenames.txt | grep -i .docx | wc -l
```

The `wc` command should tell you that the previous command had 8,861 results.

Use grep with Regular Expressions

If you scroll through the *.docx* filenames you just found, you'll see that a few of them aren't actually Word documents. For example, the filename *./aric-texas/files/DDF/2014 Austin City Limits Festival - APD Threat Overview.docx.pdf* contains *.docx* but is actually a PDF.

When you use `grep`, you can pass a regular expression (regex for short) into it as an argument. A *regex* is a character or sequence of characters that defines a search pattern. For example, the caret character (`^`) represents the beginning of a line, and the dollar sign character (`$`) represents the end of a line. Grepping for `something$` will show you only results that end with *something*. Grepping for `^something` will show you only results that begin with *something*.

To search just for filenames that end with *.docx*, add a dollar sign (`$`) to the end of the text you're grepping for. For example, try running the following command:

```
cat ../BlueLeaks-filenames.txt | grep -i .docx$ | wc -l
```

The output should tell you that there are 8,737 results, 124 less than the previous command. That means there are 8,737 Word docs in this dataset.

Run the following command to find out how many Word docs are in the *ncric* folder:

```
cat ../BlueLeaks-filenames.txt | grep ^./ncric/ | grep -i .docx$ | wc -l
```

The `cat` command outputs the list of filenames in BlueLeaks, which is then piped into the first `grep` command, which in turn filters your output down to files that begin with *./ncric*, using `^`. Next, that output is piped into the second `grep` command, which further filters the output to files that end

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with *.docx*, using `$`. Finally, the remaining output is piped into the `wc -l` command, which tells you how many lines are left. The output of the full command should tell you that there are 600 Word docs in the *ncric* folder.

On your own, try using `find`, `grep`, and `wc` to find out how many PDFs (*.pdf*) and Excel documents (*.xlsx*) are in the dataset. You can also experiment with other file types.

Search Files in Bulk with grep

In addition to piping output from other commands into `grep`, you can use `grep` to search directly within text files by using the following syntax:

```
grep search_term filename
```

For example, Linux comes with a file called */etc/passwd*, which includes a list of users on the system. To find just the line about my own user in that file, I can use one of the following commands:

```
grep micah /etc/passwd
cat /etc/passwd | grep micah
```

The `grep` command opens the */etc/passwd* file and then searches it, while the `cat` command opens that file and then pipes its contents into `grep`, which searches it. Both of these commands output the following result:

```
micah:x:1000:1000:,,,:/home/micah:/bin/bash
```

You can use `grep` to search multiple files, or even folders full of files, for hits all at once. As noted earlier, to search a folder, you use the `-r` (or `--recursive`) argument and specify the name of a folder. To specify multiple files at once, use an asterisk (*) as a wildcard character. For example, you can use `*.txt` as the filename to search all text files in your current folder.

There are CSV spreadsheets in every BlueLeaks folder that contain the contents of the websites' databases. Now that you've grepped for filenames that contain the keyword *antifa*, use the following command to bulk-search the term *Black Lives Matter* in the contents of the files, not just in their filenames:

```
grep -i "black lives matter" */*.csv
```

The `-i` argument in this command makes the search case-insensitive. The `black lives matter` argument is the search term (in quotation marks, because it has spaces). The `*/*.csv` argument is the path to search, which uses two wildcard characters. These arguments tell `grep` to open every folder, then each file within those folders that ends in *.csv*, and search for the *black lives matter* keyword.

This command takes some time to run because it's searching all 158,232 CSV files in BlueLeaks. When it's finished, it should show you the lines from CSV files that mention *black lives matter* and tell you in which files it found those lines. For example, here are snippets from a few of the lines of the output from that command:

```
arictexas/IncidentMap.csv:834,"10/26/16 00:00:00",-9.7735716800000006e+01,3.0267881299999999e+0
1,"TX",,"TLO","An APD Police Explorer received a call from a blocked number in which the caller
identified himself as an activist for Black Lives Matter, and identified the recipient by name,
address, and personal descriptors before calling him a racist for having an interest in a LE
career.  No explicit threats were made during the call...
bostonbric/EmailBuilder.csv:<p>
<strong>BRIC SHIELD Alert: </strong>To promote public safety and situational awareness for
events taking place in the City of Boston tonight, the BRIC is sharing the information below
regarding planned activities. </p>... <p><b>Known COB Activities for Tuesday, June 2nd</b></p>
<ul><li>Violence in Boston Inc & Black Lives Matter Rally and Vigil - 4:45 PM at 624 Blue Hill
Avenue. </li><li>Not One More! - 5:00 PM to 8:00 PM. Meeting at Franklin Park Road & Blue Hill
Ave and marching to Franklin Park. </li>...
chicagoheat/Blog.csv:Media sources report that the online activist group Anonymous, or a group
claiming to be Anonymous, has called for a collective 'Day of Rage' to take place in numerous
cities across the United States on Friday, July 15th. The action has been called in solidarity
with the Black Lives Matter movement in light of the recent controversial officer-involved
shootings that resulted in the deaths of Alton Sterling and Philando Castile. The group that
posted the call for action states that acts of violence or rioting are to be condemned.
ncric/Requests.csv:Organizer of a Black Lives Matter Protest for 06/02.  Currently scheduled
1PM meet time at Sears parking lot of Newpark Mall.  They plan to march to City Hall and then
to Fremont PD.  She has repeated she intends for a peaceful protest.  She further claims she
reached out to City and PD to join the march.  Recent graphics encourage non-descript clothing,
heat resistant gloves, turning off Face Id on iPhone etc.
```

The command finds a total of 178 lines in BlueLeaks CSVs that contain the term *black lives matter*. Each is a potential lead for further investigative research.

NOTE *The* grep *command is a great tool for searching the content of text files, but it doesn't work with binary files, like Microsoft Office documents or PDFs. To search those in bulk, you'll need more sophisticated tools, which you'll learn about in Chapter 5.*

On your own, try using grep to filter the list of BlueLeaks filenames for specific words or bulk-search terms within the CSV files. If you find any interesting documents, read them to see if they're newsworthy. Consider narrowing your searches once you find a lead by looking for other related documents. You might focus on a single fusion center or a topic like antifa that spans different centers. Individual documents may contain law enforcement lingo you can use as search terms for related documents. Take detailed notes on what's most revealing in each document, then rely on these notes if you decide to write about your findings.

Encrypted Data in the BlueLeaks Dataset

As you dig around in the BlueLeaks dataset, you'll notice some patterns. Most folders contain many CSVs, as well as *.aspx* files, the source code of the hacked websites. They also contain *files* subfolders containing the bulk of the files and folders uploaded to each site, including PDFs and Microsoft Office documents.

However, one folder, *repo*, contains just a *config* file and *data*, *index*, *keys*, *locks*, and *snapshots* subfolders. Inside those subfolders are other subfolders and files with apparently random names. There are no documents that can be opened—no spreadsheets or similar files. As you discovered in Exercise 4-2, the *repo* folder is the largest folder in BlueLeaks, at 46GB. Its timestamps are from June 8, 2020, although the latest timestamps for most of the rest of the dataset are from June 6. Without more information, it's not clear what these files mean or how to access them.

When I discover a mystery like this in a dataset, I search the internet. In this case, I searched for the names of the files and folders within the *repo* folder by entering *config data index keys locks snapshots* into a search engine, and found documentation for a CLI program called restic. A restic repository, according to the documentation I found at *https://restic.readthedocs.io/en/latest/100_references.html*, is a folder that holds backup data. Restic repositories contain a *config* file and folders called *data*, *index*, *keys*, *locks*, and *snapshots*, as shown in Figure 4-2.

The basic layout of a repository is shown here:

```
/tmp/restic-repo
├── config
├── data
│   ├── 21
│   │   └── 2159dd48f8a24f33c307b750592773f8b71ff8d11452132a7b2e2a6a01611be1
│   ├── 32
│   │   └── 32ea976bc30771cebad8285cd99120ac8786f9ffd42141d452458089985043a5
│   ├── 59
│   │   └── 59fe4bcde59bd6222eba87795e35a90d82cd2f138a27b6835032b7b58173a426
│   ├── 73
│   │   └── 73d04e6125cf3c28a299cc2f3cca3b78ceac396e4fcf9575e34536b26782413c
│   [...]
├── index
│   ├── c38f5fb68307c6a3e3aa945d556e325dc38f5fb68307c6a3e3aa945d556e325d
│   └── ca171b1b7394d90d330b265d90f506f9984043b342525f019788f97e745c71fd
├── keys
│   └── b02de829beeb3c01a63e6b25cbd421a98fef144f03b9a02e46eff9e2ca3f0bd7
├── locks
├── snapshots
│   └── 22a5af1bdc6e616f8a29579458c49627e01b32210d09adb288d1ecda7c5711ec
└── tmp
```

Figure 4-2: The layout of a restic respository

This suggests that the *repo* folder in BlueLeaks contains backup data in restic format. To find out what's inside this backup, I installed the `restic` package. Users of Linux or Windows with WSL can install `restic` using `apt`:

```
sudo apt install restic
```

Mac users can install `restic` from Homebrew with the following command:

```
brew install restic
```

I ran `restic --help` and found that I could view the snapshots in a repository with the `restic snapshots` command, which I then used to try to view the snapshots in the *repo* folder like so:

```
restic snapshots --repo repo/
```

I was then confronted with a password prompt:

```
enter password for repository:
```

This prompt indicates that the backup is encrypted. The only way to proceed is to guess the password, which I haven't been able to do.

While a 46GB folder full of encrypted data in a public leak is rare, it's not uncommon to stumble upon other encrypted files in datasets like Office documents or ZIP files. I can't help but imagine that the most interesting details in any dataset might be the encrypted parts. Password-cracking is outside the scope of this book, but if you can figure out the password for *repo*, please let me know.

Data Analysis with Servers in the Cloud

So far, you've used the CLI *locally* on your own computer, but you can also use it *remotely* via servers to which you connect through a cloud network. DigitalOcean, AWS, Microsoft Azure, and countless other cloud hosting companies rent virtual private servers (VPSes) to the public, usually for a few dollars a month or a few cents an hour. All the command line skills you've learned so far apply to remote servers, too.

There are many advantages to working with massive datasets in the cloud:

- Instead of dealing with USB hard disks, you can attach virtual hard disks to your virtual servers, increasing their size if you're running low on disk space.
- VPS bandwidth is generally much better than residential or commercial internet service, speeding up large dataset downloads.
- You can also pay for more powerful VPSes for scripts that require significant computational resources, so they no longer take hours or days to finish running.
- Rather than being forced to wait while a script runs on your local machine, you can do whatever you want on your computer, even suspending it or shutting it down, while your remote server is crunching data.
- If your source has the required technical skills, you can ask them to upload data to a VPS with a large hard disk, as discussed in Chapter 2.

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They can even do this anonymously using Tor. You can then download the dataset or choose to analyze it remotely on the VPS.

WARNING *Avoid working on cloud servers with high- or medium-sensitivity datasets. The cloud hosting provider has total access over your VPS and the data on it and can even give copies of that data to law enforcement or other parties in response to legal requests.*

This section will go into more detail on *SSH (Secure Shell)* software (introduced in Chapter 2), which allows you to securely get a shell on a VPS, as well as two tools that are essential for working remotely on the command line: text-based window managers and CLI text editors. This should prepare you to set up a VPS in the next exercise.

The SSH protocol is a method for securely logging into another computer remotely. You can connect to a VPS remotely by running the `ssh` command with a username and the IP address or domain name of the server to which you want to connect. For example, to log in as the root user to the server with the hostname *example.com*, you run:

```
ssh root@example.com
```

You then need to *authenticate* to the server, or prove that you have permission to log in, by typing the user password or using *SSH keys*. Similar to PGP keys (discussed in Chapter 2), generating an SSH key on your computer gives you two files: a public key and a secret key. Once you put your public key on the remote server, only people with your secret key on their computer (hopefully just you) can remotely log into that server using SSH. If someone spies on your internet, they can't see anything you're doing in your SSH session—they'll just see garbled encrypted data. Every SSH key also has a *fingerprint*, a unique string of characters that identifies that specific key. SSH keys are more secure than passwords, so cloud providers often require that you use them. Once you SSH into a remote server, you'll be dropped into a shell just like the one on your own computer, but running on a computer across the internet.

A *text-based window manager* is software that lets you open and switch between separate shells in the same terminal window, all in the same SSH session. Text-based window managers also allow you to keep programs running in the background even if you disconnect from SSH, by maintaining an active terminal session on your VPS. This protects your work if, for example, your laptop dies, you lose internet access, or you close your terminal window by mistake.

For example, say you want to download BlueLeaks on your VPS and then unzip it with a `for` loop. If you close your terminal window before the loop is done, you'll quit the remote shell, which will close the `unzip` program, and your remote work will stop. However, if you SSH to your VPS, connect to a window manager session, and then start unzipping BlueLeaks files, you can safely close the terminal window without stopping your work. If you open a new terminal later, SSH back into your server, and open your window manager again, your previous session with all your running programs should reappear. In the upcoming exercise, you'll use the Byobu window manager, which comes with Ubuntu.

When you SSH into a remote server, you don't have easy access to a graphical text editor like VS Code. To edit files—to modify a shell script, for example—you'll need to use a CLI text editor instead. Two popular CLI text editors are nano and vim. Nano is relatively easy to use but doesn't have advanced features, while vim is more powerful but has a steeper learning curve. For simplicity's sake, in the following exercise you'll use nano.

NOTE *Technically, you can use VS Code to edit files remotely over SSH, but there are some limitations. See* https://code.visualstudio.com/docs/remote/ssh *for more information on VS Code's support for editing files over SSH.*

Exercise 4-4: Set Up a VPS

In this exercise, you'll create an account on a cloud hosting provider, generate an SSH key, create a VPS on your cloud provider, SSH into it, start a Byobu session, and install updates. To follow along you'll need to spend a small amount of money. I provide detailed instructions for using DigitalOcean in this exercise, but use whatever cloud hosting provider you prefer, keeping in mind that the initial steps will likely be slightly different.

Go to *https://www.digitalocean.com* and create an account, providing a credit card number while signing up. Use a strong password, store it in your password manager, and turn on two-factor authentication.

Generate an SSH Key

To generate an SSH key, open a terminal on your local computer (if you're using Windows, use a WSL terminal), and run:

```
ssh-keygen -t ed25519
```

The `ssh-keygen` command generates an SSH key, while the options specify the type of encryption key you want to generate—in this case, `ed25519`, which uses modern elliptic curve encryption and is the most secure option.

After you run this command, the program will ask you a few questions, starting with where you want to save your key. For example, I get the following output on my Mac:

```
Generating public/private ed25519 key pair.
Enter file in which to save the key (/Users/micah/.ssh/id_ed25519):
```

Press ENTER to use the default location for the key, *~/.ssh/id_ed25519*. Next, the program should ask you for a passphrase:

```
Enter passphrase (empty for no passphrase):
```

I recommend generating a random passphrase in your password manager, saving it as *SSH key passphrase*, then copying and pasting the password into your terminal. After pressing ENTER, re-enter your passphrase and press ENTER again.

When you're done, the `ssh-keygen` command should have created two new files: your SSH secret key in *~/.ssh/id_ed25519* and your SSH public key in *~/.ssh/id_ed25519.pub*.

NOTE *If you're using Windows and prefer to SSH from PowerShell, you can install the OpenSSH client directly in Windows. Open a PowerShell window as an administrator and run* **`Add-WindowsCapability -Online -Name OpenSSH.Client~~~~0.0.1.0`** *to enable using the* `ssh` *command from PowerShell.*

Add Your Public Key to the Cloud Provider

Next, add your public key to your new DigitalOcean account. After logging into the web console, go to the Settings page and switch to the Security tab. Click **Add SSH Key**, then copy and paste your SSH public key into the form.

Back in your terminal, display the content of your public key by running this command:

```
cat ~/.ssh/id_ed25519.pub
```

Here's the output I get:

```
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAILxYgUq1ePSRSv7LTITG5hecwNBQzs3EZmo4PRzsV4yT micah@trapdoor
.local
```

Your output should look similar, with the last word being your username and the hostname of your own computer. Copy this whole string, starting with `ssh-ed25519`, and paste it into DigitalOcean, then give it a name, as shown in Figure 4-3.

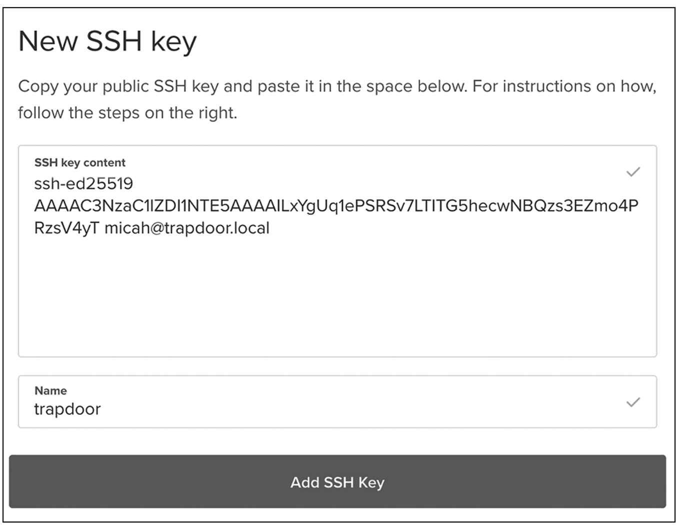

Figure 4-3: The form for adding a new SSH key to a DigitalOcean account

Name your SSH keys after the computer on which you generated them, since they're allowing this specific computer to access remote computers. For example, I've called my key *trapdoor*, the name of my Mac.

Create a VPS

Now that DigitalOcean has your SSH public key, you can create a new VPS. Click **Create** at the top of the DigitalOcean console and follow the instructions to create a new *droplet*, DigitalOcean's term for a VPS. Choose the following settings for your VPS:

1. For Choose an Image, pick **Ubuntu**.
2. For Choose a Plan, pick **Shared CPU ▸ Basic** and choose how much memory, CPU power, hard disk space, and internet bandwidth you want. Less powerful machines are cheaper; more powerful ones are more expensive. For this assignment, choose a relatively cheap option like 1GB of RAM, 1 CPU, 25GB of disk space, and 1TB of bandwidth for $7 per month.
3. For Add Block Storage, you can choose to attach an additional hard disk to your droplet. You don't need to do this now, but in the future, to work with a large dataset like BlueLeaks, you can add more disk space.
4. For Choose a Datacenter Region, choose the host city for your VPS. File transfers between your computer and your server will be fastest if you choose a nearby location, but feel free to create your VPS anywhere you'd like.
5. For Authentication, choose **SSH Keys** and select the SSH key that you just added to your DigitalOcean account.
6. For Select Additional Options, check the box beside Monitoring to see statistics about how much memory and processor power the VPS is using over time from the DigitalOcean console.
7. For Finalize and Create, choose one droplet and give it the hostname *test-vps*.

Click **Create Droplet** and wait a minute or two for DigitalOcean to provision your new VPS, then find its IP address. Figure 4-4 shows the Droplets page of my DigitalOcean account with my new server's IP address, 178.128.22.151.

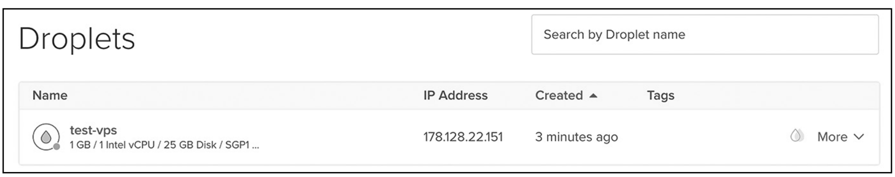

Figure 4-4: My test-vps IP address

Click the IP address to copy it to your clipboard.

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SSH into Your Server

Run the following command to SSH into your server:

```
ssh username@hostname
```

where *username* is the user you want to connect to on the remote server, and *hostname* is either the hostname or IP address of the remote server. With DigitalOcean, the username is `root`, and the hostname is the IP address of your server.

Here's what it looks like when I SSH into my server for the first time:

```
micah@trapdoor ~ % ssh root@178.128.22.151
The authenticity of host '178.128.22.151 (178.128.22.151)' can't be established.
ED25519 key fingerprint is SHA256:062oSOXq+G1sGLIzoQdFnQvJE/BU8GLLWnNr5WUOmAs.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

A remote server has its own SSH key, a *server key*. This output shows you the server key's fingerprint and asks whether you want to trust it. If you enter `yes`, your SSH software will store this fingerprint in the *~/.ssh/known_hosts* file containing all the fingerprints for the SSH servers to which you've connected in the past, so that when you SSH into your server in the future, it shouldn't prompt you again. You can also enter `no` to cancel, or copy and paste the fingerprint of the server key that you're expecting.

NOTE *If you SSH into a server and the fingerprint isn't what your software expects it to be, SSH will show you a warning message, which could mean that the server key has changed or that your SSH connection is being attacked. This authentication scheme is known as* trust on first use (TOFU)*: you trust the first fingerprint you see and deny all other fingerprints for that server in the future.*

Enter **`yes`** and press ENTER to continue. You should be dropped into a root shell on your remote server:

```
root@test-vps:~#
```

Since you provided DigitalOcean with your SSH public key, you don't need to enter a password to log in. If anyone else tries SSHing to your server, they'll get the `Permission denied (publickey)` error.

Take a look around your new cloud-based system. Run **`ls`** to list files, **`ls -al`** to see hidden files, and **`cd`** to change to folders.

Start a Byobu Session

If you used the Ubuntu image to set up your droplet, the Byobu window manager should be installed. Run the **`byobu`** command to start a Byobu session. (If you're using a different operating system, or if for some reason Byobu isn't installed, you'll get a `Command 'byobu' not found` error message. Run **`apt update`**, followed by **`apt install byobu`**, to install the program.)

The byobu command should drop you into a shell inside of your new session. A line at the bottom of your terminal shows which window you've opened, along with information like the date and time. Each Byobu window is like its own separate shell in the same Byobu session, and you can open as many windows as you want.

To demonstrate how Byobu works, run **whoami** (which should tell you that you're the root user) and **ls -l /** (which should show you a list of files in your server's root folder). Now press CTRL-A. Byobu will ask you how you want this keyboard command to operate:

```
Configure Byobu's ctrl-a behavior...

When you press ctrl-a in Byobu, do you want it to operate in:
    (1) Screen mode (GNU Screen's default escape sequence)
    (2) Emacs mode  (go to beginning of line)

Note that:
  - F12 also operates as an escape in Byobu
  - You can press F9 and choose your escape character
  - You can run 'byobu-ctrl-a' at any time to change your selection

Select [1 or 2]:
```

Enter **1** and press ENTER. This allows you to open a new window in Byobu by pressing CTRL-A, followed by C (for "create"). Try that now to open a new empty shell. Press CTRL-A followed by N (for "next") to switch back to your first window. To exit a Byobu window, you run the exit command in that shell.

NOTE *See* https://www.byobu.org *for more complete documentation for this program, including a video tutorial.*

Completely close your terminal window and click through any warnings saying that your active programs will close if you do this. Open a new terminal window and SSH back into your server using the **ssh** *username@hostname* command. Then run **byobu** again to attach your previous session. Any programs you run inside this Byobu session won't quit when you disconnect from SSH.

Install Updates

Always install updates when you set up a new server to keep it secure. Run the following commands (you don't need to use sudo, since you're the root user):

```
apt update
apt upgrade
```

Follow the instructions to finish installing updates.

If you ever need to reboot your server (such as after updating the Linux kernel), run the reboot command. You'll get kicked out of your SSH session, but you should be able to SSH back in shortly when the reboot completes. You can also reboot your VPS from DigitalOcean's web console—for example, if the entire server crashed and you can't SSH into it.

Exercise 4-5: Explore the Oath Keepers Dataset Remotely

In this exercise, you'll use BitTorrent to download the Oath Keepers dataset to your cloud server and explore it using the skills you've gained in this chapter. You'll also learn to copy data from your remote server to your laptop using the `rsync` command. Finally, you'll delete your VPS to avoid getting charged for time when you're not using it.

The Oath Keepers dataset contains data from the far-right extremist group that participated in the January 6, 2021, US Capitol insurrection. In September 2021, a hacktivist broke into the Oath Keepers servers and made off with the group's email messages, chat logs, membership lists, and other data, and then leaked it to DDoSecrets. You'll continue working with this dataset when you learn to analyze email dumps in Chapter 6.

NOTE *This book works only with the publicly available part of the Oath Keepers dataset, which contains email messages and chat logs. To access content like the Oath Keepers' donor and membership lists, which contain PII, contact DDoSecrets.*

Because your home or office internet connection is likely significantly slower than a cloud provider's, it's inefficient to download a dataset to your laptop, then upload it to your remote server. To download the dataset directly to your VPS, you'll use `transmission-cli`, the command line version of the BitTorrent client you used to download BlueLeaks in Chapter 2. In your VPS, run the following command to install `transmission-cli`:

```
apt install transmission-cli
```

You can now use the `transmission-cli` command to download files. You must pass in either the path to a *.torrent* file or a magnet link as an argument. In this exercise, you'll use the torrent file available at *https://ddosecrets.com/wiki/Oath_Keepers*.

Run the following commands:

```
mkdir ~/datasets
cd ~/datasets
```

This creates a new folder called *datasets* on your server, then changes to it. Download the torrent file from the link on the DDoSecrets page and load it into your BitTorrent client with the following commands:

```
wget https://ddosecrets.com/images/0/02/Oath_Keepers.torrent
transmission-cli -w . Oath_Keepers.torrent
```

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The wget command downloads files—in this case, *Oath_Keepers.torrent*—and saves them in the current folder. The transmission-cli command downloads the 3.9GB torrent to your server from the BitTorrent swarm and uploads parts of it to other parts of the swarm. The -w . arguments tell transmission-cli to download the torrent into the current working folder. (You could change that to -w ~/Downloads, for example, if you wanted to download it into the *~/Downloads* folder instead.)

NOTE *If no torrent file is available for a dataset, you can replace the torrent filename with a magnet link in double quotes as an argument in the* transmission-cli *command.*

When you've finished downloading the torrent, your server will be a seed until you quit the program by pressing CTRL-C. While you're waiting for the dataset to finish downloading, or if you've finished but want to continue seeding the torrent, you can work on your VPS in a separate Byobu shell.

To check how much free space your server has left, run the following command after the download is complete:

```
df -h
```

The df command tells you how much disk space is free on each connected drive, and the -h argument displays these numbers in human-readable units. After downloading the Oath Keepers dataset, I got the following output from these commands on my server:

```
Filesystem      Size  Used Avail Use% Mounted on
tmpfs            98M 1000K   97M   2% /run
/dev/vda1        25G  5.8G   19G  24% /
tmpfs           486M   80K  486M   1% /dev/shm
tmpfs           5.0M     0  5.0M   0% /run/lock
/dev/vda15      105M  5.3M  100M   5% /boot/efi
tmpfs            98M  4.0K   98M   1% /run/user/0
```

As shown in bold, my root partition mounted on / has 25GB of space, has used 5.8GB, and has 19GB free.

Change your working directory to *~/datasets/Oath Keepers*, remembering to put the filepath in quotes or escape the space in the path. For example, you could run this command from the *~/datasets* folder:

```
cd Oath\ Keepers
```

Run the following command to find that the Oath Keepers dataset takes up 3.9GB of space:

```
root@test-vps:~/datasets/Oath Keepers# du -sh --apparent-size .
3.9G    .
```

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Next, run the `ls` command to list the files in the *Oath Keepers* folder:

```
root@test-vps:~/datasets/Oath Keepers# ls -lh
total 13M
drwxr-xr-x 2 root root 4.0K Aug  2 23:47 'Oath Keepers.sbd'
-rw-r--r-- 1 root root  12M Aug  2 23:47  messages.json
-rw-r--r-- 1 root root 1.4M Aug  2 23:44  messages_old.json
```

The output shows that this folder contains a folder called *Oath Keepers.sbd*, a 12MB file called *messages.json*, and a 1.4MB file called *messages_old.json*. These JSON files are chat logs.

Switch to the *Oath Keepers.sbd* folder and run `ls` again:

```
root@test-vps:~/datasets/Oath Keepers# cd Oath\ Keepers.sbd/
root@test-vps:~/datasets/Oath Keepers/Oath Keepers.sbd# ls -lh
total 3.9G
-rw-r--r-- 1 root root 2.2M Aug  2 23:45  Archive
-rw-r--r-- 1 root root  23K Aug  2 23:44 'Saved Correspondence'
-rw-r--r-- 1 root root  25K Aug  2 23:44  Systems
-rw-r--r-- 1 root root 2.8M Aug  2 23:44  ak
--snip--
```

The output shows that this folder contains 100 files, each representing a different inbox full of email.

Since you'll use the Oath Keepers dataset later in the book, next you'll copy it from your VPS to your *datasets* USB disk with the `rsync` program, which synchronizes local folders and remote folders using SSH.

NOTE *The `scp` command (short for "secure copy") also copies files and folders from your computer to a remote server, or vice versa, over SSH. The BlueLeaks hacker likely used a Windows version of `scp`,* pscp64.exe*, to exfiltrate data from the hacked police web servers to a server they controlled. For very large folders, however, `rsync` is often a better choice than `scp`, since if it fails halfway through, you can rerun the command and it will start where it left off.*

Open a terminal running locally on your computer (not SSHed to your VPS) and run **`which rsync`** to check whether `rsync` is installed. If so, the command returns the path to the program, something like */usr/bin/rsync*. If not, you'll see no output. Windows with WSL and Linux users can install `rsync` with the following command:

```
sudo apt install rsync
```

macOS users can install it with the following command:

```
brew install rsync
```

To copy a file from a remote server to your local computer, run the following command:

```
rsync -av --progress remote_user@remote_host:remote_path local_path
```

The `-av` argument is a combination of `-a` (short for `--archive`), which preserves the file permissions in the copy you're making, and `-v` (short for `--verbose`), which outputs each filename as it copies the files. The `--progress` argument displays progress bars for each file as it's copying. The `rsync` command will SSH into the server *remote_host* with the username *remote_user*. If it authenticates successfully, it will download the file or folder at *remote_path* and save it on your computer at *local_path*.

For example, here's how I'd download the Oath Keepers dataset from my VPS to my *datasets* USB disk:

```
rsync -av --progress root@178.128.22.151:"~/datasets/Oath\ Keepers" /Volumes/datasets/
```

In this case, `root@178.128.22.151:"~/datasets/Oath\ Keepers"` is the *remote_user@remote_host:remote_path* argument, since the *Oath Keepers* folder is in the *datasets* folder in the root user's home folder on my VPS. I put the remote path in quotes and escape the space in the filename, telling my local shell that `root@178.128.22.151:"~/datasets/Oath\ Keepers"` is a single argument. The *local_path* argument is the `/media/micah/datasets/` path to my *datasets* USB disk.

NOTE *You can also use* `rsync` *to upload files from your computer to a remote server—just put the* `local_path` *argument first, as the source, and put the* `remote_user@remote_host:remote_path` *argument second, as the destination.*

Here's the output I get when I run this command:

```
receiving incremental file list
Oath Keepers/
Oath Keepers/messages.json
     12,109,624 100%    1.89MB/s    0:00:06 (xfr#1, to-chk=102/104)
Oath Keepers/messages_old.json
      1,393,296 100%    1.65MB/s    0:00:00 (xfr#2, to-chk=101/104)
Oath Keepers/Oath Keepers.sbd/
Oath Keepers/Oath Keepers.sbd/Archive
      2,288,916 100%    1.81MB/s    0:00:01 (xfr#3, to-chk=99/104)
Oath Keepers/Oath Keepers.sbd/Saved Correspondence
         23,192 100%  111.02kB/s    0:00:00 (xfr#4, to-chk=98/104)
Oath Keepers/Oath Keepers.sbd/Systems
         25,382 100%  121.51kB/s    0:00:00 (xfr#5, to-chk=97/104)
Oath Keepers/Oath Keepers.sbd/ak
      2,921,276 100%    4.33MB/s    0:00:00 (xfr#6, to-chk=96/104)
Oath Keepers/Oath Keepers.sbd/al
     41,772,536 100%    6.57MB/s    0:00:06 (xfr#7, to-chk=95/104)
--snip--
```

The `rsync` command copies every file, one at a time, from the remote folder to the local folder over SSH, displaying a line after each filename

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that shows the file's download speed and progress. You can press CTRL-C to cancel the command, then rerun that command, and `rsync` should continue where it left off. This is especially useful when you need to copy gigabytes or terabytes of data spread across millions of files—if the file transfer fails, you can pick up where you left off.

Once `rsync` finishes running, you'll have downloaded a local copy of the Oath Keepers dataset to your *datasets* USB disk. You'll use this dataset again in Chapter 6, when you learn techniques for researching email dumps.

WARNING *Destroy your VPS from the DigitalOcean web console when you're done with it. Using it for an hour or two should cost you only a few cents, but the bill can get expensive if you don't pay attention.*

Summary

In this chapter, you've put your command line skills to the test, unzipping the compressed files in BlueLeaks and learning to quickly search and sort datasets. You also worked with servers in the cloud and briefly explored the Oath Keepers dataset.

In the next chapter, you'll continue expanding your command line skills and learn two new tools: Docker, which allows you to run Linux software on any operating system, and Aleph, which allows you to search datasets by keyword.

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5

DOCKER, ALEPH, AND MAKING DATASETS SEARCHABLE

When I get my hands on a new dataset, the first thing I do is search it for any juicy, easy-to-find revelations. Depending on the dataset, I might look for politicians, organizations, or the city where I live. In the previous chapter, you learned to search text files like CSV or JSON files using `grep`, but `grep` won't work on binary files like PDFs or Office documents. In this chapter, you'll expand your search capabilities with Aleph, an open source investigation tool.

Aleph is developed by the Organized Crime and Corruption Reporting Project, a group of investigative journalists largely based in Eastern Europe and Central Asia. The tool allows you to *index* datasets, extracting all the text they contain so they're easy to search. You can use Aleph to search for keywords or *entities* (like people, companies, organizations, or addresses) and discover related entities in other datasets. Aleph also performs optical character recognition (OCR), which, as mentioned in Chapter 1, takes flat images like scanned documents or screenshots, uses artificial intelligence to recognize any words, and converts those words into text that you can search or copy and paste.

In the first half of this chapter, you'll learn the ins and outs of using Docker and Docker Compose, the software required for running Aleph. In the second half, you'll use your new Docker skills to run an Aleph server, then index and search part of the BlueLeaks dataset.

Introducing Docker and Linux Containers

Docker is the most popular software for running *Linux containers*, a type of software package. Linux containers can organize ready-to-go Linux software—complete with all of its dependencies, configuration, and source code—into a single bundle called a *container image* that you can quickly and easily run. The software inside containers is isolated from the rest of your computer; it can't access any of those files unless you allow it to do so.

For example, let's say you want to set up the popular WordPress blogging software in Linux. You use a package manager like apt or Homebrew to install the software WordPress depends on. You then put the WordPress source code in a location on your disk with the right permissions, configure your web server software so it knows where to look for that source code, and configure a database to store the blog's data. You can then save all this work in a Linux container called `wordpress` and reuse that container to spin up new WordPress sites with a single Docker command.

Because Linux containers are isolated from the rest of your computer, multiple WordPress containers can run at the same time without interfering with each other. If someone hacks the software running in your container, they won't be able to access any of the data located elsewhere on your computer—at least, not without also hacking Docker itself. This is why Dangerzone relies on Linux containers: if a malicious document manages to hack the Dangerzone container you're using, your computer should still be safe. In addition to software like WordPress, you can use Linux containers to run commands in most Linux distributions without having to install those operating systems.

Docker comes with two commands you'll use in this chapter: `docker`, which runs individual containers, and `docker-compose`, which lets you run multiple containers at once. You'll practice using the `docker` command by running Linux containers for the Ubuntu and Kali Linux operating systems, as well as for the data science software Jupyter Notebook. You'll then use `docker-compose` to run a WordPress server and an Aleph server. Aleph requires a small network of services that communicate with each other, but as with WordPress, you can use a single Docker command to start up all these individual servers in their own containers. This process should prepare you to run Linux containers with Docker for other purposes later in the book.

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This chapter covers two applications for running Docker containers: Docker Desktop and Docker Engine. Docker Desktop runs Docker containers on workstation computers in a Linux VM. Docker Engine, on the other hand, runs Docker directly on a Linux computer. Windows and Mac users, turn to Exercise 5-1 to set up Docker Desktop. Linux users, turn to Exercise 5-2 to install Docker Engine.

NOTE *It's possible for Linux users to install Docker Desktop, but I don't recommend it for this chapter. Without a VM, Docker will be free to use all of your computer's memory and processors, which will make indexing datasets in Aleph much faster.*

Exercise 5-1: Initialize Docker Desktop on Windows and macOS

When you installed Dangerzone in Exercise 1-3, Docker Desktop also should have been installed, since Dangerzone requires it. Confirm that Docker Desktop is installed by checking whether your *Applications* folder in macOS or Start menu in Windows has a Docker program; if not, download it from *https://www.docker.com/products/docker-desktop/*.

Open Docker and follow the on-screen instructions to initialize the software. You may need to reboot your computer. Before you can use Docker, Docker Desktop's Linux VM should be up and running. If you click the Docker icon in your system tray and it tells you that Docker Desktop is running, you're ready to proceed.

If you're using Windows, you can use either PowerShell or Ubuntu with WSL for this chapter, since the `docker` and `docker-desktop` commands should run fine in either. Even when you use Docker from PowerShell, it technically relies on WSL under the hood.

If you're using macOS, click the Docker icon in your system tray and choose **Preferences**. Switch to the Resources tab and make sure that the Memory resource is set to at least 6GB—higher if you have more to spare—to be sure Docker's Linux VM has enough memory to handle Aleph. Click **Apply & Restart**.

For either operating system, to test whether Docker is working, open a terminal and run this command:

```
docker run hello-world
```

This command should run a Docker container image called `hello-world`. If you don't already have the `hello-world` image on your computer, Docker should download it first. The output should look something like this:

```
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
2db29710123e: Pull complete
Digest: sha256:10d7d58d5ebd2a652f4d93fdd86da8f265f5318c6a73cc5b6a9798ff6d2b2e67
Status: Downloaded newer image for hello-world:latest
```

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```
Hello from Docker!
This message shows that your installation appears to be working correctly.
--snip--
```

Your computer is ready to run Linux containers. Skip to the "Running Containers with Docker" section on page XX.

Exercise 5-2: Initialize Docker Engine on Linux

Follow the detailed instructions for Server rather than Desktop at *https://docs.docker.com/engine/install/* to install Docker Engine for your version of Linux. In Ubuntu, the installation process involves adding a new apt repository to your computer and installing some Docker packages.

Docker Engine on Linux requires root access to run containers. After completing this exercise, if you're using Linux, add `sudo` to the beginning of all `docker` or `docker-compose` commands in this book. To run all your Docker commands as root automatically without using `sudo`, check the Docker Engine documentation for instructions on adding your Linux user to the `docker` group; however, keep in mind that doing so decreases your computer's security and isn't recommended.

Once Docker is installed, open a terminal and run:

```
sudo docker run hello-world
```

This command runs a Docker container image called `hello-world`. If you don't already have the `hello-world` image on your computer, Docker downloads it first. The output should look something like this:

```
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
2db29710123e: Pull complete
Digest: sha256:507ecde44b8eb741278274653120c2bf793b174c06ff4eaa672b713b3263477b
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.
--snip--
```

If the `hello-world` container ran successfully, you can now use the `docker` command on your computer. Next, run the following command to install the `docker-compose` package, which will give you access to the `docker-compose` command:

```
sudo apt install docker-compose
```

Your computer is now ready to run Linux containers.

PODMAN

Podman (*https://podman.io*) is another software solution for running Linux containers. It's lightweight and doesn't require root access, which makes it more secure than Docker. I prefer Podman—in fact, Dangerzone for Linux uses it instead of Docker. However, Docker is more popular, and some containers that work in Docker may not run properly in Podman. I recommend sticking with Docker while you follow along with this chapter. If you become a Linux container nerd, you can try out Podman on your own later.

Running Containers with Docker

The `docker` command you've just installed allows you to run Linux containers on your computer. In this section you'll learn how to use this command to open a shell inside containers, force running containers to quit, mount volumes to save persistent data or access certain files, set environment variables, and publish ports so your computer can connect to network services inside your container. This foundational understanding of Docker will prepare you to run Docker containers in Exercise 5-3 and help you troubleshoot any problems you later encounter with Aleph.

NOTE *For additional information on Docker commands, run* `docker help` *or check the documentation at* https://docs.docker.com.

Running an Ubuntu Container

You'll begin by learning how to run a Linux container with the Ubuntu operating system in it. People often base more complicated container images on the Ubuntu container image to access all Ubuntu software that apt can install. An Ubuntu container is also a convenient way to access a shell on a clean Ubuntu system, allowing you to install software or test programs.

Docker commands use the `docker` *`command`* syntax. Run the following to start your own Ubuntu container (if you're using Linux, remember to add `sudo`):

```
docker run -it ubuntu:latest bash
```

This command runs `ubuntu:latest`, the latest version of the `ubuntu` image. If that image isn't already on your computer, Docker automatically downloads it from Docker Hub, a library of public container images at *https://hub.docker.com*. Next, the `bash` command runs, giving you shell access inside that container. Include the `-it` argument, which is short for `-i` (or `--interactive`) and `-t` (or `--tty`), after `docker run` whenever you plan to open a shell in a container, so that any commands you type in the terminal run in the container. Without the `-it` argument, the bash shell would immediately quit before you could run any commands, as would the container.

This command gives me the following output:

```
micah@trapdoor ~ % docker run -it ubuntu:latest bash
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
d19f32bd9e41: Pull complete
Digest: sha256:34fea4f31bf187bc915536831fd0afc9d214755bf700b5cdb1336c82516d154e
Status: Downloaded newer image for ubuntu:latest
root@5661828c22a2:/#
```

Since I didn't already have the `ubuntu:latest` image, the command downloaded that image, started the container, and dropped me into a bash shell. I can now run whatever commands I want inside this container, such as installing software or running programs.

Running the exit command quits the container. If you start a new `ubuntu:latest` container, it contains none of the old container's data. For example, with the following commands, I create a file called *test.txt* in one container, quit the container, and start a new one:

```
root@5661828c22a2:/# echo "Hacks, Leaks, and Revelations" > test.txt
root@5661828c22a2:/# cat test.txt
Hacks, Leaks, and Revelations
root@5661828c22a2:/# exit
exit
micah@trapdoor ~ % docker run -it ubuntu:latest bash
root@e8888f73a106:/# cat test.txt
cat: test.txt: No such file or directory
root@e8888f73a106:/#
```

The output shows that *test.txt* no longer exists. For data in a container to persist when you rerun the container image, you need to use volumes, as we'll discuss in "Mounting and Removing Volumes" on page XX.

Listing and Killing Containers

If you've exited your Ubuntu container, run a new one. With that container running in the background, open a second terminal window and run the **`docker ps`** command. This should show you a list of all containers currently running. Here's the output I get, for example:

```
CONTAINER ID   IMAGE           COMMAND   CREATED         STATUS         PORTS     NAMES
337a795a53b2   ubuntu:latest   "bash"    9 minutes ago   Up 9 minutes
nostalgic_keldysh
```

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When you start a container with `docker run`, you can give it a name with the arguments `--name` *`your_container_name`*. Otherwise, it will be assigned a random name. The container in my `docker ps` output is called `nostalgic_keldysh`.

To *kill* a container, or force it to quit, you run `docker kill` *`your_container_name`*. For example, running the following command in my other terminal window quits my `nostalgic_keldysh` container:

```
docker kill nostalgic_keldysh
```

Run this command for your own container. If you switch back to your other terminal window, the container should have quit, and you should be back in your normal shell.

When you exit a container, Docker still keeps track of it, allowing you to restart it if you want. To see all of the containers Docker is tracking, including ones that aren't running anymore, you run `docker ps -a` (short for `--all`). Here's the output I get when I run this command:

```
CONTAINER ID   IMAGE           ...   STATUS                     PORTS     NAMES
337a795a53b2   ubuntu:latest   ...   Exited (0) 43 minutes ago            nostalgic_keldysh
```

It's good practice to run `docker rm` *`container_name`* to prune your stopped Docker containers when you're done using them. For example, I'd run `docker rm nostalgic_keldysh` to remove my `nostalgic_keldysh` container.

You can run `docker container prune` to remove all stopped containers at once. When I ran this command, I saw the following output:

```
WARNING! This will remove all stopped containers.
Are you sure you want to continue? [y/N]
```

I entered `y` and got the following output:

```
Deleted Containers:
337a795a53b25e6c28888a44a0ac09fac9bf6aef4ab1c3108844ca447cce4226

Total reclaimed space: 5B
```

This displays the container ID, a long string of random-looking text, for each container that's deleted. In my case, I deleted a single container.

Mounting and Removing Volumes

Containers support *volumes*, which you can think of as folders in your container designed to store persistent data. You can use volumes to save changes you've made to your container after you quit and remove it.

For example, suppose you start a container without any volumes that runs the PostgreSQL database software. Any data you add to it is saved to the */var/lib/postgresql/data* folder inside your container. When you quit and remove the container, you'll lose all of your data. If you instead *mount* a folder on your host operating system into */var/lib/postgresql/data* on the container, when software in the container accesses that folder, it's actually accessing the folder on your host operating system. You'll still have all of your data when the container closes and is removed, and you can start the container again in the future with the same data.

Docker has two main types of volumes: *bind mounts*, or folders from your host machine mounted into a container, and normal Docker volumes, where Docker keeps track of your persistent folders without your having to provide a path on your host operating system. For example, if you want to store your database container's data in the */Volumes/datasets/volumes/db-data* folder on your host filesystem, you would mount this folder as a bind mount. If you don't need your data to be stored in a specific folder on your host, just use a normal volume, and Docker will keep track of where it's stored.

NOTE *Storing volumes in a Linux VM with Docker Desktop makes them faster than bind mounts, but your VM might run out of disk space if your volumes get too big (if you index large datasets into Aleph, for example). In macOS, you can increase the amount of disk space available to your VM in the Docker Desktop preferences under the Resources tab. In Windows, your VM will use as much space on the* C: *drive as it needs, but again,* this *drive could run out of disk space if you're dealing with large amounts of data. Alternatively, you could use bind mounts instead of volumes, storing data on external disks.*

You can also use volumes to access data outside of a container while that container is running. In Exercise 5-5, you'll bind-mount your *datasets* USB disk as a folder in an Aleph container. This way, your container can access the BlueLeaks dataset, allowing you to index it.

Use this command to start a container with a volume:

```
docker run --mount type=volume,src=volume-name,dst=/container/path image
```

Use this command to start a container with a bind mount:

```
docker run --mount type=bind,src=/path/on/host,dst=/container/path image
```

The `--mount` argument tells Docker that you're going to mount a volume and is followed by comma-separated details about that volume. The `type` parameter specifies the type of mount: `volume` for volumes and `bind` for bind mounts. The `src` parameter specifies the source of the volume or bind mount. For volumes, its value is the volume name; for bind mounts, its value is the absolute path on your host filesystem to the folder you want to mount. The `dst` parameter specifies the destination of the volume or bind mount, in both cases the absolute path of the folder inside the container to which you're mounting.

Let's practice these two commands, starting with mounting a volume. Run the following code (your prompt will be different from mine):

```
micah@trapdoor ~ % docker run -it --mount type=volume,src=test-data,dst=/mnt
ubuntu:latest bash
```

```
root@50b8b6f86e4d:/# echo "Hacks, Leaks, and Revelations" > /mnt/test.txt
root@50b8b6f86e4d:/# exit
```

This code starts an Ubuntu container and mounts a volume called `test-data` into the */mnt* folder in the container. It then saves some data into the */mnt/test.txt* file and exits the container.

Use the following commands to open a separate container, mounting the same volume into it to see whether your data is still there (again, your command prompt will be different):

```
micah@trapdoor ~ % docker run -it --mount type=volume,src=test-data,dst=/mnt
ubuntu:latest bash
root@665f910bb21c:/# cat /mnt/test.txt
Hacks, Leaks, and Revelations
root@665f910bb21c:/# exit
```

This time, because you mounted */mnt* in the `test-data` volume, the data persisted.

To see a list of the volumes that Docker is managing, run the **`docker volume ls`** command. You should get the following output:

```
DRIVER    VOLUME NAME
local     test-data
```

You can remove volumes only from containers that have been completely removed from Docker. If you've just stopped a container but Docker is still tracking it, it won't let you remove the volume. Completely remove all stopped containers by running **`docker container prune`**, which then allows you to remove any volumes attached to those containers. You should get the following output:

```
WARNING! This will remove all stopped containers.
Are you sure you want to continue? [y/N]
```

Enter **`y`** to continue:

```
Deleted Containers:
665f910bb21ca701be416da94c05ee6a226117923367d2f7731693062683a402
50b8b6f86e4d0eab9eb0ba9bf006ae0473525d572ea687865f8afca8a92e7087

Total reclaimed space: 82B
```

You can now run `docker volume rm` *`volume-name`* to remove any volumes attached to those containers, or run `docker volume prune` to delete all volumes that Docker containers aren't currently using. Run **`docker volume rm test-data`** to remove the `test-data` volume, then run the **`docker volume ls`** command again. This time, you shouldn't see any volumes listed in the output.

Next, you'll practice bind mounting by mounting the folder on your host system containing the BlueLeaks dataset into a container running Kali Linux. This Linux distribution is designed for *penetration testing*, in which people hack into systems with permission from the system owners to find and fix security flaws.

If you're a Mac or Linux user, run the following command, replacing the path with the appropriate path on your machine:

```
docker run -it --mount type=bind,src=/Volumes/datasets/BlueLeaks-extracted,dst=/blueleaks
kalilinux/kali-rolling bash
```

This should run a `kalilinux/kali-rolling` container, mounting your *BlueLeaks-extracted* folder in it at the path */blueleaks*, and drop you into a bash shell.

Windows users might have trouble bind-mounting a folder on the *datasets* USB disk into a container, because Docker Desktop for Windows runs Linux containers using WSL, and WSL doesn't always have access to your USB disks. To avoid this problem, if you plugged in your USB disk after opening a WSL terminal or using Docker, restart WSL by running **`wsl --shutdown`** in PowerShell. You should see a notification from Docker Desktop asking if you want to restart it. Click **Restart**. After you restart WSL with the USB disk already plugged in, Docker should be able to mount it. (See Appendix A for more information.)

If you're using Windows with PowerShell to work through this chapter, run the following command to mount the folder that contains the BlueLeaks data into */datasets*, replacing *`D:/BlueLeaks-extracted`* with the appropriate path:

```
docker run -it -mount type-bind,src=D:/BlueLeaks-extracted,dst=/blueleaks kalilinux/
kali-rolling bash
```

If you're using Ubuntu with WSL in Windows, mount the *BlueLeaks* folder by accessing the *D:* drive from */mnt/d* with the following syntax:

```
docker run -it --mount type=bind,src=/mnt/d/BlueLeaks-extracted,dst=/blueleaks kalilinux/
kali-rolling bash
```

From within your Kali container, you can now use the tools that come with Kali on the BlueLeaks dataset. By default, Kali customizes your bash shell to look slightly different than Ubuntu does. The prompt will look something like this:

```
┌──(root㉿6a36e316663c)-[/]
└─#
```

Docker containers are assigned random hostnames. In this case, `root` is the name of the current user, `6a36e316663c` is the hostname of the computer, and / is the current working directory. From here, run **`ls /blueleaks/`** to list the files in the *BlueLeaks* folder:

```
211sfbay              iowaintex          pleasantonpolice
Securitypartnership   jerseyvillagepd    prvihidta
acprlea               jric               pspddoc
acticaz               kcpers             publicsafetycadets
--snip--
```

NOTE *You can learn more about volumes at* https://docs.docker.com/storage/volumes/ *and about bind mounts at* https://docs.docker.com/storage/bind-mounts/.

Passing Environment Variables

You can also use environment variables, introduced in Chapter 4, to pass sensitive information like database credentials into containers. When starting up a container, you pass an environment variable into it using the `-e` *`variable_name=value`* (the `-e` is short for `--env`) arguments. Programs in the container can then access the value of that variable.

For example, run the following command:

```
docker run -it -e DB_USER=root -e DB_PASSWORD=yourefired ubuntu:latest bash
```

This starts an Ubuntu container with the variable `DB_USER` set to `root` and the variable `DB_PASSWORD` set to `yourefired`. From inside the container, try displaying the values of those variables to confirm that you can access this information there, using the `echo $`*`variable_name`* command like so:

```
bash-5.1# echo $DB_USER
root
bash-5.1# echo $DB_PASSWORD
yourefired
```

You'll practice passing environment variables to containers further in Exercise 5-3.

Running Server Software

You can also run robust, fully configured software on the operating systems running in containers. This technique is mostly used to access *server software*, software to which you can connect over a network using web browsers, database clients, or other similar programs. You'll need this skill for Exercise 5-3 and, eventually, to run Aleph.

Different computers (or VMs, or containers), called *hosts*, are identified by IP addresses or hostnames. Your own computer's IP address is always 127.0.0.1, and its hostname is always *localhost*. Hosts can listen on different ports for incoming network connections, meaning the host is available for other hosts to connect to over a network. A *port* is a number that the computer uses to sort out which network traffic should go to which application.

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Different services have different default ports. For example, HTTP and HTTPS services are two types of websites that use port 80 and port 443, respectively. When you load the URL *http://example.com* in your browser, it will try to connect to the host *example.com* on port 80 using HTTP. If you load *https://example.com*, it will try to connect on port 443 using HTTPS.

However, you can change the default ports that services use. If you're running an HTTP service on *localhost* on port 5000, the URL for that service would be *http://localhost:5000*, where *http://* means you're using the HTTP protocol, *localhost* means you're connecting to the *localhost* host, and *:5000* means you're connecting to port 5000 instead of the default HTTP port, 80.

To connect to a network port inside your Docker container, you must *publish* a network port when you run your container, making that port available on the host operating system. To do so, use the arguments `-p` *`host_port`*`:`*`container_port`* (`-p` is short for `--publish`). Once the container starts up, your host operating system will listen on *`host_port`*. If you connect to that port, your connection will be forwarded to *`container_port`* inside the container.

Let's look at an example of running server software and publishing a port so that you can connect to it from your host computer. Run the following command:

```
docker run -p 8000:8888 jupyter/scipy-notebook:latest
```

This command should download and run the latest version of the *jupyter/scipy-notebook* container image, which includes the most popular science-related Python libraries. (Jupyter Notebook is a powerful data science tool for creating and sharing computational documents.) The syntax to publish ports is `-p` *`host_port`*`:`*`container_port`*. Jupyter Notebook starts an HTTP service on port 8888, so in this command, *`host_port`* is `8000` and *`container_port`* is `8888`. If you connect to *localhost* on port 8000, using either the URL *http://localhost:8000* or *http://127.0.0.1:8000*, you'll now actually connect to port 8888 inside the container.

Here's the output from the previous command:

```
Unable to find image 'jupyter/scipy-notebook:latest' locally
latest: Pulling from jupyter/scipy-notebook
08c01a0ec47e: Pull complete
--snip--
Status: Downloaded newer image for jupyter/scipy-notebook:latest
Entered start.sh with args: jupyter lab
Executing the command: jupyter lab
--snip--

    To access the server, open this file in a browser:
        file:///home/jovyan/.local/share/jupyter/runtime/jpserver-7-open.html
    Or copy and paste one of these URLs:
        http://cc4a555569e4:8888/lab?token=d570e7d9ecc59bbc77536ea4ade65d02dd575ff3c6713dd4
     or http://127.0.0.1:8888/lab?token=d570e7d9ecc59bbc77536ea4ade65d02dd575ff3c6713dd4
```

The output shows that this command downloaded the latest version of the *jupyter/scipy-notebook* container image from Docker Hub and then ran it. This time, instead of starting a shell in the container, the container runs only the service it was designed for, which is Jupyter Notebook. Each time Jupyter Notebook outputs a log message, the terminal window now displays it.

The end of the output shows three different URLs to access the server. Copy the final URL, paste it in your browser, and change the port number from 8888 to 8000 before you load it. When you connect to your own computer on port 8000 (127.0.0.1:8000), your connection will be forwarded to the container on port 8888. Your browser should load the Jupyter Notebook service running in your container. When this happens, you should see more log messages appear in the terminal.

Figure 5-1 shows a web browser running on my Mac, connected to a Jupyter Notebook server, which is running in my Linux container.

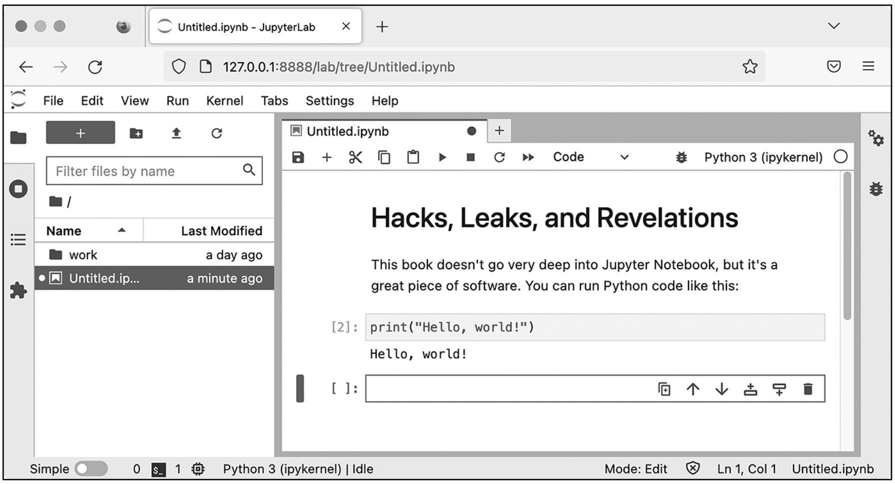

Figure 5-1: Jupyter Notebook running in a container

The container keeps running until you press CTRL-C to quit it. If you need to run any other terminal commands while the container is still running, you'll need to open a separate terminal window. For now, press CTRL-C in your terminal to exit the Jupyter Notebook container.

You won't use Jupyter Notebook further in this book, but you'll rely on your new understanding of running server software to run a WordPress website in Exercise 5-3.

NOTE *For more information about Jupyter Notebook, visit* https://jupyter.org, *and for thorough documentation on running Jupyter Notebook in Docker, see* https://jupyter-docker-stacks.readthedocs.io.

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Freeing Up Disk Space

Docker images take up a lot of disk space. To free up space quickly, use the following command to delete all of the container images you've downloaded from Docker Hub and other data that Docker stores (besides volumes):

```
docker system prune -a
```

Since this command doesn't delete volumes, it won't delete any of your important data. The next time you use `docker run` commands, you'll just redownload the container images you need from Docker Hub.

Exercise 5-3: Run a WordPress Site with Docker Compose

More complicated software like Aleph requires running multiple containers that interact with each other. To do that, you'll need to learn to use Docker Compose, as the `docker run` command's arguments quickly become hard to keep track of when used to run more complicated containers—those with volumes, environment variables, publishing ports, and so on. It's especially unwieldy to run a single application that requires multiple containers at once.

Docker Compose makes it easier to define and run such Docker applications. The tool allows you to configure your containers (choosing images, volumes, environment variables, published ports, and so on) in a single file, and to start and stop all of your containers with a single command. I often use Docker Compose even for software that requires a single container, because it simplifies keeping track of all of the configuration. You'll need to be proficient in Docker Compose to run an Aleph server.

In this exercise, you'll familiarize yourself with Docker Compose by using it to run WordPress. You won't need WordPress for the remainder of this book, but here it serves as an example to prepare you for using Docker Compose with Aleph.

Make a docker-compose.yaml File

The YAML file format (*https://yaml.org*) is popular among programmers for storing configuration files because it's relatively human-readable. YAML files have either a *.yml* or *.yaml* file extension. Docker Compose defines containers and their settings in a file called *docker-compose.yaml*.

Open a terminal and change to your *exercises* folder. Make a new folder called *wordpress* for this exercise and then, using your text editor, make a file in that folder called *docker-compose.yaml*. Enter the following code into *that* file (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-5/wordpress/docker-compose.yaml*):

```
services:
  wordpress:
    image: wordpress:latest
    volumes:
      - wordpress_data:/var/www/html
    ports:
      - 8000:80
    restart: always
  ❶ environment:
      - WORDPRESS_DB_HOST=db
      - WORDPRESS_DB_USER=wordpress
      - WORDPRESS_DB_PASSWORD=yourefired
      - WORDPRESS_DB_NAME=wordpress
  db:
    image: mariadb:10.9
    volumes:
      - db_data:/var/lib/mysql
    restart: always
  ❷ environment:
      - MYSQL_ROOT_PASSWORD=supersecurepassword
      - MYSQL_USER=wordpress
      - MYSQL_PASSWORD=yourefired
      - MYSQL_DATABASE=wordpress

volumes:
  db_data:
  wordpress_data:
```

YAML files are whitespace sensitive, meaning that indentations affect the meaning of the code. This file defines two containers named `wordpress` and `db`. For each container, it defines which container image to use, what volumes to mount, which ports to publish (in the case of the `wordpress` container), which environment variables to set, and other settings.

The `wordpress` container uses the `wordpress:latest` image to create an instance of the WordPress web application. The `db` container uses the `mariadb:10.9` container image to create an instance of a MySQL database server. (MySQL is a popular data management system that you'll learn more about in Chapter 12.)

Because these two containers are defined in the same *docker-compose.yaml* file, by default they're part of the same Docker network so that they can communicate with each other. The `wordpress` container sets `WORDPRESS_DB_HOST` to `db`, the name of the other container, because it connects to that hostname. The `wordpress` environment variables ❶ also match the `db` environment variables ❷. If these database credentials aren't the same, WordPress gets a "permission denied" error when trying to connect to the database.

NOTE *The WordPress* docker-compose.yaml *file in this example is a slightly modified version of a sample file in the Docker documentation at* https://docs.docker.com/samples/wordpress/. *See the documentation for a more thorough description of how to use Docker Compose.*

Start Your WordPress Site

In your terminal, change to the folder you created for this exercise and run the following command to start both containers at the same time:

```
docker-compose up
```

The first time you run it, Docker should download the `mariadb:10.9` and `wordpress:latest` container images from Docker Hub. The command should then run a MySQL container and a web server container running WordPress, and you should see logs from both containers scroll by in your terminal. Logs from the `db` container start with `db_1`, while logs from the `wordpress` container start with `wordpress_1`.

The `db` container doesn't need to publish any ports for WordPress to connect to it, since both containers share a Docker network. However, the `wordpress` container publishes ports 8000:80. This means that loading *http://127.0.0.1:8000* in your browser connects to your host operating system on port 8000 and loads the web server in the `wordpress` container running on port 80.

Enter *http://127.0.0.1:8000* in your browser, and you're running WordPress! Figure 5-2 shows the WordPress installation process that appears when I load that URL on my Mac after selecting English as my language.

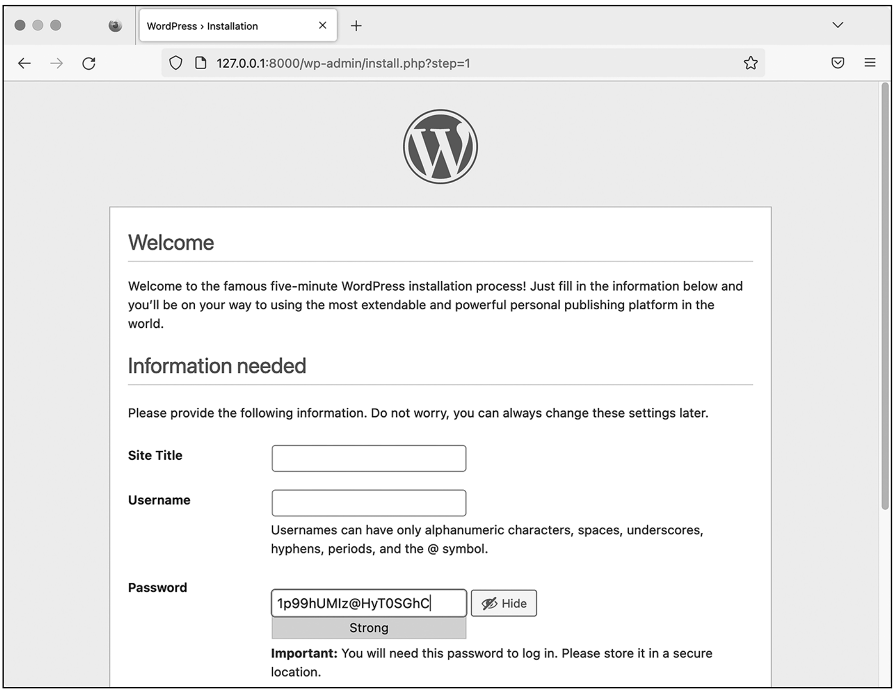

Figure 5-2: WordPress running in two containers, with Docker Compose

Fill out the form with your WordPress site's title, a username, and a password, and then explore your new WordPress site.

To open a shell and run commands in an active container with Docker Compose, you use the `docker-compose exec` *`container_name command`* syntax. For example, this is how you'd get a shell in the `wordpress` container:

```
docker-compose exec wordpress bash
```

While `docker-compose run` starts a new container, `docker-compose exec` runs a command in an active container—a little like opening a new terminal window inside a running container.

Exit the shell when you're done. Back in the terminal running `docker-compose up`, press CTRL-C to shut down the containers. Now you're ready to use your new Docker and Docker Compose skills to make your datasets searchable with Aleph.

Introducing Aleph

Truth cannot penetrate a closed mind. If all places in the universe are in the Aleph, then all stars, all lamps, all sources of light are in it, too.
—Jorge Luis Borges, "The Aleph"

The Organized Crime and Corruption Reporting Project (OCCRP), founded in 2006, has a history of publishing high-profile investigations into corruption, often leading to criminal investigations, arrests, and seizure of stolen funds. In partnership with dozens of newsrooms around the world, the group relies on large datasets for its investigations. For example, OCCRP, along with the International Consortium of Investigative Journalists (ICIJ), was part of a coalition investigating the Panama Papers, an offshore tax haven dataset that led to over 40 stories about corruption. One of those stories implicated a close friend of Vladimir Putin who had embezzled $230 million from Russian taxpayers. Because OCCRP deals with so much data, it developed Aleph as an investigation tool to make it easier to track white collar crime, follow the money, and cross-reference various datasets.

OCCRP runs an Aleph server available to the public at *https://data.occrp.org*. This server includes over 250 public datasets with documents from 139 different countries and territories. While there's some overlap with datasets published by DDoSecrets, most public datasets in OCCRP's Aleph server are different. Many of them are regularly updated datasets of public records: registries of company ownership around the world, lists of people and organizations facing international sanctions, and court records. These datasets might not seem exciting on their own, but when your investigation leads you to a specific person or company, they can be crucial for helping you fill in the gaps. OCCRP's Aleph server also contains many more private datasets, which are available to journalists who apply for access.

Take some time to check out OCCRP's Aleph server, explore which public datasets are available, and make some searches. For example, if you search for Rudy Giuliani (Donald Trump's confidant and lawyer, and the former mayor of New York City) and filter by the US Federal Courts Archive dataset, you'll find a series of court documents that reference Giuliani.

You can upload your own datasets to OCCRP's Aleph server only if OCCRP makes an account for you. Even if you do have an account, you won't be able to upload medium- or high-security datasets without sharing this data with a third party: OCCRP. That's why I help run a private Aleph server for The Intercept. You won't use OCCRP's public Aleph server further in this book. Instead, in Exercise 5-4, you'll run a small Aleph server and bring up Aleph containers on your own laptop.

Exercise 5-4: Run Aleph Locally in Linux Containers

This exercise prepares you to run your own server directly on your computer with Docker Compose. Instead of accessing Aleph at *https://data.occrp.org*, you'll bring up your Aleph containers and access your private server at *http://127.0.0.1:8080*. You'll use Docker Compose to run the many different services Aleph requires on your computer with a single command.

Make a new folder called *aleph* to use for this exercise and the next. Save a copy of *docker-compose.yml* and *aleph.env.tmpl* from Aleph's git repo, located at *https://github.com/alephdata/aleph/*, into the *aleph* folder.

The *docker-compose.yml* file describes the nine containers that Aleph requires and all of their configuration, including the volumes that will save the indexed versions of your datasets. One of these containers, called `shell`, includes a bind mount that maps your home folder (~) on your host filesystem to */host* in the container:

```
- "~:/host"
```

In your copy of *docker-compose.yml*, delete this line or comment it out by prepending a hash mark (`#`) to make Aleph run faster and avoid giving the container access to your home folder.

Now rename *aleph.env.tmpl* to *aleph.env*, and open that file in your text editor. This file contains the settings for your Aleph instance on different lines, in the format *`SETTING_NAME=setting_value`*, which you'll need to modify in a few ways.

First, run the following command to generate a random value for `ALEPH_SECRET_KEY` (Windows users, run this in your Ubuntu terminal):

```
openssl rand -hex 24
```

Since you're running Aleph on your computer instead of setting it up on a server for others to use, change `ALEPH_SINGLE_USER` in *aleph.env* to `true` instead of `false`, which allows you to use Aleph without having to create an admin user for yourself. Save the file.

Aleph relies on many different services to run, including three databases: PostgreSQL, Redis, and Elasticsearch. Elasticsearch is designed to search large amounts of data for text strings. For it to operate quickly, it needs to hold lots of data in memory. Linux's default memory management setting `vm.max_map_count` is far too low for Elasticsearch to work properly. If you're using Linux or Windows with WSL, run the following command to increase the value of `vm.max_map_count`:

```
sudo sysctl -w vm.max_map_count=262144
```

If you're using macOS, run **`sysctl -w vm.max_map_count=262144`** inside of your Linux VM managed by Docker Desktop. Then run the following command to start a shell directly in your Linux VM:

```
docker run -it --rm --privileged --pid=host alpine:edge nsenter -t 1 -m -u -n -i sh
```

Once you're in this shell, run this command:

```
sysctl -w vm.max_map_count=262144
```

Run **`exit`** to exit the Linux VM shell. Each time you restart Docker Desktop, this change is undone, so you'll need to run these commands again to continue using Elasticsearch. (Refer to the "Increasing Elasticsearch Memory in Docker Desktop" box to speed up this process in the future.)

INCREASING ELASTICSEARCH MEMORY IN DOCKER DESKTOP

If you're using macOS, you'll need to change settings before starting the Aleph containers. Instead of referring to this chapter to remember what commands to run, store them as the following shell script (which you can also find at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-5/aleph/fix-es-memory.sh*):

```
#!/bin/bash
docker run -it --rm --privileged --pid=host alpine:edge \
    nsenter -t 1 -m -u -n -i \
    sysctl -w vm.max_map_count=262144
```

Save a copy of this script in the same folder as your *docker-compose.yml* file for Aleph, and run **`chmod +x fix-es-memory.sh`** to make sure it's executable. You can now run the script before starting the Aleph containers with just these two commands:

```
./fix-es-memory.sh
docker-compose up
```

You'll need to run this script only once each time you restart Docker Desktop.

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Finally, for all operating systems, run the following command to start Aleph:

```
docker-compose up
```

The first time you run this command, you'll download a few gigabytes of container images. Text will scroll past in the terminal while Aleph boots up; wait for it to stop.

You also need to run an `upgrade` command the first time you use Aleph and whenever you upgrade your version of it. Once Aleph finishes booting, open a second terminal, change to the *exercises* folder, and run:

```
docker-compose run --rm shell aleph upgrade
```

This command initializes the databases that Aleph uses by running the command `aleph upgrade` inside the `shell` container. Wait for this command to completely finish; you'll know it's done when the program stops displaying output and you end up back at your terminal's command prompt.

NOTE *For more detailed documentation for Aleph, see* https://docs.alephdata.org.

Using Aleph's Web and CLI Interfaces

Now that you have a local Aleph server, you can explore its two different interfaces: the web interface, which you'll use to investigate datasets, and the CLI interface, which you'll use to index new datasets or administer your Aleph server.

With your Aleph containers up, open *http://127.0.0.1:8080/* in a browser to see the web interface. For example, Figure 5-3 shows Aleph running in Linux containers on my Mac.

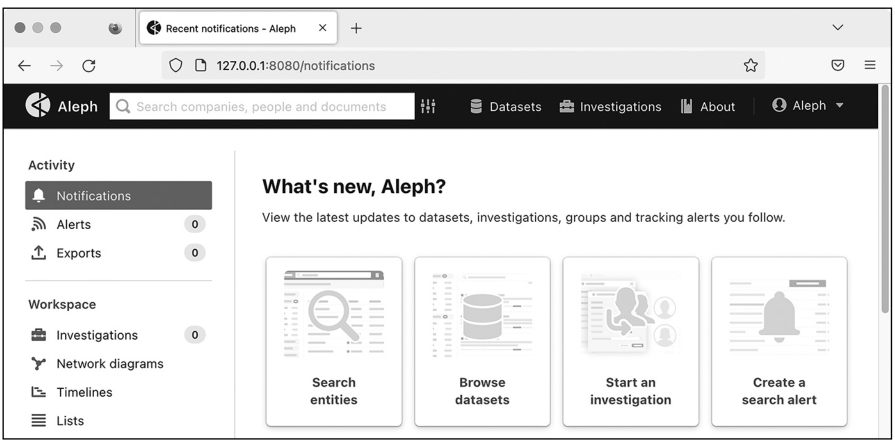

Figure 5-3: Aleph hosted in Docker containers

You'll use this interface to search data you upload into Aleph. The search bar at the top allows you to search every dataset you've indexed in your Aleph server at once, and the slider icon just to the right of the search box lets you perform advanced searches.

The Datasets and Investigations buttons at the top show you the datasets in Aleph; for now, both of those pages will be empty. In Aleph, datasets and investigations are both collections of documents, with different user interfaces for exploring each. A dataset should be static, while an investigation is a collection of documents that you might still be adding to.

After performing a search in Aleph, you can optionally save your search query as an alert. This feature is useful only on servers that have multiple users and are configured to send email. In those cases, the server automatically searches any new data indexed into the server for all of the user's saved alerts. If it gets a hit, it sends an email to the user. In the example, you set `ALEPH_SINGLE_USER` to `true`, so that feature doesn't apply.

In addition to the web-based user interface you just explored, designed for journalists and researchers, Aleph has a CLI interface designed for running the Aleph server itself. You must use the command line interface for administrative tasks like creating Aleph users (if you aren't using the `ALEPH_SINGLE_USER` setting in future projects) or indexing folders of data, which you'll do later in this chapter.

To use the CLI interface, run `bash` inside the container called `shell` to start an Aleph shell like so:

```
docker-compose run --rm shell bash
```

When you first opened a shell in a container using Docker Compose, you used `docker-compose exec`, which executes a command in an already running container. Here, `docker-compose run` runs a new container in which to execute your command. The `--rm` argument tells Docker to remove the container as soon as your command finishes running. In this case, your command is `bash`, so you can run `exit` in the bash shell to remove this temporary container.

You can now use the `aleph` command. Run **`aleph --help`** to see a list of all of the commands that Aleph supports. To learn more about a specific command, run `--help` on it. For example, to learn more about the `crawldir` command (which we'll discuss in Exercise 5-5), you'd run `aleph crawldir --help`.

Run **`exit`** to quit the Aleph shell. Back in your other terminal window, press CTRL-C to shut down all the Aleph containers when you're not using them. When you run `docker-compose up` to start the containers again, all the data in Aleph—including any datasets that you've added to it—will still be there, because that data is stored in Docker volumes, making it persistent.

Indexing Data in Aleph

Adding data to Aleph is called *indexing*. By loading and processing every file in a dataset, Aleph allows you to extract useful information, which you can browse and search via its web-based user interface.

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Indexing works differently for different types of files:

Office documents and PDFs Aleph extracts all of the searchable text from these documents and attempts to find anything that looks like a person's name, a company name, or other types of data that Aleph calls *entities*. It also extracts any metadata it can find.

Email messages Aleph again extracts searchable text and entities. This time, the entities it finds are likely to include both names and email addresses, which it determines by checking the sender and recipient of each email. It also extracts email attachments and indexes those individually.

Compressed files, such as ZIP files Aleph decompresses these files, then indexes each file inside them individually, which can become as recursive as necessary. For example, a ZIP file might contain an email file with an attachment that contains another ZIP file, and so on.

Indexing datasets can take hours, days, or weeks, depending on the size of the dataset and the computational resources available to your Aleph server. In Exercise 5-5, you'll index a single BlueLeaks folder called *icefishx*.

Exercise 5-5: Index a BlueLeaks Folder in Aleph

The *icefishx* folder contains data from an American police intelligence network called Intelligence Communications Enterprise for Information Sharing and Exchange (ICEFISHX), a partnership between law enforcement in Minnesota, North Dakota, and South Dakota. I've selected this data because it covers the state where Minneapolis cop Derek Chauvin murdered George Floyd, sparking the 2020 Black Lives Matter uprising. Searching this dataset for *George Floyd* might reveal some interesting internal docs about police violence or the protests that it triggered.

Mount Your Datasets into the Aleph Shell

If you don't already have Aleph running, change to your *aleph* folder and enter the following command:

```
docker-compose up
```

Wait for Aleph to boot up.

In a separate terminal, start an Aleph shell. This time, however, bind-mount your *datasets* USB disk into the container, using the following command, substituting the correct path for your USB disk:

```
docker-compose run --rm -v /Volumes/datasets:/datasets:ro shell bash
```

The arguments in this command are similar to the `--mount` argument you used earlier to mount a volume with the `docker` command. The `-v` argument (short for `--volume`) is followed by the colon-separated list */Volumes/*

`datasets:/datasets:ro` containing three parts: the absolute path to the folder on the host operating system (on my computer, this is */Volumes/datasets*), the absolute path to the folder in the container (*/datasets*), and the `ro` option. Short for read-only, `ro` gives the container permission to access the files in the bind mount but not to change any of them or create new files.

When you run this command, make sure to use the correct path for your USB disk. In macOS, the path is */Volumes/datasets* or similar; in Linux, it's */media/micah/datasets* or similar; and in Windows with WSL, it's */mnt/d* or similar. If you're using Windows with PowerShell, mount the *D:* drive into the container at the path */datasets* with this command:

```
docker-compose run --rm -v D:/datasets:ro shell bash
```

Altogether, this command runs a new `shell` container and executes the `bash` command inside of it. Your *datasets* folder on your host operating system becomes accessible as the folder */datasets* in the container, and it's mounted in read-only mode, preventing the container from modifying anything on the USB disk.

Now that you have access to your datasets within the Aleph shell, you'll index the *icefishx* data.

Index the icefishx Folder

To index a dataset, you use the `aleph crawldir` command. Aleph's use of the term *crawl* means to open the folder and index each file in it, then open each subfolder it finds and index each file in that, and so on, until everything in the original folder has been indexed.

Run the following command to start indexing the *icefishx* folder:

```
aleph crawldir -l eng /datasets/BlueLeaks-extracted/icefishx
```

This command tells Aleph to index data in the */datasets/BlueLeaks-extracted/icefishx* folder in the container (which is actually */Volumes/datasets/BlueLeaks-extracted/icefishx* on my host operating system). The `-l` option (short for `--language`) helps you to use OCR on documents. Because different languages use different alphabets and words, using `-l` tells the OCR software what language you're dealing with—in this case, English (`eng`).

Aleph should begin to work its way through each of the 19,992 files in the *icefishx* folder, totaling over 2GB. The output should display the filename of each file, which is added to a list of files to crawl. Even before the `aleph crawldir` command finishes, Aleph begins to index each file.

Switch to your other terminal window running Docker Compose and watch the output as it indexes and performs OCR on each file.

NOTE *You can use OCR for documents in languages other than English, too. To index a Russian dataset, for example, you'd use* `-l rus` *so that Aleph recognizes Russian words in the Cyrillic alphabet. Under the hood, Aleph uses software called Tesseract to do the OCR; for a list of valid language codes in Tesseract's documentation, see* https://tesseract-ocr.github.io/tessdoc/Data-Files-in-different-versions.html.

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The *icefishx* folder took about an hour and a half to index on my Mac. It also used about 17GB worth of Docker volumes. Indexing larger quantities of data could take days and require much more disk space.

Check Indexing Status

After `aleph crawldir` has finished running, while you're waiting for the indexing to complete, try a few more Aleph commands to query your Aleph server and check the indexing status.

First, run the following command to see a list of all of the datasets and investigations (known together as *collections*) in your Aleph server:

```
root@26430936533f:/aleph# aleph collections
Foreign ID                                              ID  Label
---------------------------------------------  ----  ------------------
28c82cbe1ba247e6a16e3fb4b7d50a67                       1  Test Investigation
directory:datasets-blueleaks-extracted-icefishx        2  icefishx
```

The `Foreign ID` field is the unique identifier for each dataset, and the `Label` field is the human-readable name for the dataset displayed in the Aleph web application. I used the Aleph web interface to create a new investigation called Test Investigation before I started indexing ICEFISHX, so I have two collections. When you use the web interface to make investigations, they get assigned completely random foreign IDs. When you use `aleph crawldir` to create them, the `Foreign ID` is based on the filesystem path that you're indexing; alternatively, you can use the `-f` *`foreign_id`* arguments to specify your own if you like.

Next, run the following command while indexing ICEFISHX to check the status of the indexing:

```
root@26430936533f:/aleph# aleph status
  Collection  Job                               Stage     Pending    Running    Finished
------------  --------------------------------  -------  ---------  ---------  ----------
           2                                                 19263          4        3387
           2  a4bb59c4e23b4b96b14d747ff78c69e2  ingest       19239          3        1145
           2  a4bb59c4e23b4b96b14d747ff78c69e2  analyze         24          1        1123
           2  a4bb59c4e23b4b96b14d747ff78c69e2  index            0          0        1119
```

This command displays a table of data that tells you the number of pending, running, and finished tasks for each collection that's indexing, split into `analyze`, `ingest`, and `index` phases. The `Collection` column shows the ID of the collection—if you look back at the output of `aleph collections`, the ID of the ICEFISHX dataset is `2`. When I ran `aleph status`, based on the total pending and finished numbers, indexing was roughly 15 percent complete (though this might be misleading; for example, one of those pending files could be a ZIP file containing another 1,000 files).

If Aleph breaks in the middle of indexing a dataset, you can recover your progress. If you're seeing a lot of error messages in the Docker Compose logs or in the Aleph web interface, the simplest solution is to restart the

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containers. In your Docker Compose terminal window, you'd press CTRL-C to quit all of the containers, and then run `docker-compose up` to start them again. After a few minutes, your containers should finish booting and the indexing should commence where it left off. If something failed before your `aleph crawldir` command finished running in the Aleph shell, you can run `aleph crawldir` again. This will reindex the entire dataset, but it should be quicker the second time around, because it won't redo time-consuming tasks like performing OCR on documents that have already been processed.

You can also check the indexing status via the Aleph web interface. In your browser, navigate to the Investigations page. From there, click the ICEFISHX investigation, and you should see a progress bar showing you how the indexing is doing. Figure 5-4 shows the indexing status from inside the web application.

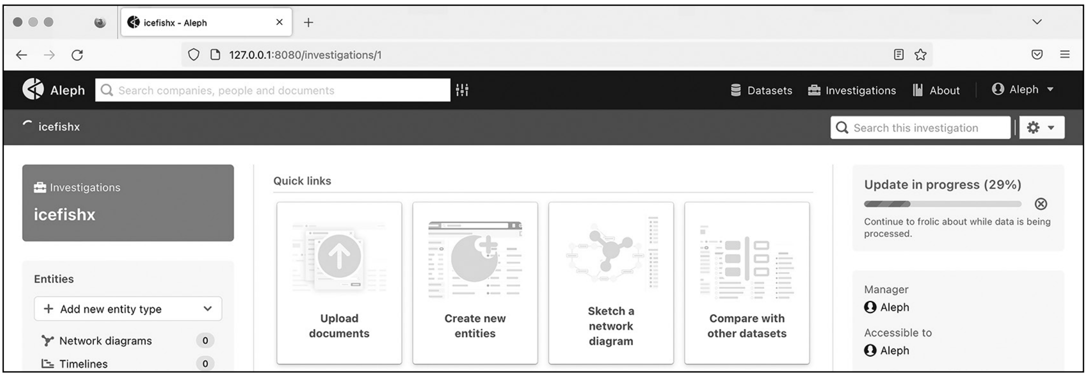

Figure 5-4: The ICEFISHX dataset in the process of indexing

While you're here, click the gear icon in the top-right corner of the screen and go to **Settings**. From there you can change the label, category, and summary of this dataset. For example, you can change the label from icefishx to something more descriptive, like *BlueLeaks: Intelligence Communications Enterprise For Information Sharing and Exchange (ICEFISHX)*. The default category is Investigations. If you change it to anything else, like Leaks, Court Archives, or Other Material, ICEFISHX will appear under Datasets instead of Investigations. For now, stick with the Investigations category.

Sit back and wait for Aleph to finish indexing the ICEFISHX dataset before moving on to the next section, where you'll begin to use Aleph to explore the data.

NOTE *It's possible to start looking through datasets in Aleph before indexing is complete, but it's best to wait for the full index to finish before digging too deep. If you don't, you'll search only the data that's been indexed to that point, so your searches might miss important documents.*

Explore BlueLeaks with Aleph

Once you've finished indexing the *icefishx* folder, navigate to the ICEFISHX dataset you've just imported in the Aleph web interface. It should be listed under the Investigations link at the top of the page. The Documents link in the left sidebar lets you manually browse the files in the dataset and open various documents, but where Aleph really shines is its search engine.

When you enter a term in the search field, Aleph searches every dataset you've imported. You can filter your results in a variety of ways, using the left sidebar: for example, you can filter to a specific dataset, a specific date range, or even to documents that mention specific email addresses, phone numbers, or names. Once you've filtered the search results, you can click on documents to preview them.

Figure 5-5 shows some of the 335 search results for the term *George Floyd* in the ICEFISHX dataset.

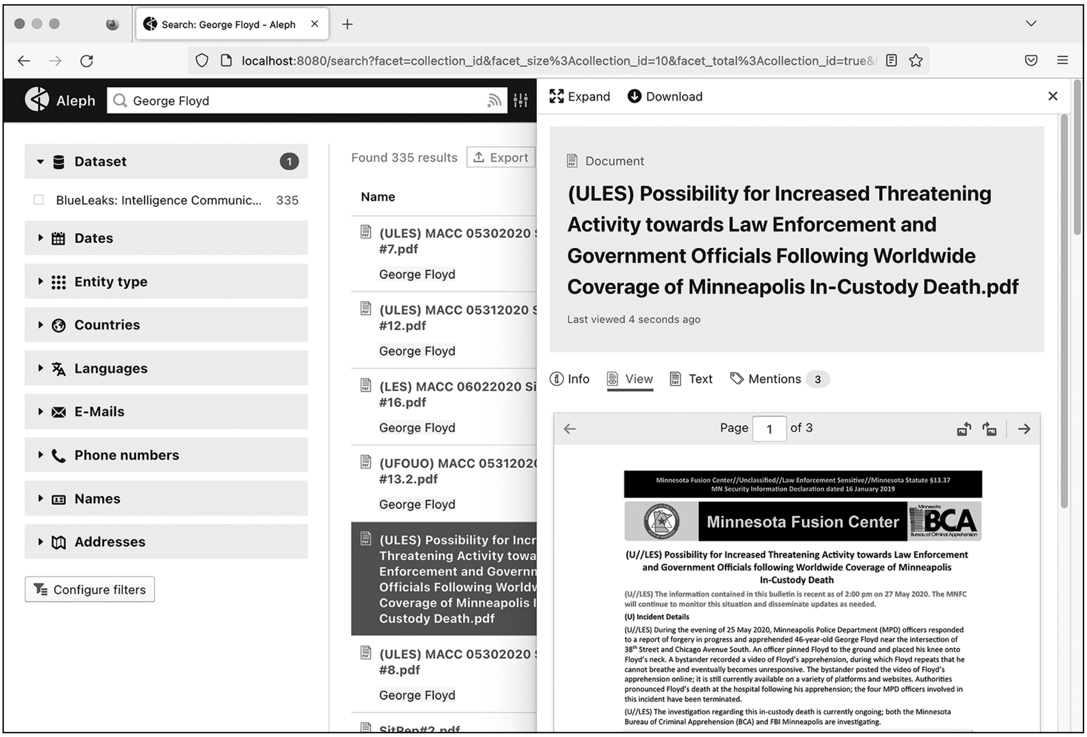

Figure 5-5: Aleph's search interface with results returned for George Floyd

The document selected in Figure 5-5, classified as U//LES (Unclassified, Law Enforcement Sensitive), was created by the Minnesota Fusion Center on May 27, 2020. It warns of an increase in threatening activity toward law enforcement officers in response to George Floyd's murder in police custody two days earlier. According to the document, two of the four officers involved had been doxed, and people protested outside one

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of their homes. Thousands of people began marching in the streets, and there were "increased discussions on White Supremacist Extremist (WSE) online forums." The document recommends that police "avoid wearing organizationally-affiliated clothing outside of work settings," "reduce social media footprint and use an alias," and consider "varying travel patterns to avoid surveillance."

Aleph makes it easy to find connections between documents. If you click Expand in the top left of the selected document, you should end up at that document's detail page. This page shows the document's metadata on the left, as well as any names or email addresses it finds that are also mentioned in other documents. If you click on one of those—for example, on someone's name or email—you should be taken to search results that list all of the documents mentioning that person.

When you're done exploring *icefishx*, try indexing additional folders in BlueLeaks or even the entire *BlueLeaks-extracted* folder.

Additional Aleph Features

There's a lot more to Aleph than what we've covered so far. This section will introduce a few of the other cool things it can do, which you'll find useful in the future as you continue to analyze hacked and leaked datasets.
As you've seen, Aleph is great at indexing folders full of a wide variety of documents, but it also supports importing *structured data*—data that follows a consistent and well-defined data model. Entities in Aleph, which I mentioned earlier, are an example of structured data. Specifically, Aleph uses a data model called FollowTheMoney, which contains types of entities like Person, Company, Organization, or Address. Learn more about the FollowTheMoney data model, and how to import these entities directly into Aleph, at *https://followthemoney.tech/*.

When you index a dataset in Aleph, it automatically extracts its best guess at entities—data like the names of people and companies, and phone numbers and addresses—but its guesses are far from perfect. Aleph also allows you to manually create and edit entities in more detail. You can add a list of people to an investigation, for example, providing not just their names but also their contact information and any relationships they have to other entities like their employers. When you're viewing an entity in Aleph's web interface, it shows you all of the data about that entity and links to all of its related entities.

You can also generate entities from data in spreadsheets like CSV or Excel files. For example, the ICEFISHX dataset has a spreadsheet called *Registrations.csv* that lists the name, rank, agency, home address, email address, phone number, supervisor, and other information about all 6,000 people who had accounts on the site. From the detail page of this file in the Aleph web interface, you can click Generate Entities to define exactly how this data should map to entities, and even how these entities should relate to other entities. This could help you build an organization chart of who reports to whom, for example.

In addition to the `aleph crawldir` command you used in Exercise 5-5, there are other ways to index data into Aleph. First, you can use a different CLI program called `alephclient`, which allows you to index data and push it into a remote Aleph server over the internet using Aleph's *application programming interface (API)*, without opening an Aleph shell. APIs are designed to allow software, rather than humans, to communicate. Every user on an Aleph server (or, if it's a server with users disabled, the whole server) has an API secret access key, a credential that allows software to add data to, or otherwise interact with, the Aleph server. You can pass this API key into `alephclient` as an argument to index large datasets on an Aleph server that someone else runs. The command to install `alephclient` is `python3 -m pip install alephclient`.

Alternatively, you can create a new investigation directly in the web interface by clicking Investigations at the top, then New Investigation. You'll be prompted to give your investigation a title and an optional summary and language. You can upload files to your investigation directly from your web browser. This is useful if you want to upload a spreadsheet of names and email address and cross-reference it with the rest of the data in your Aleph server. For uploading big datasets like BlueLeaks, however, using the Aleph shell or `alephclient` is easier and less error-prone.

One of Aleph's most powerful features is its ability to search multiple datasets at once. For example, you could index the BlueLeaks dataset, the Oath Keepers dataset you downloaded in Chapter 4, and several others to search them all for someone's name, email address, or phone number. Since the BlueLeaks dataset is full of PII of law enforcement officers and the Oath Keepers militia is known to recruit retired police, you could check if any Oath Keepers members or donors are mentioned in BlueLeaks. (I recommend waiting to try this until you further explore the Oath Keepers dataset in Chapter 6.)

Aleph can also cross-reference the entities from one dataset with entities in all of the other datasets that have been indexed in a server. Navigating to an investigation and clicking Cross-Reference in the left sidebar allows you to compare each entity in the investigation with entities in every other dataset or investigation. For example, you could upload a spreadsheet of people you're investigating—say, everyone who works at the White House—into an investigation, use the Generate Entities feature to convert it into a detailed list of Person entities, and then cross-reference this list with all of the other datasets you've indexed to see if any White House employees show up in them.

Spend some time experimenting with Aleph and getting to know its features on your own. When DDoSecrets publishes a dataset that you're interested in, try downloading it and indexing it in Aleph. Explore searching multiple datasets at once as well as using the cross-referencing feature. Aleph's documentation is available at *https://docs.alephdata.org*.

Dedicated Aleph Servers

Running Aleph in containers on your computer works well if you want to search just a few small datasets yourself. However, to index a large amount of data (such as all of BlueLeaks) that will stretch your laptop's computational resources, or to work with others on the same datasets, consider setting up a dedicated Aleph server instead. Full instructions on doing that are outside the scope of this book, but this section provides an introduction.

In Chapter 4, you learned how to create servers in the cloud; earlier in this chapter, you learned how to set up your own Aleph server. By combining those skills, you should be able to set up Aleph running in Docker containers on a cloud server. However, you'll also need to decide how to secure the server and make sure it stays updated. How will you manage its users, and how will you restrict access to the server? How will you know and what will you do if someone hacks it? To run an Aleph server for your organization, I recommend that you bring in a professional system administrator or DevOps engineer to set it up and maintain it over time.

As you set up your server, consider the security levels of the datasets on which you plan to use Aleph. For low- to medium-security datasets, you can host Aleph in a cloud server, which allows you to temporarily give your server more RAM or processing power to index a dataset more quickly. For medium- to high-security datasets, host Aleph on physical hardware, like a server in an office or in a server closet in a data center. Decide whether to require people to come into the office to use Aleph or to configure it so that they can access it over the internet. If you choose the latter, you'll need to secure your Aleph server and the data it contains. For the highest-security datasets, you'll have to download Linux containers on a computer with internet access, export the datasets, and import them on an air-gapped server.

INTELLA AND DATASHARE

You can also use software besides Aleph to help you make datasets searchable. As mentioned in Chapter 1, the first leaked dataset I worked on was the Snowden Archive. At that time, Aleph didn't exist. To index and search the Snowden Archive, we used proprietary software called Intella, installed on air-gapped Windows laptops. Intella, developed by Vound Software, is investigation software that was designed for law firms and law enforcement to explore large datasets, like email dumps or the contents of seized computers.

The Intercept used to have a license for Intella Connect, a web-based version of Intella. This software has a few advantages over Aleph: it rarely has technical issues, it comes with tech support, and it allows you to index and search large datasets faster. Like Aleph, Intella Connect supports collaborating with multiple users. After Russia invaded Ukraine in 2022 and hackers started

(continued)

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dumping terabytes of data from Russian companies online, I began downloading and indexing all of these datasets into Intella Connect. I quickly found that this project was far too complicated for The Intercept alone to handle, especially considering that all of the data was in Russian. I helped spearhead a project to invite outside journalists who spoke Russian or were interested in these datasets to use our Intella service. This project grew into a major international collaboration with OCCRP and dozens of reporters around the world, including both Russian and Ukrainian journalists, to research the Russian datasets. The project's collaborators used both Intella Connect and OCCRP's Aleph server, and we organized our findings on an internal wiki.

The Intercept has now decided to stop paying for Intella Connect and uses Aleph exclusively instead. Intella has some disadvantages: it doesn't have Aleph's ability to cross-reference between datasets and map out relationships between entities, it's quite expensive, and it requires Windows.

Another open source tool for indexing datasets is Datashare, developed by ICIJ, the group that worked in a coalition on the Panama Papers dataset along with OCCRP. Datashare is similar to Aleph but is designed for a single user to run it locally on their computer, rather than on a server. Like Aleph, Datashare runs inside of Docker containers. While it's a very promising project, I ran into issues trying to install it at the time of writing. Because it's open source and actively developed, however, I expect this will improve over time. You can read more about Datashare at *https://datashare.icij.org* and *https://github.com/ICIJ/datashare*.

Summary

In this chapter, you've learned how to run software in Linux containers using Docker, then applied those skills to run Aleph on your computer and index the *icefishx* folder from BlueLeaks, making it searchable. A search for the keyword *George Floyd* uncovered interesting law enforcement documents about the 2020 racial justice protests that you couldn't have uncovered with just `grep`. You've also learned about some Aleph features you can explore on your own, the possibility of running a dedicated Aleph server instead of running it on your laptop, and dataset-indexing tools other than Aleph.

You'll revisit Docker in Chapter 10, when you learn to use BlueLeaks Explorer, and in Chapter 12, when you learn about SQL databases. In the following chapter, you'll learn the tools and techniques required to dig through one of the most prevalent forms of data leaks: email dumps.

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6

READING OTHER PEOPLE'S EMAIL

After Russia invaded Ukraine in February 2022, hackers started flooding DDoSecrets with stolen data from Russian organizations. The data came in many formats, but the bulk of it—several terabytes' worth—was email. The entire inboxes of government agencies, oil and gas companies, and investment firms were laid bare.

Email leaks are among the most common types of data leaks, and they can have serious consequences. In the 2016 US presidential election between Hillary Clinton and Donald Trump, leaked email messages from the DNC and Clinton campaign chair John Podesta—both hacked by the Russian government—played a major role in Trump's election. The 2020 US presidential election between Trump and Joe Biden also involved email leaks, in this case stolen from the laptop of Biden's son Hunter.

With so many messages to sort through in email leaks, though, finding a place to start can be overwhelming. Depending on how the email was obtained and what software was running on the hacked server, the leaked data could be in any of several different formats, and it may not be clear how to access the messages it contains.

In this chapter, you'll learn about common formats for leaked email, the benefits and shortcomings of indexing and searching email with Aleph, and how to import email datasets into Thunderbird and Microsoft Outlook. You'll sift through leaked email from the Oath Keepers dataset you downloaded in Chapter 4, in addition to datasets from Australian offshore detention centers and the conservative US think tank the Heritage Foundation. We'll begin by taking a look at the standard composition of an email message.

The Email Protocol and Message Structure

A *protocol* is a shared language that software developers agree upon to make their code interoperate. The email protocol we use today was first implemented in the early 1980s, got a major revamp in 1995, and hasn't changed much since. Unlike modern centralized messaging systems (Facebook Messenger, for example), this protocol allows anyone to run an email server with their own software. For example, Google runs a server at gmail.com, the Russian search engine Yandex runs one at mail.yandex.com, and the Swiss company Proton runs one at proton.me. These servers are powered by different software but communicate using the same protocol, meaning they can all send messages to one another. *Internet standards*, specifications for how certain types of software should behave, ensure that all email software communicates with a shared protocol and a shared message format.

Because the email message format is an internet standard, all messages have a similar structure. To see what this format looks like, open any email and choose **Show Original** or **View Source**. Each message is a text file with two sections: the headers and body. The headers contain an email's metadata in `Header-Field: Value` format, while the body contains the main text of the message.

The following headers are included in nearly every email message:

```
Subject: What's up?
From: Alice <alice@example.com>
To: Bob <bob@example.com>
```

There are many more headers than these; your email software shows only a few of them. When email servers send, forward, or receive messages, they add headers describing these actions. For example, the common header `DKIM-Signature` allows you to verify, using cryptography, that an email actually came from the server that it claims sent it. Messages also typically include a `Content-Type` header, which describes the format of the body text.

After the headers, the email includes a blank line followed by the body. The body is typically in plaintext (text with no formatting), HTML, or Multipurpose Internet Mail Extensions (MIME) format. In MIME email, the most common format, the body is split into parts for text, HTML components, and email attachments.

Though email messages are text files, you can send binary files like PNGs or ZIPs as attachments. Your email client converts the binary file into text using *Base64* encoding and includes that encoded attachment in the message. Just as you can convert any decimal number (that is, one conveyed using 10 digits) into a binary number (conveyed using 2 digits) and back, you can convert any binary data into Base64 data (conveyed using 64 characters). For example, here's how a PNG image containing a 1×1 transparent pixel looks with each of its 86 bytes of data represented as binary digits:


```
10001001 01010000 01001110 01000111 00001101 00001010 00011010 00001010 00000000 00000000
00000000 00001101 01001001 01001000 01000100 01010010 00000000 00000000 00000000 00000001
00000000 00000000 00000000 00000001 00001000 00000110 00000000 00000000 00000000 00011111
00010101 11000100 10001001 00000000 00000000 00000000 00000110 01100010 01001011 01000111
01000100 00000000 11111111 00000000 11111111 00000000 11111111 10100000 10111101 10100111
10010011 00000000 00000000 00000000 00001011 01001001 01000100 01000001 01010100 00001000
11010111 01100011 01100000 00000000 00000010 00000000 00000000 00000101 00000000 00000001
11100010 00100110 00000101 10011011 00000000 00000000 00000000 00000000 01001001 01000101
01001110 01000100 10101110 01000010 01100000 10000010
```


And here's the Base64-encoded version of the same binary file:


```
iVBORw0KGgoAAAANSUhEUgAAAAEAAAABCAYAAAAfFcSJAAAABmJLR0QA/wD/AP+gvaeTAAAAC0lE
QVQI12NgAAIAAAUAAeImBZsAAAAASUVORK5CYII=
```


Base64-encoded data looks like a block of seemingly random text that includes capital letters, lowercase letters, numbers, plus signs (`+`), and forward slashes (`/`), and sometimes ends with equal signs (`=`). The Base64-encoded version of some data conveys the same information as the decoded version, but it can be included more compactly in a text file, like an email. When the recipient of the email loads it, their email client will convert it from Base64 text back into a binary file. Sometimes plaintext or HTML email is encoded in Base64 as well (for example, `hello world` is `aGVsbG8gd29ybGQ=` in Base64). Although email messages are text files, you can't rely on grep to search them, because much of the content you're hunting for might be Base64-encoded.

Keeping in mind those basics, let's turn now to the specific formats typically encountered in email leaks.

File Formats for Email Dumps

The most common file formats for email *dumps*, or collections of email messages, are EML files, MBOX files, and PST Outlook data files. You'll download email in each format in the upcoming exercise.

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EML Files

The simplest type of email dump is a folder full of EML files, the standard email message format. An EML file is a text file with the extension *.eml* that contains the raw email message—the headers followed by the body.

When you download an email from your personal account, it will be in EML format. If you have a Gmail account, for example, open a message, click the **More** menu (the three dots icon) in the upper-right corner, and choose **Download Message**. Other email clients should likewise allow you to download individual messages in EML format. You can sometimes read an EML file in a text editor, but you'll frequently be stymied by the Base64-encoded parts, so it's more useful to open it in an email program like Thunderbird, Outlook, or the Mail app on macOS.

You can forward an email inline or as an attachment. Most email systems default to forwarding inline, copying the text of the body of the email you're forwarding into the body of the email you're writing. When you instead forward as an attachment, you attach the raw EML file to the email you're writing. From a Gmail inbox, for example, select the box next to an email message, click the **More** menu, and choose **Forward as Attachment**. Other email clients should allow you to forward email as attachments as well. EML files include information that isn't included in inline forwarded email, such as the original email headers.

EML files don't include information on how the email was organized in the user's inbox, such as the folder where the email was stored. For this reason, people who leak email dumps in EML format often organize the files into folders, with each folder representing a different user's inbox. Sometimes they organize the files from each inbox into subfolders, too.

In Exercise 6-1, you'll download email messages in EML format from the Nauru Police Force dataset.

MBOX Files

In an MBOX email dump, each file is a collection of many email messages, generally representing a full folder of email. MBOX files often have the file extension *.mbox*, but sometimes they have no file extension at all.

Like EML files, MBOX files are text files that are viewable in a text editor but not very human-readable because of the Base64 encoding. However, you can't just open an MBOX file in an email client to read the email like you can with an EML file. Instead, you'll need to import the file.

The Oath Keepers dataset is a series of MBOX files, one for each hacked inbox. I'll give more detail on the structure of this dataset in Exercise 6-1.

PST Outlook Data Files

Email dumps may also come in the form of PST files, a proprietary format that represents a Microsoft Outlook inbox with the *.pst* file extension. Microsoft's email server is called Microsoft Exchange. Whenever an

Outlook user wants to create a backup of their email, or when an Exchange server is hacked, the data is downloaded in PST format.

A PST file represents a full email inbox, complete with a hierarchy of folders and their contents. These files can get *big*. For example, in April 2022 hackers made off with 786GB of data from the All-Russia State Television and Broadcasting Company (VGTRK), the largest state-owned media company in Russia, and leaked it to DDoSecrets. This dataset includes 252 PST files, each representing a different email address. One file, *intercoord@vgtrk.ru.pst*, is 48GB alone.

In Exercise 6-1 you'll download a 1GB PST file containing email from the Heritage Foundation.

Exercise 6-1: Download Email Dumps from Three Datasets

In this exercise, you'll work with three different datasets from the Nauru Police Force, the Oath Keepers, and the Heritage Foundation. You should already have the Oath Keepers dataset from Chapter 4, so you'll download the other two next. You'll also learn more about their contents and structure.

The Nauru Police Force Dataset

Nauru is a tiny island in the Pacific with a population of about 10,000. While technically it's an independent country, it hosts abuse-ridden offshore detention centers that the Australian government uses to hold immigrants and asylum seekers. The Nauru Police Force dataset (*https://ddosecrets.com/wiki/Nauru_Police_Force*) is a 54GB torrent full of 127 ZIP files, each a copy of all of the email from a specific email address at npf.gov.nr, the domain for the Nauru Police Force. Inside each ZIP file is a collection of folders containing EML files. This dataset contains over 285,000 messages.

For this chapter, you'll be working with the file *iven-notte.zip*, which is about 2.9GB. Download the file directly from *https://data.ddosecrets.com/Nauru%20Police%20Force/npf.gov.nr/iven-notte.zip. Once you've done so,* save it into a folder called *Nauru Police Force* on your *datasets* USB disk and unzip it. You should end up with a folder called *iven-notte containing the* subfolders *calendar*, *contacts*, *deleteditems*, *drafts*, *inbox*, and more. Each of these subfolders is full of EML files.

The Oath Keepers Dataset

The public part of the Oath Keepers dataset is a 3.9GB torrent of MBOX files taken from the server that hosted email for the oathkeepers.org domain. This dataset has a folder called *Oath Keepers.sbd*, containing subfolders called *ak*, *al*, *alb*, *ar*, *Archive*, *az*, and many others, each of which is an MBOX file (without the *.mbox* file extension) that contains several email messages. Each US state chapter of the Oath Keepers militia has its own inbox, so, for example, you can find the Arizona chapter's email in the MBOX file *az*. There are a few other MBOX files, including *volunteers* and *stewart.rhodes* (Stewart Rhodes is the founder of the militia, and was convicted of seditious conspiracy and sentenced to 18 years in prison for his group's role in the January 6, 2021, attack on the US Capitol). DDoSecrets distributes an additional part of the dataset, which contains donor and membership records, only to journalists and researchers who request access, because it contains so much PII.

If you didn't already download the Oath Keepers dataset in Chapter 4, visit the DDoSecrets page for the Oath Keepers at *https://ddosecrets.com/wiki/Oath_Keepers*. This page includes a link to the torrent file as well as the magnet link. Add the torrent to your BitTorrent client and download the full dataset, saving it to your *datasets* USB disk.

The Heritage Foundation Dataset

The Heritage Foundation is a conservative think tank that played a major role in US politics during the Reagan administration. This dataset, a 1GB file called *backup.pst*, is a backup of a personal email account used by an employee on the foundation's major gifts team. His email address was hosted with his residential ISP at the domain *embarqmail.com*. In 2015, the Twitter user @jfuller290 noticed that the foundation had accidentally put this backup in PST format on a public Amazon S3 bucket—an Amazon cloud service that hosts files—and he tweeted the link to it. (The Heritage Foundation at first claimed that it was hacked, but in fact it had inadvertently made the file public itself.) The email backup was made in 2009, six years before @jfuller290 noticed it.

Visit the DDoSecrets page for the Heritage Foundation at *https://ddosecrets.com/wiki/Heritage_Foundation*. This page includes links to the torrent as well as a direct download for this dataset. Because the dataset is just a single, relatively small Outlook Data File, directly download it from *https://data.ddosecrets.com/Heritage%20Foundation/backup.pst* and save it into a folder called *Heritage Foundation* on your *datasets* USB disk.

While you're waiting for these email dumps to finish downloading, read on to learn about the tools you can use to research them.

Researching Email Dumps with Thunderbird

Before you start reading the email you've downloaded, you'll install and configure *Thunderbird, an open source email program for Windows, macOS, and Linux* that allows you to work with email dumps in different formats. You can use Thunderbird to import folders full of EML or MBOX files and search and read everything inside them. When you open an EML file in Thunderbird, the program will parse the file, Base64-decode everything for you, and let you see HTML email and download attachments.

Thunderbird users typically use the program just to check their personal email, sometimes for multiple email accounts. If you want, you can add your existing email accounts to it and use it to read and write email

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yourself. For research purposes, though, you'll use Thunderbird to import email into *local folders*, which will allow you to work with the email locally on your computer without connecting to an email server. You don't need internet access when using Thunderbird to research email dumps in this way, which means you can use an air-gapped computer.

Like its sister project, the Firefox web browser, Thunderbird supports third-party extensions that add functionality to the program. The ImportExportTools NG extension is crucial to working with email dumps; it adds support for importing MBOX files and for bulk-importing folders full of EML files, keeping their folder structure intact. However, to import PSTs into Thunderbird, you must first convert them into EMLs using the `readpst` program. You'll import all three file types into Thunderbird later in the chapter.

After importing email dumps into Thunderbird, you can click through all of the folders and read the email messages as if you were reading your own email. You can also use Thunderbird's built-in search feature to bulk-search all of the email you've imported. However, you can't use Thunderbird to search the content of attachments—for that, you'll need a tool like Aleph, which we'll discuss in "Other Tools for Researching Email Dumps" on page XX.

Exercise 6-2: Configure Thunderbird for Email Dumps

In this exercise, you'll install Thunderbird and configure it in order to analyze the three email dumps you've downloaded.

Download Thunderbird from *https://www.thunderbird.net* and install it on your computer. When you open the program the first time, it asks if you want to set up an existing email account. While you won't need to use a real email account to research email dumps, adding an account to Thunderbird makes it easier to import these data dumps later on. If you don't want to use Thunderbird to check your real email, I recommend that you create a new email account just for this purpose. Click the **Get a New Email Address** link to create a new free email account directly within Thunderbird on an email provider called Mailfence. Select an email address and generate a random password in your password manager, then provide an existing email address to activate your new account. After creating your account, log in to it with Thunderbird, and you should see the message "Account successfully created."

Next, switch to the main Thunderbird tab. In the Folders sidebar on the left, you should see the email address you added, and beneath it a section called Local Folders. You added an email address just to create the Local Folders section, so if you don't plan on using Thunderbird to check this email account, you can delete it. To do so, click the menu icon in the top-right corner and choose **Account Settings**. Make sure your new email account is selected, click **Account Actions** in the bottom left, and choose **Remove Account**. Select the **Remove Message Data** box and click **Remove**.

Now switch back to the main Thunderbird window, and only Local Folders should remain in the left sidebar.

Next, to install the ImportExportTools NG Thunderbird add-on, click the menu icon in the top-right corner and choose **Add-ons and Themes**. Switch to the **Extensions** tab, search for **ImportExportTools NG**, and install the add-on. A lot of this add-on's functionality appears in the Tools menu bar at the top, which appears automatically in macOS. To access it in Windows or Linux, click the menu icon in the top-right corner and choose **View ▸ Toolbars ▸ Menu Bar**. A menu bar should appear at the top of the Thunderbird window. Go to **Tools ▸ ImportExportTools NG** to access the add-on's features.

Finally, click the Thunderbird menu icon and choose **Settings**. Switch to the **Privacy & Security** tab and make sure that Allow Remote Content in Messages is unchecked (it should be unchecked by default). *Remote content* is any content hosted on the internet instead of inside of the email, like images loaded from URLs. When you open an email with remote content, like an HTML email with images, loading those images will leave a trace that the email was opened from a certain IP address.

NOTE *Thunderbird will always give you the chance to load remote content on individual email messages if you'd like, but I recommend that you connect to a VPN beforehand so that the VPN's IP address, rather than your IP address, will be tracked (see the* *"Covering Your Tracks with a VPN Service" box in Chapter 9).*

Reading Individual EML Files with Thunderbird

During your own investigations, you may find only a few EML files in a dataset, or someone might forward email messages to you as attachments. Thunderbird is a good tool for inspecting these messages individually without needing to import them.

Once your downloads from Exercise 6-1 have finished, try using Thunderbird to view some individual messages. Open your file manager app, like Explorer in Windows or Finder in macOS, and browse to the extracted *iven-notte* folder in the Nauru Police Force dataset. Open the *inbox* folder, right-click one of the EML files, and open it in Thunderbird. Thunderbird should show you the headers, like the date the email was sent, and the From, To, and Subject lines. You can also read the email exactly as it was originally formatted, and if it has attachments, you can open them.

Just as you shouldn't blindly open attachments you receive in your personal email, don't blindly open attachments that you find in email dumps, because they could hack your computer. Refer back to Chapter 1 for tips on how to open such documents safely.

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EXTRACTING ATTACHMENTS FROM EML FILES

A single EML file could contain several file attachments, all Base64-encoded. The `munpack` program lets you extract these attachments without needing to use an email client. Install `munpack` with `sudo apt install mpack` in Linux or Windows with WSL, or use `brew install mpack` in Homebrew on macOS. You can then run the command `munpack` *`filename.eml`* to extract the attachments from an email.

For example, the Nauru Police Force dataset contains an EML file called *68.eml*. When I run `munpack 68.eml`, it extracts the attachments from that email—in this case, *RegistrationXForm.pdf* and *COPXPassport.pdf*—into the current working folder. You could also use `munpack` in a script to extract all of the attachments from every email message in an email dump, all from the terminal.

In the following exercises, you'll import each of the email dumps you just downloaded into Thunderbird, starting with the EML files from the Nauri Police Force dataset.

Exercise 6-3: Import the Nauru Police Force Email Dump in EML Format

To import an email dump with the ImportExportTools NG add-on, select the folder into which you'd like to import it. Always import email dumps into a local folder, rather than a remote folder on an email server. From the Folders sidebar on the main Thunderbird tab, right-click **Local Folders** and choose **New Folder**, as shown in Figure 6-1.

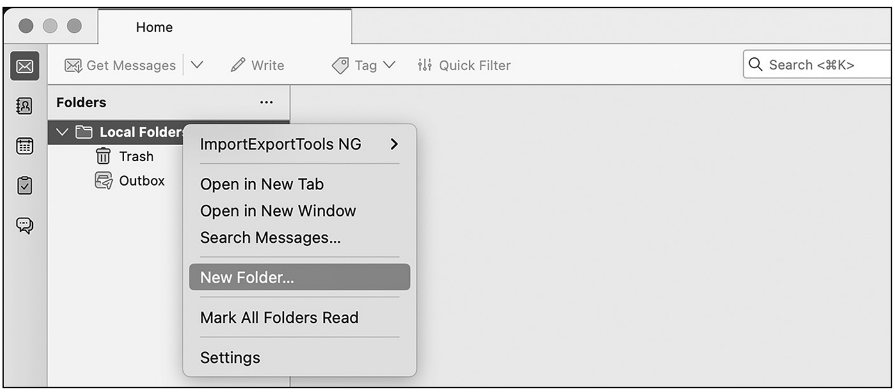

Figure 6-1: Creating a new local folder in Thunderbird

Name your folder **Nauru Police Force** and click **Create Folder**. You should now see the *Nauru Police Force* folder in your Local Folders list.

Right-click the **Nauru Police Force** folder you just created and choose **New Subfolder**. Name your subfolder **iven-notte**, the name of the email account whose inbox data you'll be importing, and click **Create Folder**. Right-click the new *iven-notte* subfolder that you just created and choose **ImportExportTools NG ▸ Import All Messages from a Directory ▸ Also from Its Subdirectories**. A dialog will pop up, allowing you to browse for a folder. Select your *iven-notte* subfolder.

This subfolder should immediately start filling up with the 14,964 email messages that you're importing. It will probably take a few minutes to finish (importing all 127 inboxes in this dataset would take considerably longer).

Figure 6-2 shows Thunderbird with the *iven-notte* inbox loaded up. You can see all of the folders and the number of unread messages in each. (If you'd like, you can mark all of these messages as unread to keep track of which messages you have left to read.)

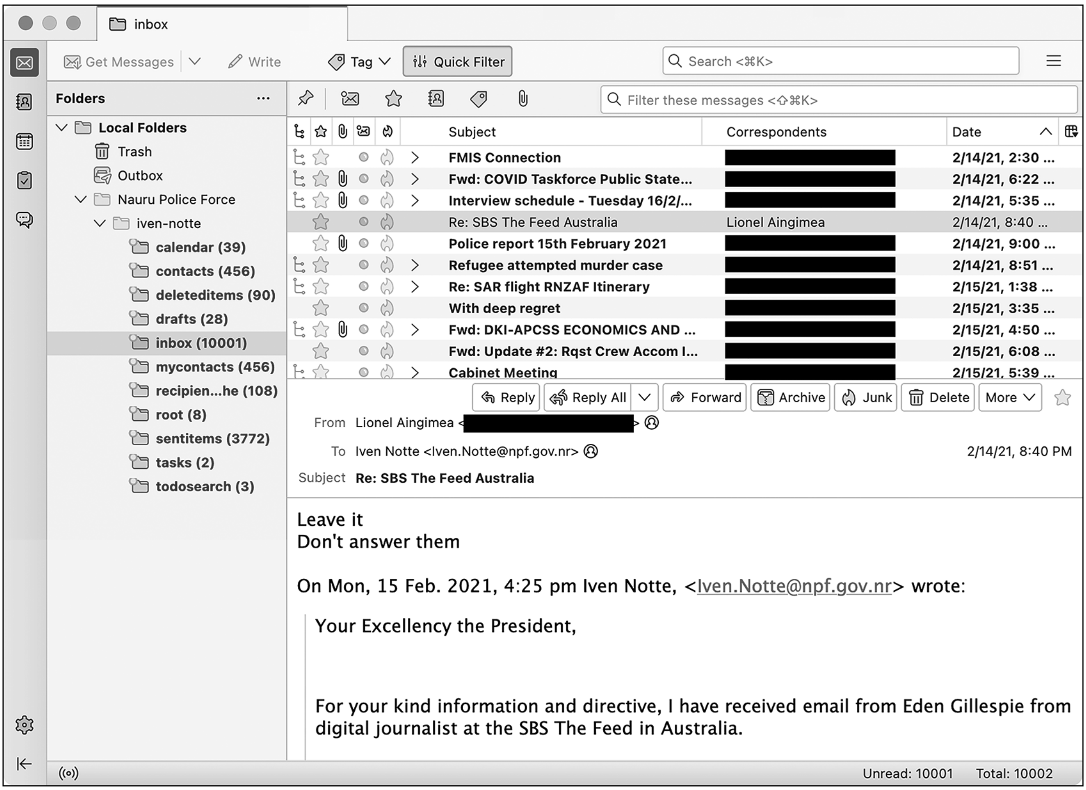

Figure 6-2: An email dump imported in Thunderbird

The email selected in Figure 6-2 is in the *inbox* folder and was sent from Lionel Aingimea, at that time the president of Nauru. In the email, he instructs Iven Notte, the Nauru police chief and the inbox owner, to not respond to Australian journalist Eden Gillespie, who had asked about two

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Nauru men who had allegedly attacked a refugee worker, possibly run him over, and stolen his motorbike. "Leave it," President Aingimea wrote. "Don't answer them."

Cam Wilson, a reporter for the Australian news site Crikey, dug into the Nauru Police Force dataset and revealed "the appalling disregard for refugees and asylum seekers detained there." You can read Wilson's reporting on Crikey's website, *https://www.crikey.com.au/*.

Searching Email in Thunderbird

Now that you've got Thunderbird configured and loaded with data, you're ready to explore that data. For example, you may want to search the Nauru Police Force dataset for other email from President Aingimea or from Australian politicians. You could also search for email that contains keywords like *refugee* or was written on specific days. This section covers search methods you can use on any email dump you import into Thunderbird.

Quick Filter Searches

The simplest search option is to filter the email that shows up in the currently selected folder. When viewing a folder, near the top of the Thunderbird window, make sure the Quick Filter button is toggled on so that an extra toolbar appears. This toolbar has buttons to quickly filter out only messages that are unread, contain attachments, or have other properties.

The Quick Filter toolbar also has a search box that you can use to find only messages that include certain text. You can also filter for messages that include the search term in the sender field, recipient field, subject line, or body. This is the most common way I search in Thunderbird. For example, I entered Aingimea in the Quick Filter search box to quickly find all of the email related to President Aingimea in the *inbox* folder. I could also put his email address in the search box and filter for messages where he's the sender or the recipient (though he won't be the recipient of any of this email, because this is Iven Notte's inbox, not his).

The Search Messages Dialog

The Quick Filter search is essentially a more limited version of the Search Messages dialog, which is the most powerful way to search for email in Thunderbird. Open this dialog by clicking the **Edit** menu and choosing **Find ▸ Search Messages**. You can choose which folder to search, or you can elect to search all the email in an account at once. You can then choose more granular search queries. For example, you could find all email messages that mention *asylum* in the body. You can then filter those results by adding further criteria, such as showing only email sent from or to a specific email address, or only email with attachments.

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There's also a search box in the top right of the Thunderbird window, above the Quick Filter search box, that will quickly search the full email account. I find this feature less useful than the Search Messages dialog. If I can't find what I'm looking for with Quick Filter, I move on to Search Messages, which lets me make my searches as granular as necessary.

Exercise 6-4: Import the Oath Keepers Email Dump in MBOX Format

In this exercise, you'll import email from the Oath Keepers dataset into Thunderbird. The Oath Keepers dataset contains the files *messages.json* and *messages_old.json*, which are chat logs, and the *Oath Keepers.sbd* folder, which contains 100 files in MBOX format. You'll focus on the latter here. As mentioned previously, you can't open MBOX files in an email client to read the messages like you can with EML files; you must import them into Thunderbird first.

To keep your different datasets separate in Thunderbird, you'll create a new folder for the Oath Keepers data. In the left panel, right-click **Local Folders** and choose **New Folder**. Name your folder **Oath Keepers** and click **Create Folder**. You should now see the *Oath Keepers* folder in your Local Folders list. Right-click the **Oath Keepers** folder you just created and choose **ImportExportTools ▸ Import MBOX File**. A pop-up dialog with more options should appear. Choose **Import Directly One or More MBOX Files** and click **OK**. Browse for your *Oath Keepers.sbd* folder and select all of the files in it.

Thunderbird might become unresponsive while it imports the 3.9GB of email, not allowing you to click on anything, but be patient. When the import is complete, you should have 100 separate folders full of email.

The Oath Keepers folder with the most email, by far, is *oksupport*, the Oath Keepers support email account. Figure 6-3 shows an email in this folder from a member renouncing his membership shortly after the January 6 attack.

I haven't found many major revelations in this email dump; most of those are contained in the private part of the Oath Keepers database, the membership and donor lists that DDoSecrets distributes only to journalists and researchers. The publicly available email contains many people writing about joining the militia or complaining that they paid their membership dues but haven't had any further communication. There's also a massive amount of spam, including right-wing extremist, conspiratorial, and anti-vaccine bulk email. Look through the various email accounts you imported and try out Thunderbird's search tools to see if you can find anything interesting I missed.

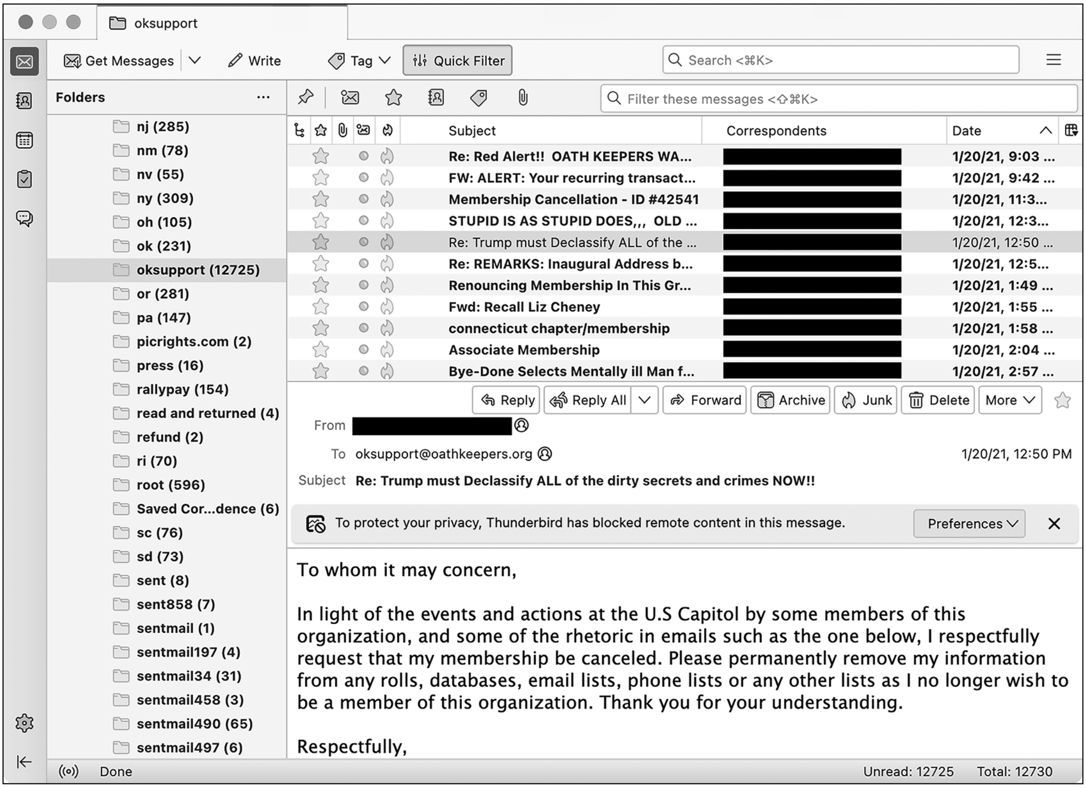

Figure 6-3: An email from the Oath Keepers email dump

Exercise 6-5: Import the Heritage Foundation Email Dump in PST Format

In this exercise, you'll import the Heritage Foundation email dump, a Microsoft Outlook PST file called *backup.pst*, into Thunderbird. Since the ImportExportTools NG add-on doesn't support PST files, first you'll need to convert the PST into an EML or MBOX file.

The `readpst` program can convert a PST file into several different formats, including EML and MBOX files. You can access the program by installing the `libpst` package in macOS or the `pst-utils` package in Ubuntu. Start by opening a terminal. Mac users, run the following command:

```
brew install libpst
```

Linux and Windows with WSL users, run this command:

```
sudo apt update
sudo apt install pst-utils
```

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Next, change to the folder that contains the *backup.pst* file. For example, on my macOS computer, I run:

```
cd /Volumes/datasets/Heritage\ Foundation
```

To convert a PST file into EML file, you use the following command, where the `-e` argument tells `readpst` to output as EML files:

```
readpst -e filename.pst
```

Run that command on the *backup.pst* file like so:

```
readpst -e backup.pst
```

This command creates a folder called *Personal Folders*, which contains additional *Contacts*, *Heritage*, *Inbox*, *Junk E-mail*, and other subfolders (this is how the email in *backup.pst* is organized). Within each folder are several EML files, one for each email message.

NOTE *I've found it easier to import EML files generated by* `readpst` *into Thunderbird, but you can also convert PSTs into MBOX files with the* `readpst -r filename.pst` *command.*

In the left panel, right-click **Local Folders** and choose **New Folder**, as you did in the previous exercises. Name your folder **Heritage Foundation** and click **Create Folder**. You should now see the *Heritage Foundation* folder in your Local Folders list.

Right-click the **Heritage Foundation** folder, choose **New Subfolder**, and name your new subfolder **backup.pst**. Right-click the *backup.pst* subfolder and choose **ImportExportTools NG ▸ Import All Messages from a Directory ▸ Also from Its Subdirectories**. Browse for the *Personal Folders* folder that you just created using `readpst` and start the import. This folder should start filling up with over a thousand email messages.

These email messages, all belonging to the former Heritage Foundation fundraiser Steve DeBuhr, are meticulously organized into folders. In addition to Heritage Foundation work, this email dump also includes DeBuhr's personal email. This email dump is very old—the latest messages are from 2009—so it's unlikely you'll find very many revelations in here. Since DeBuhr worked with major donors, though, the email in the *Heritage* folder contains many attachments full of financial details. Figure 6-4 shows this email dump in Thunderbird.

Particularly, I noticed as I browsed through this email that the *Social Issues* folder contains homophobic and otherwise bigoted messages that DeBuhr had forwarded from his official heritage.org address account to his personal one.

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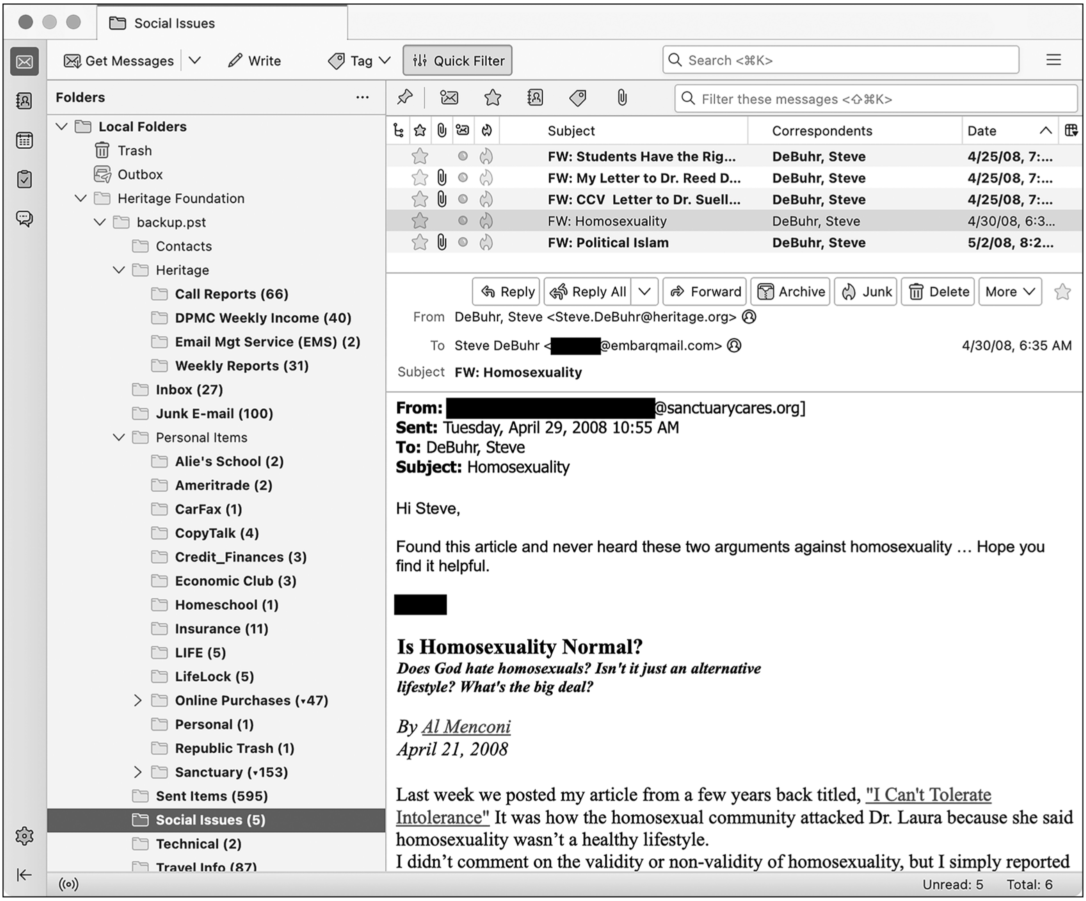

Figure 6-4: A Heritage Foundation email in Thunderbird

Other Tools for Researching Email Dumps

This chapter has focused on using Thunderbird as a tool for researching email dumps, but in your future work, you might find two alternative tools helpful: Microsoft Outlook and Aleph. In this section I'll go over how you can use each tool to import and search email dumps. You don't need to follow the instructions in this section to work through the rest of the book, but reading along will give you a sense of what the options are and when to use them.

Microsoft Outlook

Unlike Thunderbird, Microsoft's desktop email program, Outlook, supports importing email dumps directly in PST format. However, Outlook has some downsides. First, it's not free; the cheapest way to get Outlook is to buy a Microsoft 365 license, which at the time of writing costs around $7 per month or $70 per year. Second, Outlook is available only for Windows and macOS, not Linux (though Linux users can run Outlook in a Windows VM). Still, you might find Outlook useful if you're familiar with

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the program and understand its advanced features, or just want to see an email in its original interface.

Let's look at how to import PST files directly into Outlook, using a real example from a hacked Russian email dump. First, set up a Windows VM for Outlook. Do this even if you're a Windows or macOS user who already uses Outlook for email, in order to avoid mixing up your actual email and a leaked email dump. Microsoft publishes free Windows VM images for several different VM programs like VirtualBox, VMWare, and Parallels. Download the VM image at *https://developer.microsoft.com/en-us/windows/downloads/virtual-machines* and import it into your VM software. You'll also need to install Microsoft Office in your VM. If you have a Microsoft 365 license, download Office from *https://www.office.com* by logging in and clicking the **Install Office** link. If you don't have a license, Microsoft offers a free trial.

When you open Outlook the first time, it prompts you to log in to your Office 365 account to check your license. After that, it prompts you to set up an email account. At the bottom, click the link **Create an Outlook.com Email Address to Get Started** in order to create a new account. Make sure to save your email and password in your password manager. Once you're finished, click **Done**. Outlook should open with the empty inbox of the new email account you just created.

With Outlook set up, add the PST email dumps to it. Click **File ▸ Account Settings ▸ Account Settings**, then click **Data Files ▸ Add** and browse for the PST file you want to add. If you have the disk space to spare, make a copy of the PST file and add the copy instead. All information about this inbox, including details like which messages are marked read, is stored in this file, so working from a copy will prevent you from modifying the original.

The PST file you added should appear in the left sidebar. You can now sift through this inbox as if it were your own. Even the unread email counts you'll see are the actual counts of unread email for each folder at the time the PST file was exported.

As an example, I set up a Windows VM, installed Outlook, logged into it using my Microsoft 365 account, and added *intercoord@vgtrk.ru.pst* (the 48GB PST file hacked from VGTRK mentioned earlier in the chapter).

Figure 6-5 shows this VGTRK inbox, where I've used Outlook's search feature to search for Такер Карлсон. This is the Cyrillic spelling of Tucker Carlson, the American white nationalist and former Fox News host.

The subject line of the selected email in Figure 6-5 translates roughly to "Tucker Carlson sync." The email body contains a translated quote in which Carlson claims that Ukraine is not an independent country, but rather is controlled by the US Democratic Party. The quote also includes the false claim that in 2016, then Vice President Joe Biden fired Ukraine's attorney general for investigating Biden's son Hunter. (In fact, Biden leveraged $1 billion in US aid to persuade Ukraine to oust its top prosecutor, Viktor Shokin, who refused to investigate corruption from powerful Ukrainians. Biden worked in tandem with anti-corruption efforts across Europe: European leaders, as well as civil society groups within Ukraine, urged Shokin to resign for the same reason.) Russian TV likely aired this Tucker Carlson clip, and this email was likely the translation for their Russian dubbed version.

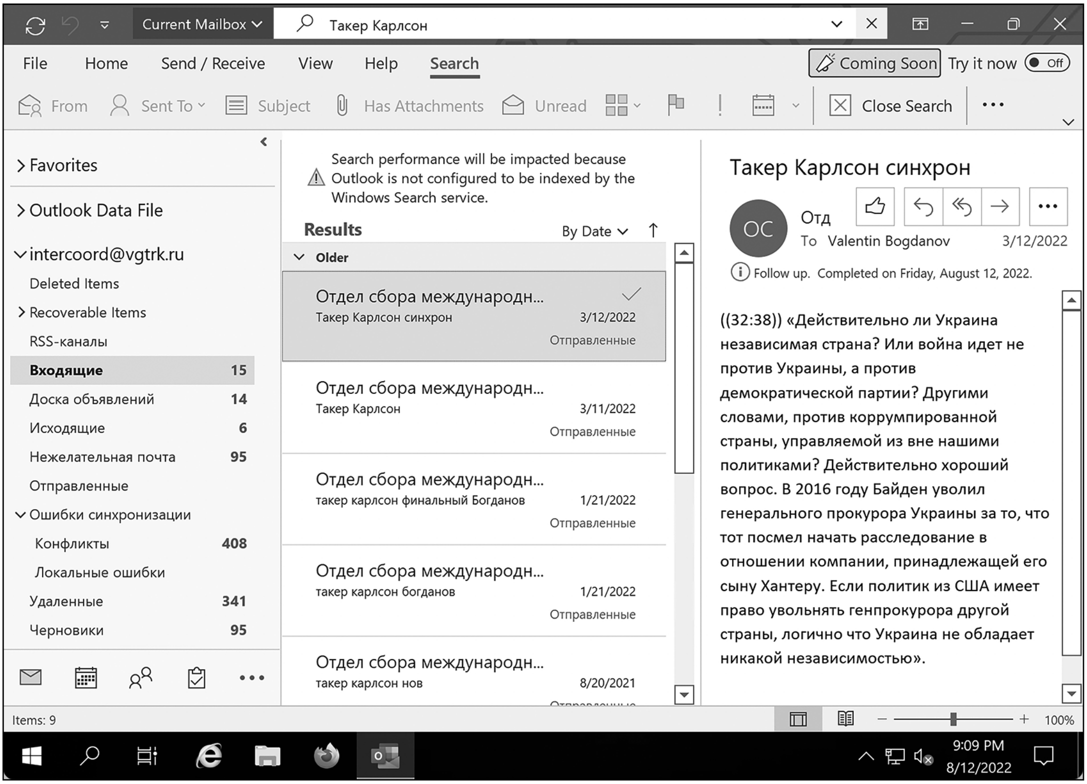

Figure 6-5: Researching a PST file in Outlook

NOTE *When working with data dumps in foreign languages that you don't read, you can rely on machine translation tools like DeepL or Google Translate—assuming, of course, that you're comfortable sharing the contents of the leak with a third-party service. I've also found the Google Translate phone app useful: if you hold your phone's camera up to your screen, it will translate text in real time. This works even with scanned documents that aren't OCR'd.*

Aleph

As you learned in Chapter 5, you can use Aleph to index and browse a wide variety of email, including PST or EML files. When you index a folder containing PSTs, Aleph recognizes the file format and indexes all of the individual messages inside of each PST file, keeping the folder hierarchy intact. Aleph also has the following benefits for working with email dumps:

- Unlike Thunderbird and Outlook, Aleph will also index, make searchable, and even add OCR to email attachments.
- As with any dataset it processes, Aleph will automatically list all of the people and organizations it finds in the dataset, and you can use it to cross-reference that data with other datasets you've indexed.

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- If you run an Aleph server for a group of researchers, you can easily enable them to search email dumps; all they need is a web browser and an Aleph account.

Using Aleph for email dumps has a few downsides. First, it requires a lot of technical work to spin up an Aleph server and to index datasets, especially if you plan on putting it on the internet for others to use. In my experience, if you try to import large datasets like email dumps into Aleph, you're likely to run into technical hurdles with your Docker setup. Using Thunderbird is a simpler solution.

Aleph also can't properly index MBOX files; it tries to index them as text files rather than as collections of different email messages. It won't do any Base64-decoding of the data inside MBOX files, so it's not much more useful than grep for this task. If you want an MBOX-formatted email dump indexed in your Aleph server, import it into Thunderbird and then export it again (using ImportExportTools NG) in EML format.

Aleph has other quirks that make working with email dumps more complicated. For example, if there's an email attachment in a format Aleph doesn't understand, it just won't display the attachment at all when you view that email message. If you want to be sure you're seeing everything in the email, download an individual EML file from Aleph and open it in Thunderbird.

In sum, Outlook is a reasonable choice for PST files, and Aleph is a good choice if you're working with groups of people or want to cross-reference an email dump with other datasets. However, Thunderbird is the simplest way to quickly start your email dump investigation, and it supports all email formats.

Summary

In this chapter, you learned how to import email dumps in the EML, MBOX, and PST formats into Thunderbird to read and search them. You read an email from the president of Nauru, got insights into the type of email the Oath Keepers receive, and explored an old email dump from the Heritage Foundation. You also saw how to use Microsoft Outlook and Aleph as alternatives to Thunderbird. You can use the skills you've learned here in your future email dump investigations.

In the next chapter, you'll level up your technical skills for analyzing datasets by taking a crash course in Python programming.

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PART III

PYTHON PROGRAMMING

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7

AN INTRODUCTION TO PYTHON

The skills you've learned in the last few chapters are instrumental for investigating leaked datasets, but having basic programming knowledge is even more powerful. Using Python or other programming languages, you can give your computer precise instructions for performing tasks that existing tools or shell scripts don't allow. For example, you could write a Python script that scours a million pieces of video metadata to determine where the videos were filmed. In my experience, Python is also simpler, easier to understand, and less error-prone than shell scripts.

This chapter provides a crash course on the fundamentals of Python programming. You'll learn to write and execute Python scripts and use the interactive Python interpreter. You'll also use Python to do math, define variables, work with strings and Boolean logic, loop through lists of items, and use functions. Future chapters rely on your understanding of these basic skills.

Exercise 7-1: Install Python

Some operating systems, including most versions of Linux and macOS, come with Python preinstalled, and it's common to have multiple versions of Python installed at once. This book uses Python 3. After you follow the Python installation instructions for your operating system in this exercise, you should be able to run Python scripts with the `python3` (for Linux and Mac) or `python` (for Windows) command.

Windows

Download and install the latest version of Python 3 for Windows from *https://www.python.org*. During installation, check the box **Add Python 3.*x* to PATH** (where **3.*x*** is the latest Python 3 version), which allows you to run the `python` command in PowerShell without using the Python program's absolute path.

Wherever this chapter instructs you to open a terminal, use PowerShell instead of an Ubuntu terminal. You can also learn to use Python in Ubuntu with WSL by following this chapter's Linux instructions, but running Python directly in Windows makes reading and writing data on your Windows-formatted USB disk much faster.

Windows users should replace all instances of `python3` with `python` when running the example code in this chapter.

Linux

Open a terminal and make sure the `python3`, `python3-pip`, and `python3-venv` packages are installed, using this `apt` command:

```
sudo apt install python3 python3-pip python3-venv
```

This command either installs the latest version of Python 3 available in the Ubuntu repositories (as well as a few related packages you'll need for this chapter) or does nothing if the packages are already installed.

macOS

Open a terminal and run the following Homebrew command to make sure `python3` is installed:

```
brew install python3
```

This command either installs the latest version of Python 3 available in Homebrew or does nothing if it's already installed.

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Exercise 7-2: Write Your First Python Script

Now that you've downloaded Python, you'll write and run a simple Python script that displays some text in your terminal.

In your text editor, create a new file called *exercise-7-2.py* (all Python scripts end in *.py*). The first time you open a Python script in VS Code, it asks if you want to install the Python extension. I recommend doing so in order to enable VS Code to make suggestions as you're typing. The extension also has various features for highlighting syntax errors and helping you format your code nicely.

Enter the following code (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-7/exercise-7-2.py*), then save the file:

```
print("hacks")
print("leaks")
revelations = "revelations".upper()
print(revelations)
```

As with shell scripts, Python scripts run instructions one line at a time, starting at the top. When you run this code, `print("hacks")` calls a function called `print()` and passes the string `hacks` into it, displaying `hacks` in your terminal window. The second line similarly displays `leaks`. (I'll explain strings in greater detail in the "Python Basics" section on page XX, and functions in the "Functions" section on page XX.)

Next, the script defines a variable called `revelations` and sets its value to the uppercase version of the string `revelations`. To find the uppercase version of that string, the program calls the `upper()` method, which is a type of function. The final line then displays what's stored in the `revelations` variable: `REVELATIONS`.

NOTE *I have fond memories of retyping snippets of code from books. When I was a teenager, I taught myself web and video game development by reading programming books and typing the code samples I found into my own editor. I always found that actually retyping the code, rather than copying and pasting it, helped make the concepts stick, so I recommend doing that for the exercises in this book.*

In a terminal, change to your *exercises* folder for this exercise and run the script you just created with the following command (Windows users, remember to replace `python3` with `python`):

```
micah@trapdoor chapter-7 % python3 exercise-7-2.py
```

The argument in this command is the path to the script that you want to run, *exercise-7-2.py*. You should get the following output:

```
hacks
leaks
REVELATIONS
```

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Try making the following changes to your script, running it after each change to see the results:

- Change the text in the `print()` functions.
- Add new `print()` functions to display more text.
- Use the string methods `lower()` and `capitalize()` instead of `upper()`.

Python Basics

In this section, you'll learn to write code in the interactive Python interpreter, comment your code, start doing simple math in Python, and use strings and lists. This gentle introduction to Python syntax will let you quickly try out some code on your own, before you dive into more advanced topics.

As you read, don't be shy about searching online for answers to any Python questions you might have beyond what this book covers. I frequently find solutions to Python problems on websites like Stack Overflow, a forum where people can ask technical questions and others can answer them.

The Interactive Python Interpreter

The *Python interpreter* is a command line program that lets you run Python code in real time, without writing scripts first, allowing you to quickly test commands. To open the Python interpreter, you run the `python3` command without any arguments, like so:

```
micah@trapdoor ~ % python3
--snip--
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

The interpreter starts by telling you exactly which version of Python you're using. Similar to a command line interface, it gives you the prompt >>> and waits for you to enter a Python command.

Run the following command:

```
>>> print("Hello World!")
Hello World!
>>>
```

Entering `print("Hello World!")` and pressing ENTER should immediately run your code, displaying `Hello World!` on the next line. Exit the interpreter and return to the shell by running **`exit()`** or pressing CTRL-D.

In the remainder of this book, if my examples include the >>> prompt, that means they're running in the Python interpreter. Run the same code in your own interpreter as you follow along.

Comments

Writing code can be confusing even to experienced programmers, so it's always a good idea to *comment* your code: add inline notes to yourself or to others who might read your program. If you describe the purpose of a specific portion of code in plain English (or whatever language you speak), whoever looks at this code in the future can understand the gist of what it's doing at a glance.

If a line of code starts with a hash mark (#), the whole line is a comment. You can also add a hash mark after some code, followed by your comment. For example, run the following lines of code:

```
>>> # This is a comment
>>> x = 10 # This sets the variable x to the value 10
>>> print(x)
10
```

This is exactly the same as comments in shell scripting, which you learned about in Chapter 3. Python ignores comments, since they're intended for humans.

Math with Python

Computers, which are technically complicated calculators, are great at doing math. It might not be immediately apparent, but investigating datasets means constantly dealing with basic math: calculating disk space, counting files, searching for keywords, and sorting lists. Here's how a few basic mathematical operations work in Python:

Operators

The arithmetic operators for addition (+), subtraction (−), multiplication (×), and division (/) are mostly the same in Python: `+`, `-`, and `/`, with an asterisk `*` for multiplication.

Variables

In math, a variable is a placeholder, normally a letter like *x*. Variables in math often represent something unknown and it's your job to solve for it, but Python variables are never unknown—they always have a value. Name your Python variables something descriptive like `price` or `number_of_retweets` rather than single letters without clear meanings. Variables in Python can represent much more than just numbers, as you'll see later in this chapter.

Expressions

An expression is a bit like a sentence made up of numbers, variables, and operators. For example, here are a few expressions:

```
1 + 1
100 / 5
x * 3 + 5
```

Like sentences, expressions need to have the correct syntax. Just like "potato the inside" isn't a valid sentence, `1 1 +` isn't a valid expression. Enter the following expressions in the Python interpreter to see how it evaluates them:

```
>>> 1 + 1
2
>>> 100 / 5
20.0
>>> 3.14 * 2
6.28
```

Just like a calculator, Python respects the order of operations. It also supports using parentheses:

```
>>> 100 - 12 * 2
76
>>> (100 - 12) * 2
176
```

As in the rest of math, Python won't allow you to divide by zero:

```
>>> 15 / 0
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ZeroDivisionError: division by zero
```

You define a variable in Python by saving a value inside that variable with the equal sign (`=`). Try defining `price` and `sales_tax` variables and then using them in an expression:

```
>>> price = 100
>>> sales_tax = .05 # 5% sales tax
>>> total = price + (price * sales_tax)
>>> print(total)
105.0
```

You can't use variables that you haven't yet defined. For example, if you use an undefined variable `x` in an expression, you'll get an error:

```
>>> x * 10
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'x' is not defined
```

Instead of just setting a variable equal to some value, you'll often want to modify its existing value by a certain amount. For example, if you're keeping track of the total price of items in a shopping cart in the `total` variable and want to add 10 dollars to that total, you would define the variable like so:

```
total = total + 10
```

Python's `+=` operator performs the same operation:

```
total += 10
```

The `+=` operator adds the number on the right to the variable on the left. The Python operators `-=`, `*=`, and `/=` work the same way. In your Python interpreter, define a variable, then try changing its value using these operators.

Strings

A *string* is a sequence of characters. Any time you need to load, modify, or display text, you store it in a string. If you load the contents of a text file into a variable in Python (for example, a 5MB EML file that includes attachments), that's a string. But strings are also often very short: in Exercise 7-2, you used the strings `"hacks"`, `"leaks"`, and `"revelations"`.

In Python, strings must be enclosed in either single quotes (`'`) or double quotes (`"`). Run the following examples, which demonstrate how to use each type of quote:

```
>>> "apple" # A string with double quotes
'apple'
>>> 'apple' # The same string with single quotes
"apple'
>>> # Use double quotes if you have single quotes within the string
>>> "She's finished!"
"She's finished!"
>>> # Use single quotes if you have double quotes within the string
>>> 'She said, "Hello"'
'She said, "Hello"'
```

Some of the same techniques you learned in Chapter 3 to work with strings in your shell also apply to strings in Python. If your string uses double quotes, you can escape them like so:

```
>>> "She said, \"Hello\""
```

You can similarly escape single quotes in a single-quote string:

```
>>> 'She\'s finished!'
```

Like numbers, strings can be stored in variables. Run the following code to define `first_name` and `last_name` variables, replacing my name with yours:

```
>>> first_name = "Micah"
>>> last_name = "Lee"
```

In Python, *f-strings* are strings that can contain variables. To use an f-string, put the letter `f` before the quotes, then put variable names in braces ({ and }). For example, run the following commands to display the values of the variables you just defined:

```
>>> print(f"{first_name} {last_name}")
Micah Lee
>>> full_name = f"{first_name} {last_name}"
>>> print(f"{first_name}'s full name is {full_name}, but he goes by {first_name}")
Micah's full name is Micah Lee, but he goes by Micah
```

Place expressions inside f-strings in order to evaluate them:

```
>>> print(f"1 + 2 + 3 + 4 + 5 = {1 + 2 + 3 + 4 + 5}")
1 + 2 + 3 + 4 + 5 = 15
```

Python will evaluate the expression for you, in this case `1 + 2 + 3 + 4 + 5`, and just print the result, which is `15`.

Exercise 7-3: Write a Python Script with Variables, Math, and Strings

In this exercise, you'll practice the concepts you've learned so far by writing a simple Python script that uses variables and a few basic math expressions and prints some strings. The script calculates how old a person is in months, days, hours, minutes, and seconds, given their name and an age (in years), and then displays this information. In your text editor, create a new file called *exercise-7-3.py* and define these two variables:

```
name = "Micah"
age_years = 37
```

Replace the values of `name` and `age_years` with your own name and age.

Next, define some more variables that represent age in different units: months, days, hours, minutes, and seconds. Start with months:

```
age_months = age_years * 12
```

Add a days variable:

```
age_days = age_years * 365
```

Finally, define variables for hour, minutes, and seconds:

```
age_hours = age_days * 24
age_minutes = age_hours * 60
age_seconds = age_minutes * 60
```

Now that you've defined the variables, you can display them to the user. Since the numbers in this exercise are going to get big, you'll include commas to make them easier to read. For example, run this code in the interpreter to display the variable `number` with commas using an f-string, adding `:,` after the variable name within the braces:

```
>>> number = 1000000
>>> print(f"the number is: {number}")
the number is: 1000000
>>> print(f"the number is: {number:,}")
the number is: 1,000,000
```

Back in the Python script, add code to display all of the values, like this:

```
print(f"{name} is {age_years:,} years old")
print(f"That would be {age_months:,} months old")
print(f"Which is {age_days:,} days old")
print(f"Which is {age_hours:,} hours old")
print(f"Which is {age_minutes:,} minutes old")
print(f"Which is {age_seconds:,} seconds old")
```

This code uses `{name}` to display the value of the name variable. That variable is a string, so it doesn't make sense to try to separate it with commas. The rest of the variables are numbers, though, so the code includes `:,` inside the braces for all of them to include commas in the output. (The `age_years` values don't need commas, unless you happen to be older than 1,000, but it doesn't hurt to use the `:,` syntax—it adds a comma only if one is needed.)

Save the file in your text editor. (A complete copy of the script is available at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-7/exercise-7-3.py*.) In a terminal, change to your *exercises* folder for this exercise and run the script. Here's what happens when I do so:

```
micah@trapdoor chapter-7 % python3 exercise-7-3.py
Micah is 37 years old
That would be 444 months old
Which is 13,505 days old
Which is 324,120 hours old
Which is 19,447,200 minutes old
Which is 1,166,832,000 seconds old
```

When you run the script with your name and age, try changing the age and running it again to see how the numbers change.

Lists and Loops

You'll often need to manage lists when investigating datasets. For example, you might work with lists of filenames or rows in a spreadsheet. In this section, you'll learn how to store lists as variables and loop through those lists in order to run the same code for each list item. You did something similar in Chapter 4 with `for` loops in the shell, but this time, you'll be working in Python.

Defining and Printing Lists

In Python, lists are defined with brackets (`[` and `]`), with each item in the list separated by commas (`,`). You might have a list of numbers:

```
[1, 2, 3]
```

Or of strings:

```
["one", "two", "three"]
```

Or an empty list:

```
[]
```

Just as variables can contain numbers or strings, they can also contain lists. Use this line of code to store a list of letters in the Hebrew alphabet, spelled out using Latin characters, in the `hebrew_letters` variable:

```
>>> hebrew_letters = ["aleph", "bet", "gimel", "dalet", "he", "vav", "zayin",
"chet", "tet", "yod", "kaf", "lamed", "mem", "nun", "samech", "ayin", "pe",
"tsadi", "qof", "resh", "shin", "tav"]
```

Now use the `print()` function to display the items in the `hebrew_letters` variable:

```
>>> print(hebrew_letters)
['aleph', 'bet', 'gimel', 'dalet', 'he', 'vav', 'zayin', 'chet', 'tet', 'yod',
'kaf', 'lamed', 'mem', 'nun', 'samech', 'ayin', 'pe', 'tsadi', 'qof', 'resh',
'shin', 'tav']
```

You can make long lists easier to read by entering each item in the list on its own line, indented, like this:

```
hebrew_letters = [
    "aleph",
--snip--
    "tav"
]
```

Each item in a list has an *index*, a number that represents where in the list that item is located. The index of the first item is 0, the second is 1, the third is 2, and so on. To select a list item, you append brackets with the item's index to the end of the list. For example, to select the first letter in the `hebrew_letters` list, use `hebrew_letters[0]`:

```
>>> print(hebrew_letters[0])
aleph
>>> print(hebrew_letters[1])
bet
```

The first line of code uses the `print()` function to display the item from the `hebrew_letters` list at index 0 (`aleph`), and the second line displays the item at index 1 (`bet`).

Now use negative numbers to select items starting from the end of the list, like so:

```
>>> print(hebrew_letters[-1])
tav
>>> print(hebrew_letters[-2])
shin
```

You can use the `len()` function to count the number of items in a list. For example, run this code to get the number of items in the `hebrew_letters` list:

```
>>> print(len(hebrew_letters))
22
```

This code uses the `print()` function to display the output of the `len()` function. You could get the same result by storing the output of the `len()` function in a variable:

```
>>> length_of_hebrew_alphabet = len(hebrew_letters)
>>> print(length_of_hebrew_alphabet)
22
```

The first line of code runs `len(hebrew_letters)` and stores the result in the `length_of_hebrew_alphabet` variable. The second line uses the `print()` function to display that result.

You don't have to store a list in a variable to select items from it. For example, run this code to display the second item (at index 1) in the list `[1,2,3]`:

```
>>> print([1,2,3][1])
2
```

The `append()` method lets you add items to lists. For example, run the following code to add a new color to a list of favorites:

```
>>> favorite_colors = ["red", "green", "blue"]
>>> favorite_colors.append("black")
>>> print(favorite_colors)
['red', 'green', 'blue', 'black']
```

This code defines the variable `favorite_colors` as a list of strings containing `red`, `green`, and `blue`. It then adds another string, `black`, to the list by using the `append()` method, before finally displaying the value of the `favorite_colors` variable, using the `print()` function.

When writing code that analyzes datasets, you'll often create an empty list and then append items to that list to make the data easier to work with. For example, you'll learn in Chapter 13 about the code I wrote while investigating America's Frontline Doctors, an anti-vaccine group. To properly analyze a dataset of hundreds of thousands of files containing patient information, I wrote code that created an empty list, opened each file, and appended the pertinent patient data to that list.

Running for Loops

In Chapter 4, you used a `for` loop to unzip each BlueLeaks ZIP file. Python also has `for` loops, and they work the same way they do in shell scripting: by running a snippet of code, called a *block*, on each item in a list. A `for` loop has the following syntax:

```
for variable_name in list_name:
```

followed by a block of indented code. Once you choose a new variable to define in *`variable_name`*, you can use it in your code block.

For example, run this code to loop through the `hebrew_letters` list, store each item in the variable `letter`, and then display that item:

```
>>> for letter in hebrew_letters:
...     print(letter)
...
```

After you enter the `for` loop, which ends in a colon (`:`), the Python interpreter changes the prompt from >>> to `...` and waits for you to enter the code block that will run for each item. Indent every line in your block with the same number of spaces, then end your block with a blank line. In this example, the code block that runs is just one line: `print(letter)`.

The code should return the following output:

```
aleph
bet
--snip--
shin
tav
```

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In this example, the `for` loop runs 22 times, once for each item in the list, and stores the item in the variable `letter`. The first time it loops, the value of `letter` is `aleph`. The second time, the value is `bet`, and so on.

NOTE *Indentation tells Python which lines of code are part of your code blocks. If some lines are indented with four spaces, but others with two or three spaces, your Python code won't work. To keep things simple, I recommend always indenting with four spaces. When writing scripts in VS Code, you can indent multiple lines of code by selecting them with your mouse and then pressing TAB (which indents four spaces for you) or Unindent by selecting a line and pressing SHIFT-TAB.*

The following, slightly more complicated, example uses the `len()` function to count not the number of items in a list, but characters in a string:

```
>>> for letter in hebrew_letters:
...     count = len(letter)
...     print(f"The letter {letter} has {count} characters")
...
The letter aleph has 4 characters
The letter bet has 3 characters
The letter gimel has 5 characters
--snip--
The letter resh has 4 characters
The letter shin has 4 characters
The letter tav has 3 characters
```

This code tells you how many characters are used to spell the word for each Hebrew letter in the Latin alphabet.

You can use `for` loops to loop through strings as well, since a string is essentially a list of characters:

```
>>> word = "hola"
>>> for character in word:
...     print(character)
...
h
o
l
a
```

You can run a single `for` loop as many times as you need for the dataset you're working on. For example, in Chapter 9, you'll write code that can open each of the hundreds of spreadsheets in the BlueLeaks dataset and uses a `for` loop to run your block of code on each row.

In the next section, you'll learn to make your programs more dynamic and useful by determining which blocks of code should run under which circumstances.

Control Flow

Python scripts start at the top and run one line of code at a time, but they don't always run these lines consecutively. In for loops, for example, the same block of code might run over and over again before the loop completes and the program continues to the next line. The order in which your lines of code run is your program's *control flow*.

As you start writing code, you'll often alter the control flow by telling your computer to do different things in different situations. If you write a program that loops through a list of files in a dataset, for instance, you may want to run different code when the program reaches a PDF document than when it encounters an MP4 video.

This section teaches you how to run certain blocks of code under certain conditions. To do this, you'll learn how to compare values, use if statements based on these comparisons, and express arbitrarily complicated conditions using Boolean logic, all of which allow you to control the flow of your program. You'll need this sort of logic whenever you write code that searches a dataset for something specific and then responds according to what it finds.

Comparison Operators

As mentioned earlier in this chapter, expressions that use the arithmetic operators +, -, /, and * generally evaluate to numbers: 1 + 1 evaluates to 2, for example. Expressions in Python also use the following *comparison operators* to compare terms:

< Less than

<= Less than or equal to

> Greater than

>= Greater than or equal to

== Equal to (not to be confused with a single equal sign (=), which defines a variable)

!= Not equal to

A *Boolean* is a type of variable that is either True or False. Expressions that use comparison operators evaluate to Booleans instead of numbers, as in the following examples:

```
>>> 100 > 5
True
>>> 100 < 5
False
>>> 100 > 100
False
>>> 100 >= 100
True
>>> 0.5 < 1
True
>>> 0.999999 == 1
False
```

You can use these same operators to compare strings, too. In Python, saying that one string is less than another means that the former comes before the latter in alphabetical order, as in the following examples:

```
>>> "Alice" == "Bob"
False
>>> "Alice" != "Bob"
True
>>> "Alice" < "Bob"
True
>>> "Alice" > "Bob"
False
```

Strings are case sensitive. If you don't care about capitalization and want to just see whether the strings are made up of the same words, make them both lowercase before you compare them:

```
>>> name1 = "Vladimir Putin"
>>> name2 = "vladimir putin"
>>> name1 == name2
False
>>> name1.lower() == name2.lower()
True
```

This technique allows you to determine whether strings of data fulfill a given condition. For example, in Chapter 11, you'll write code to analyze the metadata of over a million videos uploaded to the far-right social network Parler. Using comparison operators, you'll determine which videos were filmed on January 6, 2021, in Washington, DC, during the insurrection after Trump lost the 2020 election.

if Statements

You use `if` statements to tell your code to do something under certain conditions but not others. The syntax for an `if` statement is `if` *`expression`*`:` followed by an indented block of code. If the expression evaluates to `True`, then the code block runs. If the expression evaluates to `False`, the code doesn't run, and the flow moves on to the next line.

For example, run the following code:

```
>>> password = "letmein"
>>> if password == "letmein":
...     print("ACCESS GRANTED")
...     print("Welcome")
...
ACCESS GRANTED
Welcome
>>>
```

This code sets the value of the `password` variable to `letmein`. That means the expression in the `if` statement (`password == "letmein"`) evaluates to `True` and the code block runs, so it displays `ACCESS GRANTED` and `Welcome`.

Now try including the wrong password in your `if` statement:

```
>>> password = "youarefired"
>>> if password == "letmein":
...     print("ACCESS GRANTED")
...     print("Welcome")
...
>>>
```

This time, because you set the password to `"yourefired"`, the expression `password == "letmein"` evaluates to `False`, and Python doesn't run the `if` statement's code block.

An `if` statement can optionally incorporate an `else` block so that if the condition is true, one code block runs, and if it's false, another block runs:

```
if password == "letmein":
    print("ACCESS GRANTED")
    print("Welcome")
else:
    print("ACCESS DENIED")
```

You can also incorporate `elif` blocks, short for "else if." These let you make another comparison if the first comparison is false, as shown in Listing 7-1.

```
if password == "letmein":
    print("ACCESS GRANTED")
    print("Welcome")
elif password == "open sesame":
    print("SECRET AREA ACCESS GRANTED")
else:
    print("ACCESS DENIED")
```

Listing 7-1: Comparing `if`, `elif`, and `else` statements

In this code, the `if` statement evaluates the `password == "letmein"` expression. If it evaluates to `True`, the code block runs and displays the `ACCESS GRANTED` and `Welcome` messages. If the expression evaluates to `False`, the program moves on to the `elif` block, which evaluates the `password == "open sesame"` expression. If that evaluates to `True`, it runs the block of code that displays `SECRET AREA ACCESS GRANTED`. If it evaluates to `False`, the program moves on to the `else` code block, which displays `ACCESS DENIED`.

Nested Code Blocks

You can also accomplish the results of Listing 7-1 with multiple `if` statements and no `elif`, using *nested* code blocks, or indented blocks of code inside other indented blocks of code:

```
if password == "letmein":
    print("ACCESS GRANTED")
    print("Welcome.")
else:
    if password == "open sesame":
        print("SECRET AREA ACCESS GRANTED")
    else:
        print("ACCESS DENIED")
```

This code is functionally the same as Listing 7-1.

The more complicated your code, the more nested code blocks may come in handy. You might include `for` loops inside your `if` statement code blocks, or `if` statements inside `for` loops, or even `for` loops inside `for` loops.

You might prefer `elif` statements to nested `if` statements purely for readability purposes: it's easier to read and write code with 100 `elif` statements than code that's indented 100 times because it has 100 nested `if` statements.

Searching Lists

The Python `in` operator, which tells you whether an item appears in a list, is useful for working with lists. For example, to check whether the number 42 appears in a list of numbers, you can use `in` as follows:

```
favorite_numbers = [7, 13, 42, 101]
if 42 in favorite_numbers:
    print("life, the universe, and everything")
```

To the left of the `in` operator is a potential item inside a list, and to the right is the list name. If the item is in the list, then the expression evaluates to `True`. If not, it evaluates to `False`.

You can also use `not in` to check if an item *isn't* in a list:

```
if 1337 not in favorite_numbers:
    print("mess with the best, die like the rest")
```

Additionally, you can use `in` to search for smaller strings inside of larger strings:

```
sentence = "What happens in the coming hours will decide how bad the Ukraine
crisis gets for the vulnerable democracy in Russian President Vladimir Putin's
sights but also its potentially huge impact on Americans and an already deeply
unstable world."
if "putin" in sentence.lower():
    print("Putin is mentioned")
```

This code defines the variable `sentence`, then checks to see if the string `putin` is inside the lowercase version of that sentence.

Logical Operators

It's possible to describe any scenario, no matter how complicated, using the *logical operators* `and`, `or`, and `not`. Like comparison operators, logical operators also evaluate to `True` or `False`, and they let you combine comparisons.

For example, say you like astronomy and want to know if it's a good time for stargazing. Let's set this up as a logical expression: if ((it's dark out) **and** (it's **not** raining) **and** (it's **not** cloudy)) **or** (you have access to the James Webb Space Telescope), then yes. Otherwise, no. Logical operators let you define this sort of logic in your Python code.

Like other operators, the `and` and `or` operators compare an expression on the left with an expression on the right. With `and`, if both sides are true, the whole expression is true. If either is false, the whole expression is false. For example:

```
True and True == True
True and False == False
False and True == False
False and False == False
```

With `or`, if either expression is true, the whole expression is true. The whole expression is false only when both expressions are false. For example:

```
True or True == True
True or False == True
False or True == True
False or False == False
```

The `not` expression differs from the others in that it doesn't use an expression to the left, just to the right. It flips true to false, and false to true. For example:

```
not True == False
not False == True
```

In sum, use `and` to determine whether two things are both true, use `or` to determine whether at least one of two things is true, and use `not` to change a true to a false or vice versa. For example, consider this code:

```
if country == "US" and age >= 21:
    print("You can legally drink alcohol")
else:
    if country != "US":
        print("I don't know about your country")
    else:
        print("You're too young to legally drink alcohol")
```

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The first `if` statement has an expression that compares two other expressions, `country == "US"` and `age >= 21`. If `country` is `US` and `age` is greater than or equal to `21`, the expression simplifies to `True and True`. Since both Booleans are true, this evaluates to simply `True`, and the code block after the `if` statement runs, printing `You can legally drink alcohol` to the screen.

The first `else` block determines what happens if that expression evaluates to `False`. For example, if `country` is `Italy`, but `age` is `30`, the expression simplifies to `False and True`. Since at least one of the Booleans is false, this evaluates to simply `False`, so the code block after `else` runs. Likewise, if `country` is `US` but `age` is `18`, then the expression simplifies to `True and False`. This, too, evaluates to `False`, so the code block after `else` runs.

Inside the second `else` block is a simple `if` statement without Boolean logic: if `country` isn't `US`, the screen displays `I don't know about your country`. Otherwise (meaning `country` is `US`), it displays `You're too young to legally drink alcohol`.

Just like with math, you can use parentheses in `if` statements to compare multiple expressions. For example, the drinking age in the US is 21 and the drinking age in Italy is 18. Let's add Italy to this program, this time incorporating an `or` operator:

```
if (country == "US" and age >= 21) or (country == "Italy" and age >= 18):
    print("You can legally drink alcohol")
else:
    if country not in ["US", "Italy"]:
        print("I don't know about your country")
    else:
        print("You're too young to legally drink alcohol")
```

In plain English, the first `if` statement tells the program that if your country is the US and you're at least 21, *or* if your country is Italy and you're at least 18, then you can legally drink. In either case, the whole expression in the `if` statement is true, and the program prints `You can legally drink alcohol`. If just one of those is true and not the other (for instance, if you're a 19-year-old Italian), the whole statement is still true. That's what `or` means: if either of the things you're comparing is true, then the whole expression is true.

Use the operator `not` to turn `True` values into `False` or `False` values into `True`. For example:

```
if country == "US" and not age >= 21:
    print("Sorry, the drinking age in the US is 21")
```

You could replace `not age >= 21` with `age < 21` for the same result.

Exception Handling

Python programs may abruptly quit with an error called an *exception*. This is typically known as "throwing an exception." *Exception handling* ensures that

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your Python code will run another code block when your code catches an exception, instead of quitting with an error.

You've seen a few examples of exceptions already in this chapter, like when you tried dividing by zero (something you can't do in math) or using a variable that hasn't been defined:

```
>>> 15 / 0
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ZeroDivisionError: division by zero
>>> x * 10
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'x' is not defined
```

In these cases, Python threw a `ZeroDivisionError` exception and a `NameError` exception, respectively.

You can write code that catches exceptions when they're thrown, allowing you to handle them gracefully. For example, let's say you have a list of names called `names`, and you want display the first name in the list:

```
>>> names = ["Alice", "Bob", "Charlie"]
>>> print(f"The first name is {names[0]}")
The first name is Alice
```

This code displays the value at `names[0]`, or the first item in the `names` list. This works as expected if there are a few names in the list. But what if `names` is empty?

```
>>> names = []
>>> print(f"The first name is {names[0]}")
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
IndexError: list index out of range
```

In this case, since the index 0 doesn't exist because the list is empty, Python throws an `IndexError` exception.

You can catch this exception using `try` and `except` statements, like this:

```
try:
    print(f"The first name is {names[0]}")
except:
    print("The list of names is empty")
```

This code first runs a `try` statement, followed by a code block. It attempts to run the code in that block, and if it succeeds without hitting an exception, it moves on to the next line of code after the `except` block. However, if it hits an exception, then it runs the code in the `except` block before moving on.

Here's what it looks like when there's no exception:

```
>>> names = ["Alice", "Bob", "Charlie"]
>>> try:
...     print(f"The first name is {names[0]}")
... except:
...     print("The list of names is empty")
...
The first name is Alice
```

In this case, the code block after the try statement ran successfully, so the control flow moved on past the except block.

Here's what it looks like when the exception is thrown, but the code catches it and handles it gracefully:

```
>>> names = []
>>> try:
...     print(f"The first name is {names[0]}")
... except:
...     print("The list of names is empty")
...
The list of names is empty
```

The code block after the try statement ran, but Python threw an IndexError exception when it evaluated names[0]. Instead of crashing and displaying an error, this code caught the exception and the except block ran. In this case, the except statement runs if any exception is thrown in the try block, but you can get more granular than that by using different except statements for different types of exceptions. Consider the following example:

```
try:
    --snip--
except ZeroDivisionError:
    # This catches ZeroDivisionError exception
    --snip--
except NameError:
    # This catches NameError exceptions
    --snip--
except IndexError:
    # This catches IndexError exceptions
    --snip--
except:
    # This catches any other exceptions that haven't been caught yet
    --snip--
```

By using except *Exception*:, where you replace *Exception* with a specific exception you're interested in catching, you can write different code to handle different types of exceptions. You'll revisit exception handling in Chapter 10, when you learn how to work with JSON data, and in the Chapter 14 case study on neo-Nazi chat logs.

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Now that you know how control flow works in Python, you'll practice some basic Python syntax and make comparisons using `if` statements and Boolean logic in the next exercise.

Exercise 7-4: Practice Loops and Control Flow

In social media slang, a common form of mockery is to employ *alternating caps*, or switching from uppercase to lowercase and back to uppercase, when quoting people. For example, here's the text of a viral tweet from the now-suspended Twitter account account *@BigWangTheoryy*:

> *failing classes*
> Me: "Can I get some extra credit?"
> Professor: "cAn i GEt SomE eXtRa creDiT?"

In this exercise, you'll write a Python script that starts with some text and converts it into alternating caps style, using the control flow concepts you learned in the previous section.

In your text editor, create a new file called *exercise-7-4.py*, and start by defining the variable `text`, like this:

```
text = "One does not simply walk into Mordor"
```

The simplest way to write this script is to start with an empty string, called `alternating_caps_text`, and then loop through the characters in `text`, adding characters to `alternating_caps_text` one at a time and alternating their capitalization as you do so. Add a second line to your script defining that variable, like this:

```
alternating_caps_text = ""
```

Next, you'll define a Boolean variable called `should_be_capital`. Each time you loop through a character in `text`, you'll use this Boolean to keep track of whether the current character should be capital or lowercase. For this example, start with a capital letter:

```
should_be_capital = True
```

Beneath that line, add the main part of the script:

```
for character in text:
    if should_be_capital:
        alternating_caps_text += character.upper()
        should_be_capital = False
    else:
        alternating_caps_text += character.lower()
        should_be_capital = True
```

Using a for loop, this code loops through the characters in text, storing each character in the character variable. It then adds these characters to alternating_caps_text, switching between upper- and lowercase.

During each iteration of the for loop, character is another character in text, the variable containing the "One does not simply walk into Mordor" string. The first time the code loops, character is O. When the code reaches the if statement, should_be_capital evaluates to True for this character, so the code block runs. The += operator adds character.upper() (or, the uppercase version of character) to alternating_caps_text. Since the code began by adding a capital letter, you want it to add a lowercase letter next, so you set should_be_capital to False. The code block ends, and the code starts its second loop.

During the second iteration, character is n and should_be_capital evaluates to False. When the code reaches the if statement, the expression evaluates to False, so the else block runs. This is similar to the other block, except that it appends the lowercase version of character, character.lower(), to alternative_caps_text and sets should_be_capital back to True. So far, alternating_caps_text is On.

During the third iteration, character is e and should_be_capital evaluates to True. When the code reaches the if statement, the expression evaluates to True, so that code block runs again, adding a capital E to alternating_caps_text and setting should_be_capital to False again. The code continues in this way for the rest of the characters in text. Note that the uppercase and lowercase versions of the space character, " ".upper() and " ".lower(), are identical. The upper() and lower() methods also don't change punctuation characters like ,, ., !, and so on.

When this for loop is finished, all you have left to do is display the value of alternating_caps_text by adding this line to your script:

```
print(alternating_caps_text)
```

Your Python script is complete (you can also find a complete copy at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-7/exercise-7-4.py*). Run your script. Here's the output I get:

```
micah@trapdoor chapter-7 % python3 exercise-7-4.py
OnE DoEs nOt sImPlY WaLk iNtO MoRdOr
```

Now change the value of text and run the script again. For example, I changed the value to "There are very fine people on both sides":

```
micah@trapdoor chapter-7 % python3 exercise-7-4.py
ThErE ArE VeRy fInE PeOpLe oN BoTh sIdEs
```

You've gained a beginner's understanding of using lists and loops and controlling the flow of execution. I'll conclude the chapter with one more fundamental programming skill: breaking your code down into simpler chunks using functions.

Functions

The more complicated your programs get, the more important it is to break the problems you're trying to solve down into smaller chunks and work on them individually. This allows you to focus on the bigger picture, using those smaller chunks of code as building blocks. In this section, you'll learn how to do this using functions.

Functions, fundamental building blocks of programming, are reusable chunks of code. They take *arguments*—the variables that you pass into a function—as input, and can *return* a value after they finish running. You've already used a few functions that come with Python, like `print()` and `len()`, but you can also define your own function and use it as many times as you want without having to rewrite that code. You'll learn how to do that in this section.

The def Keyword

You can define a new function using the `def` keyword. For example, this code defines a function called `test()`, which prints a string to your terminal:

```
>>> def test():
...     print("this is a test function")
...
>>> test()
this is a test function
```

Function definition lines end with a colon and are followed by an indented code block that defines exactly what the function does: in this case, it displays the string `this is a test function`. This `test()` function doesn't include any arguments, which means every time you run it, it will do the exact same thing.

Listing 7-2 defines a slightly more complicated function, `sum()`, that adds two numbers together.

```
def sum(a, b):
    return a + b
```

Listing 7-2: Defining an example function

This new function takes `a` and `b` as arguments and returns the sum of those two variables. For any function that takes more than one argument, like this one, you separate the arguments with commas (`,`).

Each variable has a *scope*, which describes which parts of your code can use that variable. The arguments of a function (in this case, `a` and `b`), as well as any variables defined inside the function, have a scope that can be accessed only by code in that function's code block. In other words, you can use these `a` and `b` variables only inside the `sum()` function, and they won't be defined outside of that code block.

You can think of defining a function as telling Python, "I'm making a new function with this name, and here's what it does." However, the function itself won't run until you *call* it. Consider the following Python script:

```
def sum(a, b):
    return a + b

red_apples = 10
green_apples = 6
total_apples = sum(red_apples, green_apples)

print(f"There are {total_apples} apples")
```

First, the code defines a function called `sum()` to be a code block with just a `return` statement. This function doesn't run yet. The code then defines the `red_apples` variable, setting its value to `10`, and the `green_apples` variable, setting its value to `6`.

The next line starts with `total_apples =`, but before Python can set the value of that variable, it needs to learn what that value should be. To do that, the code first calls the `sum()` function, passing in the arguments `red_apples` and `green_apples` as `a` and `b`. Now that the code is finally calling this function, `return a + b` runs. In this function call, `a` is `red_apples` and `b` is `green_apples`. The function returns `a + b`, which is `16`. Now that the `sum()` function has returned, the code defines a variable called `total_apples`, setting its value to the return value of the `sum()` function, `16`.

Finally, the code calls the `print()` function, passing in an f-string as an argument, which displays the `total_apples` variable. It will display the message `There are 16 apples`.

Default Arguments

Function definitions can also have *default arguments*, which means defining their value is optional. If you haven't passed in any values for them when the function is called, the default value is used instead.

For example, consider this function, which, given a number and optionally a number of exclamation marks and question marks, prints a greeting using its arguments:

```
def greet(name, num_exclamations=3, num_questions=2):
    exclamations = "!" * num_exclamations
    questions = "?" * num_questions
    print(f"Hello {name}{exclamations}{questions}")
```

The argument `name` is a *positional argument*, which means when you call this function, the first argument you pass in always has to be `name`. However, `num_exclamations` and `num_questions` are default arguments, so passing values in for those is optional. The `greet()` function defines the strings `exclamations` and `questions` and sets them to a series of exclamation points and question marks. (In Python, when you multiply a string by a number, you get the original string repeated multiple times; for example, `"A" * 3` evaluates to the string `AAA`.) The code then displays `Hello`, followed by the value of `name`, followed by the number of exclamation points and question marks passed into the function.

This function has one positional argument (name) and two default arguments (num_exclamations and num_questions). You can call it just passing in name, without passing values in for the default arguments, and they will automatically be set to 3 and 2, respectively:

```
>>> greet("Alice")
Hello Alice!!!??
```

You can also keep the default value for one of the default arguments, but choose a value for another. When you manually choose a value for a default argument, you're using a *keyword argument*. For example:

```
>>> greet("Bob", num_exclamations=5, num_questions=5)
Hello Bob!!!!!?????
>>> greet("Charlie", num_questions=0)
Hello Charlie!!!
>>> greet("Eve", num_exclamations=0)
Hello Eve??
```

The first function call uses keyword arguments for both num_exclamation and num_questions; the second function call uses a keyword argument only for num_questions and uses the default argument for num_exclamations; and the third function call uses a keyword argument for num_exclamations and uses the default argument for num_questions.

Return Values

Functions become a lot more useful when they take some input, do some computation, and then return a value, known as the *return value*. The greet() function just described displays output, but it doesn't return a value that I could save in a variable or pass into further functions. However, the len() function you used earlier takes input (a list or a string), does some computation (calculates the length of the list or string), and returns a value (the length).

Here's an example of a function that takes a string s as an argument and returns the number of vowels in the string:

```
def count_vowels(s):
    number_of_vowels = 0
    vowels = "aeiouAEIOU"
    for c in s:
        if c in vowels:
            number_of_vowels += 1

    return number_of_vowels
```

This function brings together many of the concepts covered in this chapter so far: it defines the variable number_of_vowels as 0, then defines the variable vowels as a string containing lowercase and uppercase English vowels. Next, it uses a for loop to loop through each character in s, the string that's passed into the function.

In each loop, the code uses an `if` statement to check whether the character is a vowel (since `vowels` contains both lowercase and uppercase letters, this code considers both `a` and `A` to be vowels). If the character is a vowel, the code increases the `number_of_vowels` variable by one. Finally, it returns `number_of_vowels`, which equals however many vowels it counted in `s`.

Here are a few examples of calling this function and passing in different strings:

```
>>> count_vowels("THINK")
1
>>> count_vowels("lizard")
2
>>> count_vowels("zzzzzzz")
0
>>>
```

When you define a variable, you can set its value to the return value of a function just by setting the variable equal to that function call:

```
>>> num_vowels_think = count_vowels("THINK")
>>> num_vowels_lizard = count_vowels("lizard")
```

This code defines the variable `num_vowels_think` and sets its value to the return value of `count_vowels("THINK")`, or the number of vowels in the string `THINK`. It also defines the variable `num_vowels_lizard` and sets its value to the return value of `count_vowels("lizard")`.

You can then use those variables to define new variables:

```
>>> total_vowels = num_vowels_think + num_vowels_lizard
>>> print(total_vowels)
3
```

This code adds those two variables together, saving their sum in a new variable called `total_vowels`. It then prints the value of `total_vowels` to the terminal.

When a `return` statement runs, the function immediately ends, so `return` is also useful if you want to stop a function early. For example, the following `is_exciting()` function loops through all the characters in a string `s` to check whether the character is an exclamation point:

```
def is_exciting(s):
    for character in s:
        if character == "!":
            return True

    return False
```

If the function finds an exclamation point, it returns `True`, immediately stopping the function. If it checks each character and finds no exclamation points, it returns `False`. For example, if you call this function and pass in the string `!@#$`, the function will return `True` during the first iteration of the loop and immediately end—it will never even get to the second iteration. If you pass in the string `hello!`, it won't return `True` until the last iteration of the loop, since it doesn't find the `!` until the end of the string. And if you pass in the string `goodbye`, it will loop through the entire string and not find an exclamation point, so it will return `False`.

Docstrings

In *self-documenting* code, documentation is defined as part of the code as docstrings rather than in a separate document. *Docstrings* are strings enclosed by three double quotes (`"""`) or three single quotes (`'''`) on either side, placed as the first line of code after a function definition. When you run the function, the program ignores the docstring, but Python can use it to pull up documentation about the function on request. Docstrings are optional, but they can help other people understand your code.

For example, here's how you'd define the `sum()` function with a docstring:

```
>>> def sum(a, b):
...     """This function returns the sum of a and b"""
...     return a + b
```

This is exactly the same as the `sum()` function defined in Listing 7-2, except it includes a docstring.

If you run the `help()` function, passing in the name of a function (without arguments) as the argument, the Python interpreter will display documentation for that function. For example, running `help(sum)` gives you the following output:

```
Help on function sum in module __main__:

sum(a, b)
    This function returns the sum of a and b
```

The `help()` function works for any function, though it's useful only if the programmer who wrote that function included a docstring. In this case, it tells you that it's showing you help for the function called `sum()` in the `__main__` module. You'll learn more about modules in Chapter 8, but they're essentially functions you write yourself. Try running **`help(print)`** or **`help(len)`** to view the docstrings for the `print()` and `len()` functions.

Press **Q** to get out of the help interface and back to the Python interpreter.

Exercise 7-5: Practice Writing Functions

In this exercise, you'll turn the script you wrote in Exercise 7-4 into a function. You can then call this function multiple times, passing text into it so that it returns an alternating caps version of that text each time.

In your text editor, create a new file called *exercise-7-5.py* and create a new function called `alternating_caps()`, which takes in the argument `text`, like this:

```
def alternating_caps(text):
    """Returns an aLtErNaTiNg cApS version of text"""
```

Next, copy the code from Exercise 7-4 and paste it into this function, making sure to indent it so that it aligns with the docstring. Delete the line that defines the `text` value; instead, define `text` by passing it into the function as an argument. Also change the last line of the Exercise 7-4 code from `print(alternating_caps_text)` to `return alternating_caps_text`. This function shouldn't display the alternating caps version of a string; it should create a variable containing this version of a string and return it.

Your complete function should look like this (you can also find a copy at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-7/exercise-7-5.py*):

```
def alternating_caps(text):
    """Returns an aLtErNaTiNg cApS version of text"""
    alternating_caps_text = ""
    should_be_capital = True

    for character in text:
        if should_be_capital:
            alternating_caps_text += character.upper()
            should_be_capital = False
        else:
            alternating_caps_text += character.lower()
            should_be_capital = True

    return alternating_caps_text
```

Now that you have a function—a reusable chunk of code—you can use it as many times as you want. Call this function a few times, remembering to display its return value using the `print()` function, like this:

```
print("Hacks, Leaks, and Revelations")
print(alternating_caps("This book is amazing"))
print(alternating_caps("I'm learning so much"))
```

You can change the text that you pass in to the `alternating_caps()` function calls to whatever you want.

Here's what it looks like when I run this script:

```
micah@trapdoor chapter-7 % python3 exercise-7-5.py
Hacks, Leaks, and Revelations
ThIs bOoK Is aMaZiNg
I'M LeArNiNg sO MuCh
```

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While the output of this script is displayed in a mocking tone, I hope that the sentiment is true for you!

Summary

This chapter has covered several basic Python programming concepts you'll rely upon in future investigations. You learned to write simple Python scripts that incorporate the major features of the language, including variables, `if` statements, `for` loops, and functions. You're ready to continue your Python programming journey in the next chapter, this time writing code to directly investigate datasets.

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8

WORKING WITH DATA IN PYTHON

The basics of Python are behind you, but there's still a lot to learn. In this chapter, you'll expand your programming skills and start to directly investigate datasets, including BlueLeaks and chat logs leaked from a pro-Putin ransomware gang after Russia invaded Ukraine in 2022.

We'll go over some more advanced Python topics, like how to use modules, how to traverse the filesystem, and how to create your own command line programs in Python. You'll write programs that look through all of the files in a folder, including the hundreds of thousands of files in the BlueLeaks dataset, and learn to add arguments to your programs. You'll also start working with a new type of variable in Python, the dictionary, which will prove handy for working with data that's too complex to store in simple lists. As with the previous chapter, future chapters rely on your understanding of the topics covered here.

Modules

As you learned in Chapter 7, functions are reusable blocks of code that you can run as many times as you want without having to rewrite any code. Python *modules* are similar, but instead of making a single block of code reusable, they make an entire Python file (or multiple files) reusable. You can think of a module as a separate Python file that you can load into the file you're currently working on.

Python includes a wealth of features, but most of them aren't available to every Python script by default. Instead, they're stored in *built-in* modules, those that come with Python. Once you import a module into your script using an `import` statement, you can access all of the functions, variables, and other Python objects defined in that module using the syntax *`module_name.item_name`*.

For example, the `time` module includes the function `time.sleep()` (pronounced "time dot sleep"), which makes your program wait a given number of seconds before continuing to the next line of code. Run the following commands to import the `time` module and then have it tell Python to wait five seconds:

```
>>> import time
>>> time.sleep(5)
```

Your Python interpreter should wait five seconds before the prompt appears again.

Here are a few of the built-in modules I use the most:

`os` Includes useful functions for browsing the filesystem, like `os.listdir()` and `os.walk()`. It also includes the submodule `os.path`, which is full of functions to inspect files. For example, it includes `os.path.isfile()` and `os.path.isdir()`, which help determine whether a specific path is a file or a folder.

`csv` Lets you work with CSV spreadsheet data.

`json` Lets you work with JSON data.

`datetime` Includes useful Python features for working with dates and times. For example, it allows you to convert strings like `February 24, 2022 5:07:20 UTC+3` (the exact time that Russia invaded Ukraine) into a timestamp that Python can understand and compare with other timestamps, then convert it back into strings of any format you choose.

You'll use the `os` module extensively later in this chapter, the `csv` module in Chapter 9, and the `json` module in Chapter 11. You'll briefly see how `datetime` works later in this chapter when you take a look at chat logs from a ransomware gang, as well as in the Chapter 14 case study, where you'll analyze leaked neo-Nazi chat logs.

As your programs get more complex, you might find it useful to split them up into multiple files, with each file containing a different part of your code. When you do this, you're creating your own modules. The name of the module is the same as its filename. For example, if you define some functions in a file called *helpers.py*, another Python file can access those functions by importing the helpers module. The *helpers.py* file could contain the following code:

```
def get_tax(price, tax_rate):
    return price * tax_rate

def get_net_price(price, tax_rate):
    return price + get_tax(price, tax_rate)
```

This module contains two functions for calculating sales tax, get_tax() and get_net_price(). The following Python script, *price.py*, imports it like so:

```
import helpers
total_price = helpers.get_net_price(50, 0.06)
print(f"A book that costs $50, and has 6% sales tax, costs ${total_price}")
```

The first line, import helpers, makes the functions defined in the helpers module accessible to this script. The second line calls the helpers.get_net_price() function from that module and stores the return value in the variable total_price. The third line displays the value of total_price.

Here's what it looks like when I run this script:

```
micah@trapdoor module % python3 price.py
A book that costs $50, and has 6% sales tax, costs $53.0
```

Running the *price.py* script executes the code defined in the helpers module. Inside that module, the get_net_price() function calls get_tax() and uses its return value to calculate the net price, then returns *that* value back into the *price.py* script.

Before you write your first advanced Python script in Exercise 8-1, let's look at the best way to start new Python scripts.

Python Script Template

I use the same basic template for all my Python scripts, putting my code into a function called main(), then calling that function at the bottom of the file. This isn't required (you didn't do this for any of the scripts you wrote in Chapter 7, after all), but it's a good way to organize your code. Here's what it looks like:

```
def main():
    pass

if __name__ == "__main__":
    main()
```

The template defines the `main()` function with a `pass` statement that tells Python, "Skip this line." I later replace `pass` with the real body of the script.

Next, the `if` statement tells Python under which conditions it should run `main()`. Python automatically defines the `__name__` variable, and the definition differs depending on what Python file is being run. If you're running the currently executing Python file directly, then Python sets the value of `__name__` to the `__main__` string. But if you imported the currently executing Python file from another script, Python sets the value of `__name__` to the name of the imported module. Using the example from the previous section, if you run the *helpers.py* script directly, the value of `__name__` inside that script will be `__main__`, but if you run the *price.py* script, then the value of `__name__` will be `__main__` inside *price.py* and the value of `__main__` will be `helpers` inside *helpers.py*.

In short, if you run your script directly, the `main()` function will run. But if you import your script as a module into another script or into the Python interpreter, the `main()` function won't run unless you call it yourself. This way, if you have multiple Python scripts in the same folder, you can have one script import another script to call the functions defined within it without worrying about calling the latter script's `main()` function.

After I create this template script, I start filling in the `main()` function with whatever I want the script to do. Putting the main logic of your script inside a function allows you to use the `return` statement to end `main()` early, which will quit the script early. You can't use `return` when you're not in a function.

In the following exercise, you'll put this into practice by writing a script to start investigating BlueLeaks.

Exercise 8-1: Traverse the Files in BlueLeaks

To efficiently investigate datasets, you need to be able to write code that looks through large collections—sometimes thousands or millions—of files for you. In this exercise, you'll learn various ways to traverse the filesystem in Python using functions in the `os` module, working with the BlueLeaks dataset. You'll also rely on the foundational skills you learned in Chapter 7, like using variables, `for` loops, and `if` statements.

As you read along and run the scripts, feel free to modify the code however you'd like and try running those versions too. You might discover revelations I didn't think to look for.

List the Filenames in a Folder

Start by using `os.listdir()` to list the files in the *BlueLeaks-extracted* folder. In your text editor, create a file called *list-files1.py* and enter this short script (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/list-files1.py*):

```
import os

def main():
    blueleaks_path = "/Volumes/datasets/BlueLeaks-extracted"
    for filename in os.listdir(blueleaks_path):
        print(filename)

if __name__ == "__main__":
    main()
```

First, the script imports the `os` module. It then defines the variable `blueleaks_path` with the path of the *BlueLeaks-extracted* folder (update the script to include the path of this folder on your own computer). The `os.listdir()` function takes the path to the folder as an argument and returns a list of filenames in that folder. The code uses a `for` loop to loop through the output of `os.listdir(blueleaks_path)`, displaying each filename.

NOTE *Windows paths include the backslash character (\), which Python strings consider an escape character. For example, if your* BlueLeaks-extracted *folder is located at* D:\BlueLeaks-extracted*, Python will misinterpret the string* `"D:\BlueLeaks-extracted"`*, assuming that* `\B` *is a special character. To escape your backslashes for any Windows path you store as a string, use* `\\` *instead of* `\`*. In this case, set the* `blueleaks_path` *string to "*`D:\\BlueLeaks-extracted`*".*

Run this script. Here's what the output looks like on my computer:

```
micah@trapdoor chapter-8 % python3 list-files1.py
211sfbay
Securitypartnership
acprlea
acticaz
akorca
--snip--
```

Next, you'll try something slightly more advanced. Instead of just listing the filenames in BlueLeaks, you'll check each filename to see if it's a folder, and if so you'll open each of those folders and count how many files and subfolders they contain.

Count the Files and Folders in a Folder

Create a file called *list-files2.py* and enter the following code (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/list-files2.py*):

```
import os

def main():
    blueleaks_path = "/Volumes/datasets/BlueLeaks-extracted"
  ❶ for bl_folder in os.listdir(blueleaks_path):
        bl_folder_path = os.path.join(blueleaks_path, bl_folder)
```

```
    ❷ if not os.path.isdir(bl_folder_path):
          continue

    ❸ files_count = 0
      folders_count = 0
    ❹ for filename in os.listdir(bl_folder_path):
          filename_path = os.path.join(bl_folder_path, filename)

        ❺ if os.path.isfile(filename_path):
              files_count += 1

          if os.path.isdir(filename_path):
              folders_count += 1

    ❻ print(f"{bl_folder} has {files_count} files, {folders_count} folders")

if __name__ == "__main__":
    main()
```

This script counts the number of files and folders it finds within each BlueLeaks folder. It starts like *list-files1.py* does, importing `os` and defining the `blueleaks_path` variable (remember to update the variable's value to match the correct path on your computer).

The first `for` loop cycles through the filenames in your *BlueLeaks-extracted* folder, this time saving each filename in the `bl_folder` variable, so its value will be something like `miacx` or `ncric` ❶. The script then sets the value of the new `bl_folder_path` variable accordingly. The `os.path.join()` function connects filenames together to make complete paths. Its first argument is the starting path, and it adds all other arguments to the end of that path. For example, if the value of `bl_folder` is `miacx`, then this function will return the string `/Volumes/datasets/BlueLeaks-extracted/miacx` on my computer (the output will be different if your `blueleaks_path` is different, or if you're using Windows and your filenames use backslashes instead of slashes).

Since you want to look inside `bl_folder_path` and count the number of files and folders it contains, the script needs to check that it's actually a folder and not a file, using the `os.path.isdir()` function ❷. If `bl_folder_path` isn't a folder, the script runs the `continue` statement. This statement, which can run only inside of loops, tells Python to immediately continue on to the next iteration of the loop. In short, if the script comes across a file instead of a folder, it ignores it and moves on.

The script then prepares to count the number of files and folders within each individual BlueLeaks folder as the code loops by defining the variables `files_count` and `folders_count` with a value of `0` ❸.

A second `for` loop loops through the files in the BlueLeaks folder from the first `for` loop, saving each filename in the `filename` variable ❹. Inside this loop, the script defines `filename_path` as the absolute path for the filename under consideration. For instance, if the value of `filename` is a string like `Directory.csv`, then the value of `filename_path` would be a string like `/Volumes/datasets/BlueLeaks-extracted/211sfbay/Directory.csv`.

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The script then checks to see if this absolute path is a file or a folder, using the `os.path.isfile()` and `os.path.isdir()` functions ❺. If the path is a file, the script increments the `files_count` variable by 1; if it's a folder, the script increments `folders_count` by 1. When the second `for` loop finishes running, these two variables should contain the total count of files and folder for the BlueLeaks folder you're currently looping through in the first `for` loop. Finally, the script displays an f-string that shows these numbers ❻.

Try running the script. The output should show how many files and folders are contained in each BlueLeaks folder, potentially with the list of folders in a different order:

```
micah@trapdoor chapter-8 % python3 list-files2.py
bostonbric has 506 files, 10 folders
terrorismtip has 207 files, 0 folders
ociac has 216 files, 1 folders
usao has 0 files, 84 folders
alertmidsouth has 512 files, 10 folders
chicagoheat has 499 files, 10 folders
--snip--
```

So far, you've combined various functions in the `os` module to make a list of filenames in your BlueLeaks folder and check whether each name actually refers to a file or to another folder. Now it's time to learn to write code that can also traverse the BlueLeaks folder's nested folders.

Traverse Folders with os.walk()

Let's say you want to write a program that displays all of the files in a folder and its subfolders, and its subsubfolders, and so on. When you have nested folders but don't actually know how deep the folder structure goes, listing all of the filenames just by using `os.listdir()`, `os.path.isfile()`, and `os.path.isdir()` isn't so simple. Python's `os.walk()` function solves this problem.

The `os.walk()` function takes a path to a folder as an argument and returns a list of *tuples*, or multiple values contained in a single value. To define a tuple, you place all of the values, separated by commas, within parentheses. For example, `(3, 4)` is a tuple, as is `("cinco", "seis", "siete")`. Tuples can also contain mixed types like `(1, "dos")` and can contain any number of values.

The `os.walk()` function returns a list of tuples where each tuple contains three values:

```
(dirname, subdirnames, filenames)
```

where `dirname` is a string, `subdirnames` is a list of strings, and `filenames` is a list of strings. For example, the following code loops through the return value of `os.walk(path)`:

```
for dirname, subdirnames, filenames in os.walk(path):
    print(f"The folder {dirname} has subfolders: {subdirnames} and files: {filenames}")
```

When you use `for` loops to loop through lists, you normally assign just a single variable to each item in the list. However, since each item is a tuple, you can assign three variables to it: `dirname`, `subdirnames`, and `filenames`. In each loop, the values for this set of variables will be different: the value of `dirname` is the path to a folder, the value of `subdirnames` is a list of subfolders inside that folder, and the value of `filenames` is a list of files inside that folder.

For example, suppose you have a folder called *example* that contains these subfolders and files:

```
example
├──downloads
│   ├──screenshot.png
│   └──paper.pdf
└──documents
    ├──work
    │   └──finances.xlsx
    └──personal
```

This folder has two subfolders: *downloads* (containing the files *screenshot.png* and *paper.pdf*) and *documents*. The *documents* folder has its own subfolders: *work* (containing *finances.xlsx*) and *personal*.

The following commands loop through the return value of `os.walk("./example")`, where *./example* is the path to this *example* folder, to find the values of `dirname`, `subdirnames`, and `filenames` for each loop:

```
>>> for dirname, subdirnames, filenames in os.walk("./example"):
...     print(f"The folder {dirname} has subfolders: {subdirnames} and files: {filenames}")
...
```

Running this command returns the following output:

```
The folder ./example has subfolders: ['documents', 'downloads'] and files: []
The folder ./example/documents has subfolders: ['personal', 'work'] and files: []
The folder ./example/documents/personal has subfolders: [] and files: []
The folder ./example/documents/work has subfolders: [] and files: ['finances.xlsx']
The folder ./example/downloads has subfolders: [] and files: ['paper.pdf', 'screenshot.png']
```

This code loops once for each folder, including all subfolders, with the path to that folder stored in `dirname`. The list of subfolders in that folder is stored in `subdirnames`, and the list of files is stored in `filenames`. Once you've looped through the folder and all of its subfolders, the `for` loop ends.

Any time you need to traverse all of the files in a dataset that contains lots of nested folders, you'll want to use `os.walk()`. With a single `for` loop, you'll be able to write code that inspects each file in the entire dataset. The `os.walk()` function has many uses, including figuring out which files are the largest or smallest, as you'll see next.

Exercise 8-2: Find the Largest Files in BlueLeaks

In this exercise, you'll use `os.walk()` to write a script that looks through all the files, folders, and subfolders in BlueLeaks; measures the size of each file; and displays the filenames for files over 100MB. This code allows you to loop through all of the files in a folder, no matter how deep the folder structure.

Create a file called *find-big-files.py* and enter the following code (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/find-big-files.py*):

```
import os

def main():
    blueleaks_path = "/Volumes/datasets/BlueLeaks-extracted"
    for dirname, subdirnames, filenames in os.walk(blueleaks_path):
        for filename in filenames:
            absolute_filename = os.path.join(dirname, filename)
            size_in_bytes = os.path.getsize(absolute_filename)
            size_in_mb = int(size_in_bytes / 1024 / 1024)
            if size_in_mb >= 100:
                print(f"{absolute_filename} is {size_in_mb}MB")

if __name__ == "__main__":
    main()
```

Inside the `main()` function, the script first defines the `blueleaks_path` variable as the path of the *BlueLeaks-extracted* folder and loops through all of the files in the entire BlueLeaks dataset using the `os.walk()` function. Inside each loop in the first `for` loop are the `dirname`, `subdirnames`, and `filenames` variables. Each item in the list that `os.walk()` returns represents a different folder or subfolder in the BlueLeaks dataset, so by the time this loop finishes, the code will have traversed the entire dataset.

To find the biggest files, the next step is to look at each file with another `for` loop, this time looping through `filenames`. Inside this second `for` loop, the script defines `absolute_filename` to be the absolute path to the filename. Since `dirname` tells the script which folder it's looking in, and `filename` tells the script which file it's looking at, the script passes these values into `os.path.join()` to combine them, creating the absolute path to the filename.

A new function, `os.path.getsize()`, returns the size, in bytes, of the file under consideration, and stores it in the variable `size_in_bytes`. The script then converts this value from bytes to megabytes (storing that in the variable `size_in_mb`) and checks if it's greater than or equal to 100MB. If it is, the output displays its filename and file size in megabytes with the `print()` function.

Try running the script. It will take longer than the previous scripts in this chapter, because this time, you're measuring the size of every single file in BlueLeaks. Here's what the output looks like when I run it (your output may be displayed in a different order):

```
micah@trapdoor chapter-8 % python3 find-big-files.py
/Volumes/datasets/BlueLeaks-extracted/usao/usaoflntraining/files/VVSF00000/001.mp4 is 644MB
/Volumes/datasets/BlueLeaks-extracted/chicagoheat/html/ZA-CHICAGO HEaT_LR-20160830-034_Final
Files.pdf is 102MB
/Volumes/datasets/BlueLeaks-extracted/nmhidta/files/RFIF300000/722.pdf is 148MB
/Volumes/datasets/BlueLeaks-extracted/nmhidta/files/RFIF200000/543.pdf is 161MB
/Volumes/datasets/BlueLeaks-extracted/nmhidta/files/RFIF100000/723.pdf is 206MB
/Volumes/datasets/BlueLeaks-extracted/fbicahouston/files/VVSF00000/002.mp4 is 145MB
/Volumes/datasets/BlueLeaks-extracted/fbicahouston/files/PSAVF100000/009.mp4 is 146MB
/Volumes/datasets/BlueLeaks-extracted/fbicahouston/files/PSAVF100000/026.mp4 is 105MB
--snip--
```

The script should display the absolute paths of the 101 files in BlueLeaks that are at least 100MB, along with each file's size.

Third-Party Modules

In addition to built-in modules, Python also supports third-party modules that you can easily incorporate into your own code. Most Python scripts that I write, even simple ones, rely on at least one third-party module (when a Python program depends on third-party modules, they're called *dependencies*). In this section, you'll learn how to install third-party modules and use them in your own scripts.

The Python Package Index (PyPI) contains hundreds of thousands of third-party Python *packages*, or bundles of Python modules, and subpackages. Pip, which stands for Package Installer for Python, is a package manager similar to Ubuntu's apt or macOS's Homebrew used to install packages hosted on PyPI. You can search for packages on PyPI's website (*https://pypi.org*), then install a package by running the `python3 -m pip install` *`package_name`* command.

For example, I frequently use a package called Click, which stands for Command Line Interface Creation Kit. The `click` Python module makes it simple to add command line arguments to your scripts. To see what happens when you try importing this module before you've installed it, open a Python interpreter and run **`import click`**. Assuming you don't already have the package installed, you should see a `ModuleNotFoundError` error message:

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ModuleNotFoundError: No module named 'click'
>>>
```

Now exit the Python interpreter and install `click` with pip by running the following command:

```
micah@trapdoor ~ % python3 -m pip install click
Collecting click
  Using cached click-8.1.3-py3-none-any.whl (96 kB)
Installing collected packages: click
Successfully installed click-8.1.3
```

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Open the Python interpreter again and try importing Click once more:

```
>>> import click
>>>
```

If no error messages pop up, you've successfully imported the `click` module, and its additional features are now available for you to use.

The command to uninstall a package is `python3 -m pip uninstall` *`package_name`*. Try uninstalling `click`:

```
micah@trapdoor ~ % python3 -m pip uninstall click
Found existing installation: click 8.1.3
Uninstalling click-8.1.3:
  Would remove:
    /usr/local/lib/python3.10/site-packages/click-8.1.3.dist-info/*
    /usr/local/lib/python3.10/site-packages/click/*
Proceed (Y/n)? y
  Successfully uninstalled click-8.1.3
```

As you can see, when I ran this command, the output listed the files that pip would need to delete to uninstall the `click` module, then asked if I wanted to proceed. I entered Y and pressed ENTER, and the files were deleted and the module uninstalled.

You can install multiple Python packages at once like so:

```
python3 -m pip install package_name1 package_name2 package_name3
```

The same is true of uninstalling.

It's common to define the Python packages that your script requires inside a file called *requirements.txt*, then install all of them at once with the `python3 -m pip install -r requirements.txt` command. For example, suppose in addition to using `click`, you want to use the HTTP client `httpx` to load web pages inside Python and the `sqlalchemy` module to work with SQL databases. To include all three in your Python script, first create a *requirements .txt* file with each package name on its own line:

```
click
httpx
sqlalchemy
```

Then run the following command to install them simultaneously:

```
micah@trapdoor chapter-8 % python3 -m pip install -r requirements.txt
Collecting click
  Using cached click-8.1.3-py3-none-any.whl (96 kB)
Collecting httpx
  Using cached httpx-0.23.0-py3-none-any.whl (84 kB)
--snip--
Successfully installed anyio-3.6.1 certifi-2022.9.24 click-8.1.3 h11-0.12.0 httpcore-0.15.0
httpx-0.23.0 idna-3.4 rfc3986-1.5.0 sniffio-1.3.0 sqlalchemy-1.4.41
```

As you can see, this command installs more than just those three Python packages: `rfc3986`, `certifi`, `sniffio`, and so on are also included. That's because `click`, `httpx`, and `sqlachemy` have dependencies of their own. For example, `httpcore` is a dependency of the `httpx` package, so it installs that as well. To summarize, the *requirements.txt* file defines your project's dependencies, each of which might depend on its own list of packages.

NOTE *To learn more about how to use* `httpx` *and other Python modules to automate interacting with websites, check out Appendix B. I recommend waiting until you complete Chapters 7, 8, 9, and 11, however, since the instructions covered there rely on the skills you'll pick up in those chapters.*

> **VIRTUAL ENVIRONMENTS**
>
> It's not unusual to have multiple versions of Python, and multiple versions of the same dependencies for different projects, installed on the same computer. If you routinely install Python packages with pip for various projects, this can get very messy over time. For example, different projects might depend on different versions of the same module to work, but you can't have two versions of a module installed at the same time—at least not without *virtual environments*, which are like stand-alone folders containing your Python dependencies for a specific project. This way, different projects' dependencies won't trip each other up.
>
> To keep things simple, this book doesn't use virtual environments, and it uses only pip to install Python packages. As long as you don't have multiple Python projects requiring specific versions of the few third-party modules this book uses, you should be fine without using a virtual environment.
>
> You can learn more about virtual environments at *https://docs.python.org/3/tutorial/venv.html*. For larger Python projects, you might also consider using Python package management programs such as Poetry (*https://python-poetry.org*) or Pipenv (*https://github.com/pypa/pipenv*), which handle the complicated parts of keeping track of Python packages and virtual environments for you.

Now that you know how to install third-party modules, you'll practice using Click.

Exercise 8-3: Practice Command Line Arguments with Click

As you learned in the previous section, the Click package makes it simple to add command line arguments to your scripts. You can use it to define variables to pass into your `main()` function from the terminal, without having to define those variables in your code. In this exercise, you'll learn how to use Click by writing a sample script in preparation for using this module in later exercises.

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First, install the Click package with pip again by running **`python3 -m pip install click`**. Next, open your text editor and enter the following Python script, *exercise-8-3.py* (or copy and paste it from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/exercise-8-3.py*):

```
import click

@click.command()
@click.argument("name")
def main(name):
    """Simple program that greets NAME"""
    print(f"Hello {name}!")

if __name__ == "__main__":
    main()
```

First, the script imports the `click` module. It then runs a few *decorators*, function calls that begin with `@` and add functionality to another function you're about to define—the `main()` function, in this case. The `@click.command()` decorator tells Click that `main()` is a CLI command, and the `@click.argument("name")` decorator tells Click that this command has a CLI argument called `name`.

Next, the script defines the `main()` function, which takes `name` as an argument. This function has a docstring, `Simple program that greets NAME`. Click uses this docstring for its commands when it builds the output for `--help`, as you'll see shortly. The `main()` function simply displays a string with the name you passed in as an argument.

Finally, the script calls the `main()` function. Notice that even though `main()` requires an argument (`name`), the script doesn't explicitly pass that argument in when calling the function. This is where the magic of the Click decorators comes in. When the script calls `main()`, Click will figure out what arguments it needs to pass in, find their values from the CLI arguments, and pass them in for you.

Run the script as follows:

```
micah@trapdoor chapter-8 % python3 exercise-8-3.py
Usage: click-example.py [OPTIONS] NAME
Try 'click-example.py --help' for help.

Error: Missing argument 'NAME'.
```

When you run the program, if you don't pass in the correct CLI arguments, Click tells you what you did wrong. As you can see, you're missing the required `NAME` argument. Click also tells you that you can get help by running the script again with the `--help` argument.

Try running the `--help` command:

```
micah@trapdoor chapter-8 % python3 exercise-8-3.py --help
Usage: click-example.py [OPTIONS] NAME

  Simple program that greets NAME

Options:
  --help  Show this message and exit.
```

This time, the output shows a description of the program based on the docstring. Any CLI program that uses Click will display the docstring for the command when you run it with `--help`.

Try running the command again, this time passing in a name. For example, here's what happens when I pass in `Eve` as the name:

```
micah@trapdoor chapter-8 % python3 exercise-8-3.py Eve
Hello Eve!
```

NOTE *You can read more about using Click at* https://click.palletsprojects.com.

Avoiding Hardcoding with Command Line Arguments

As you've seen in previous chapters, CLI arguments let you run the same program in many different ways, targeting different data. For example, in Chapter 4, you used the `du` command to estimate the disk space of a folder by adding the folder's path as an argument. In `du -sh --apparent-size` *`path`*, the arguments are `-sh`, `--apparent-size`, and *`path`*.

The `du` command would be much less useful if it could only measure disk space for a single hardcoded folder. *Hardcoding* means embedding information, like a path, directly into source code. You can avoid hardcoding anything in your CLI programs by having the user provide this information as arguments when running them.

Passing paths into scripts, rather than hardcoding them, makes for a better user experience. In previous exercises in this chapter, you hardcoded the path to your copy of the BlueLeaks dataset into your Python scripts. If you were to pass the appropriate path in as an argument, however, other people could use your script without editing it—they could just pass in *their* path when they ran it.

Using arguments rather than hardcoding can also make your scripts more universally useful. For example, in Exercise 8-2, you wrote a script to find all of the files that are at least 100MB in the BlueLeaks dataset. Using CLI arguments, you could make this script work for any dataset you get your hands on, not just BlueLeaks, and for any minimum file size, allowing you to run it in a variety of situations. You'd just need to pass in the dataset path and the minimum file size as CLI arguments. You'll try this out in the next exercise.

Exercise 8-4: Find the Largest Files in Any Dataset

In this exercise, you'll modify the script you wrote in Exercise 8-2 to make it work for any dataset, and for any minimum file size, using CLI arguments. In the following chapters you'll write simple Python scripts that use Click for CLI arguments, so you can provide the paths to the datasets you'll be working with.

Create a new file called *exercise-8-4.py*, and copy and paste the *exercise-8-2.py* code into it. Next, make the following modifications to the code, highlighted in bold (or find the full modified script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/exercise-8-4.py*):

```
import os
import click

@click.command()
@click.argument("path")
@click.argument("min_file_size", type=click.INT)
def main(path, min_file_size):
    """Find files in PATH that are at least MIN_FILE_SIZE MB big"""
    for dirname, subdirnames, filenames in os.walk(path):
        for filename in filenames:
            absolute_filename = os.path.join(dirname, filename)
            size_in_bytes = os.path.getsize(absolute_filename)
            size_in_mb = int(size_in_bytes / 1024 / 1024)
            if size_in_mb >= min_file_size:
                print(f"{absolute_filename} is {size_in_mb}MB")

if __name__ == "__main__":
    main()
```

This code imports the `click` module at the top of the file. Next, it adds Click decorators before the `main()` function: `@click.command()` makes the `main()` function a Click command, and `@click.argument()` adds `path` and `min_file_size` as CLI arguments. The script specifies with `type=click.INT` that the `min_file_size` argument should be an *integer*, or a whole number, as opposed to a string. Then it adds `path` and `min_file_size` as arguments to the `main()` function and adds a docstring that describes what this command does.

The new script uses CLI arguments instead of hardcoded values. It deletes the line that defines the `blueleaks_path` variable, and in the `os.walk()` function call, it changes `blueleaks_path` to just `path`, which is the CLI argument. Finally, it changes `100` in `size_in_mb >= 100` to `min_file_size`.

You can now use this program to find big files in any folder in the BlueLeaks dataset or elsewhere. For example, here's what it looks like when I search for all files that are at least 500MB in */Applications* on my Mac:

```
micah@trapdoor chapter-8 % python3 exercise-8-4.py /Applications 500
/Applications/Dangerzone.app/Contents/Resources/share/container.tar.gz is 692MB
/Applications/Docker.app/Contents/Resources/linuxkit/services.tar is 577MB
```

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As you can see, I have only two apps installed that include files this big: Dangerzone and Docker Desktop.

Now that you've seen how to add CLI arguments to your Python scripts using Click, you should be able to avoid hardcoding information like dataset paths in your future programs.

Next, we'll switch gears and explore a new powerful type of Python variable called dictionaries.

Dictionaries

In the course of your investigations, sometimes you'll need to keep track of data with more structure than a simple list. To do so, you can use Python dictionaries. Instead of a collection of items, a *dictionary* (*dict* for short) is a collection of keys that map to values. *Keys* are labels that you use to save or retrieve information in a dictionary, and *values* are the actual information being saved or retrieved. Nearly every Python script I write that deals with data uses dictionaries. In this section, you'll learn how to define dictionaries, get values from them, add values to them, and update existing values in them.

Defining Dictionaries

Dictionaries are defined using braces ({ and }), sometimes referred to as curly brackets. Inside the braces is a list of key/value pairs in the format `key: value`, where each pair is separated from the next by commas—for example, `{"country": "Italy", "drinking_age": 18}`. For longer dictionaries, you can make your code more readable by putting each key/value pair on its own line.

Listing 8-1 shows an example dictionary stored in the variable `capitals`.

```
capitals = {
    "United States": "Washington, DC",
    "India": "New Delhi",
    "South Africa": "Cape Town",
    "Brazil": "Brasília",
    "Germany": "Berlin",
    "Russia": "Moscow",
    "China": "Beijing"
}
```

Listing 8-1: A dictionary stored in the `capitals` variable

In this case, the keys are country names and the values are the capitals of those countries.

Each key in a dictionary can have only one value. If you try to set the same key more than once, Python will save the version you last set. For example, if you define a dictionary and use the `name` key more than once, the dictionary will overwrite the previous value with the most recent one:

```
>>> test_dict = {"name": "Alice", "name": "Bob", "hobby": "cryptography"}
>>> print(test_dict)
{'name': 'Bob', 'hobby': 'cryptography'}
```

However, you can also use lists, or other dictionaries, as values:

```
>>> test_dict = {"names": ["Alice", "Bob"], "hobby": "cryptography"}
>>> print(test_dict)
{'names': ['Alice', 'Bob'], 'hobby': 'cryptography'}
```

In this case, the value for the key `names` is `['Alice', 'Bob']`, which itself is a list. You can use a combination of lists and dictionaries to organize pretty much any type of data, no matter how complicated, allowing you to more easily work with it in Python.

Getting and Setting Values

To retrieve an item you've stored inside a dictionary, add square brackets containing the item's key to the end of the dictionary name. If you try to use a key you haven't defined, your script will crash with a `KeyError`. For example, here's how to look up the capitals of certain countries in the `capitals` dictionary:

```
>>> capitals["United States"]
'Washington, DC'
>>> capitals["China"]
'Beijing'
>>> capitals["Kenya"]
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
KeyError: 'Kenya'
```

When you run `capitals["Kenya"]`, Python throws the error message `KeyError: 'Kenya'`. This means that `Kenya` isn't a valid key in the `capitals` dictionary. You can see that the only keys defined in Listing 8-1 are `United States`, `India`, `South Africa`, `Brazil`, `Germany`, `Russia`, and `China`. Because `Kenya` isn't a key in this dictionary, you can't retrieve its value.

You can add new key/value pairs to a dictionary, or update an existing one, like this:

```
>>> capitals["Kenya"] = "Nairobi"
>>> capitals["United States"] = "Mar-a-Lago"
>>> print(capitals)
{'United States': 'Mar-a-Lago', 'India': 'New Delhi', 'South Africa': 'Cape Town', 'Brazil':
'Brasília', 'Germany': 'Berlin', 'Russia': 'Moscow', 'China': 'Beijing', 'Kenya': 'Nairobi'}
```

This code defines a new key, `Kenya`, with the value `Nairobi`. It also updates an existing key, `United States`, to have the value `Mar-a-Lago`, overwriting its old value, which used to be `Washington, DC`.

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Navigating Dictionaries and Lists in the Conti Chat Logs

You can combine dictionaries and lists in a single flexible data structure that allows you to represent a wide variety of information. If you're writing Python code to work with datasets, chances are you're going to need both. You might directly load the data in this format, or you might create your own dictionaries and lists to store aspects of the data.

To describe how to use data structures that include a combination of dictionaries and lists, I'll use an example from a real dataset. The day after Russia invaded Ukraine on February 24, 2022, the notorious Russian ransomware gang Conti, known for hacking companies around the world and extorting millions of dollars from them, published a statement on its website throwing its full support behind the Russian government. It threatened any "enemy" who launched cyberattacks against Russia with retaliation against their "critical infrastructure." Three days later, a Ukrainian security researcher anonymously leaked 30GB of internal data from Conti: hacking tools, training documentation, source code, and chat logs. The Conti chat logs originally came in the form of JSON files, which is structured data, so it can be stored inside dictionaries and lists. When you load JSON files into Python, they'll automatically be loaded as a combination of lists and dictionaries.

In this section, you'll look through some of these chat logs in order to practice working with real leaked data stored in dictionaries and lists. Using Python code, you'll learn how to navigate these structures to access specific pieces of data as well as how to quickly loop through the chat logs and select just the parts you're interested in.

Exploring Dictionaries and Lists Full of Data in Python

You can download the complete Conti dataset from vx-underground (*https://share.vx-underground.org/Conti/*), a website that hosts a database of malware and other hacking information. However, for this section, you'll use just one file from the dataset, *2022-02-24-general.json*, which the Ukranian security researcher extracted from a chat system called RocketChat.

Download *2022-02-24-general.json* from *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/2022-02-24-general.json*. Open a terminal, change to the folder where you stored this file, and open a Python interpreter. Load this file into a dictionary with the following commands:

```
>>> import json
>>> with open("2022-02-24-general.json") as f:
...     data = json.load(f)
...
```

This code uses the `json` module and loads the data from *2022-02-24-general.json* into the `data` variable. The chat logs from this file are too long to display in their entirety, but Listing 8-2 shows a snippet of the value of the `data` dictionary that demonstrates its structure:

```
{
    "messages": [ ❶
        {
--snip--
        },
        {
            "_id": "FmFZbde9ACs3gtw27",
            "rid": "GENERAL",
            "msg": "Некоторые американские сенаторы предлагают помимо соцсетей блокировать в
Россииещё и PornHub!",
            "ts": "2022-02-24T22:02:38.276Z",
            "u": {"_id": "NKrXj9edAPWNrYv5r", "username": "thomas", "name": "thomas"},
            "urls": [],
            "mentions": [],
            "channels": [],
            "md": [
                {
                    "type": "PARAGRAPH",
                    "value": [
                        {
                            "type": "PLAIN_TEXT",
                            "value": "Некоторые американские сенаторы предлагают помимо
соцсетейблокировать в России ещё и PornHub!",
                       }
                    ],
                }
            ],
            "_updatedAt": "2022-02-24T22:02:38.293Z",
        },
        {
--snip--
        },
    ],
    "success": True ❷
}
```

Listing 8-2: Conti chat logs from RocketChat

The `data` variable is a dictionary with two keys, `messages` and `success`. You access the value of the `messages` key, which is a list of dictionaries, using the expression `data["messages"]` ❶. You can tell that the value of `data["messages"]` is a list because it's enclosed in square brackets ([and]), and you can tell that the items inside it are dictionaries because they're enclosed in braces ({ and }). Almost all of the data in this file is stored in this list.

Each dictionary in the `data["messages"]` list describes a chat message. This snippet of code includes only one of the dictionaries, the ninth chat message in the list (I snipped out the first eight messages, so you can't tell that it's the ninth without looking at the original file). You can access the dictionary that contains that specific chat message using the expression `data["messages"][8]`. (Remember, in programming we start counting at 0, not 1, so the first item is at index 0, the second item is at index 1, and so on.) If you run the command `print(data["messages"][8])` to display the dictionary

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for the ninth message, the output should match the message in the listing. Notice that just as you place index numbers within brackets to select from lists, you place keys within brackets to select from dictionaries, like `["messages"]` or `["success"]`.

You can also access the value of the `success` key with `data["success"]`. Its value is the Boolean `True` ❶. I'm not entirely sure what this means, but I suspect that the `success` key was left over from whatever system the Ukrainian researcher used to export these chat messages from RocketChat, confirming that exporting the data was successful and that there were no errors.

The file from which I loaded this code contained 604 different chat messages, each in its own dictionary, that were sent in Conti's #general RocketChat channel on February 24, 2022. I discovered that this list has 604 items by measuring its length with the `len()` function, like this:

```
>>> len(data["messages"])
604
```

The dictionary for each chat message has many keys: `_id`, `rid`, `msg`, `u`, `urls`, and so on.

You can find out what types of data these keys contain using the `for` *`key_variable`* `in` *`dictionary`* syntax, and you can determine a variable's data type using the `type()` function. Try this out using the following commands:

```
>>> for key in data["messages"][8]:
...     print(f"{key}: {type(data['messages'][8][key])}")
...
```

This command loops through the `data["messages"][8]` dictionary and stores each key in the `key` variable. Then, using the `print()` function and an f-string, it displays the key (`key`) and the type of data stored in that key, as shown in the following output:

```
_id: <class 'str'>
rid: <class 'str'>
msg: <class 'str'>
ts: <class 'str'>
u: <class 'dict'>
urls: <class 'list'>
mentions: <class 'list'>
channels: <class 'list'>
md: <class 'list'>
_updatedAt: <class 'str'>
```

In the output, the values at the `_id`, `rid`, `msg`, `ts`, and `_updatedAt` keys are all strings. The value at the `u` key is a dictionary. The value at the `urls`, `mentions`, `channels`, and `md` keys are lists.

You can get the value of the data at the key using `data['messages'][8][key]`. Remember that to retrieve the value of a key in a dictionary, you put the key in square brackets. In this case, the key itself is stored in the variable `key`, so you can get its value by putting `key` inside the square brackets.

To find out what type of data that is, then, just pass the value into the `type()` function.

Selecting Values in Dictionaries and Lists

When working with datasets, you often end up with structures like this: a mess of dictionaries and lists that you need to make sense of. Being able to select the exact values you're looking for is an important skill. To practice navigating through dictionaries and lists, take a closer look at the value of just one of these keys, the `md` key, by running the following command:

```
>>> print(data["messages"][8]["md"])
```

In the output, you can tell that this value is a list because it's surrounded by square brackets:

```
[{'type': 'PARAGRAPH', 'value': [{'type': 'PLAIN_TEXT', 'value': 'Некоторые американские сенаторы предлагают помимо соцсетей блокировать в России ещё и PornHub!'}]}]
```

The list's single item is a dictionary, which is surrounded by braces. The dictionary has a `type` key whose value is `PARAGRAPH`, as well as a `value` key. The value of `value` is another list with one item containing another dictionary; that dictionary itself contains `type` and `value` keys, where the value of `type` is `PLAIN_TEXT`.

These data structures can have as many sublists and subdictionaries as you'd like. To select specific values, after the `data` variable keep adding square brackets containing an index (if it's a list) or a key (if it's a dictionary) until you get to the value you're looking for. For example, use the following command to access the value of the `value` key in the inner dictionary within the inner list, which is in another `value` key in the outer dictionary in the outer list:

```
>>> print(data["messages"][8]["md"][0]["value"][0]["value"])
```

You already know that `data["messages"][8]` is a dictionary that represents a chat message. To find the value of the `md` key in that dictionary, you include`["md"]` in the command. As you can tell from inspecting the structure in Listing 8-2, this is a list with one item, so adding `[0]` selects that item. This item is a dictionary, and you select the value of its `value` key by adding `["value"]`. This item is another list with one item, so you again add `[0]` to select that one item. This is yet another dictionary, so you can select the value of the final inner `value` key by adding another `["value"]`.

You should get the following output:

```
Некоторые американские сенаторы предлагают помимо соцсетей блокировать в России ещё и PornHub!
```

In English, the message that you just displayed says, "Some American Senators suggest blocking PornHub in Russia in addition to social networks!" It was posted right after Russia started its invasion of Ukraine, and

US and European leaders immediately began imposing economic sanctions on Russia. After invading Ukraine, the Russian government censored access to Twitter and Facebook from the Russian internet. Rumors spread that PornHub, a popular American porn website, would block access to Russian users (though this didn't happen). This same user followed up their first post with, "That's it, we're done," and then "They will take away our last joys!"

Analyzing Data Stored in Dictionaries and Lists

Whenever I work with any sort of structured data, I find myself looping through a list of dictionaries and selecting specific pieces of data. As long as you understand its structure, you can write your own similar code to quickly pull out the relevant information, no matter what dataset you're working with. For example, you might want to view the chat logs in the format *timestamp username*: *message* in order to hide the unimportant sections of data so that you can directly copy and paste the relevant parts into machine translation systems like DeepL or Google Translate. Run the following commands to display all of the messages in `data["messages"]` in that format:

```
>>> for message in data["messages"]:
...     print(f"{message['ts']} {message['u']['username']}: {message['msg']}")
...
```

You should get the following output:

```
--snip--
2022-02-24T22:02:49.448Z thomas: последние радости у нас заберут
2022-02-24T22:02:44.463Z thomas: ну все, приплыли)
2022-02-24T22:02:38.276Z thomas: Некоторые американские сенаторы предлагают помимо соцсетей
блокировать в России ещё и PornHub!
2022-02-24T22:00:00.347Z thomas:
2022-02-24T21:58:56.152Z rags: угу :(
--snip--
```

Since `data["messages"]` is a list, each time the `for` loop in this command runs, it updates the value of the `message` variable to a different item in that list. In this case, each item is a different dictionary. Inside the `for` loop, the `print()` function displays three values: the timestamp (`message['ts']`), the username (`message['u']['username']`), and the message itself (`message['msg']`).

You can change this command to display whatever information you'd like from each message. Maybe you're interested is the user's ID rather than their username. In that case, you could display `message['u']['_id']`.

The previous output shows the same messages about PornHub just discussed, as well as a message posted just before that from another user, `rags`. If you're interested in seeing only the messages posted by `rags`, view those by running the following commands:

```
>>> for message in data["messages"]:
...     if message["u"]["username"] == "rags":
...         print(f"{message['ts']} {message['u']['username']}: {message['msg']}")
...
```

This code is similar to the previous example. A `for` loop loops through each message in `data["messages"]`, and then a `print()` statement displays specific pieces of information from that message. This time, though, each loop also contains an `if` statement. Each time the code finds another message, it checks to see if the username is `rags`, and if so, displays the message. Otherwise, it moves on to the next message. You should get the following output:

```
2022-02-24T22:08:49.684Z rags: давай бро спокойной ночи
2022-02-24T22:03:50.131Z rags: сча посмотрю спасиб =)
2022-02-24T21:58:56.152Z rags: угу :(
--snip--
```

Finally, suppose you want to figure out how many messages each person posted, perhaps to find the most active poster in the #general chat room on this day. The simplest way to do this is to create a new empty dictionary yourself and then write code to fill it up. Run the following command to create an empty dictionary called `user_posts`:

```
>>> user_posts = {}
```

The keys in this dictionary will be usernames and the values will be the number of posts from that user. Fill up the `user_posts` dictionary with the following code:

```
>>> for message in data["messages"]:
...     username = message["u"]["username"]
...     if username not in user_posts:
...         user_posts[username] = 1
...     else:
...         user_posts[username] += 1
...
>>>
```

Again, this code uses a `for` loop to loop through the messages. Next, it defines the `username` variable as `message["u"]["username"]`, the username of the person who posted the message the code is currently looping through. Next, using an `if` statement, the code checks to see if this username is already a key in the `user_posts` dictionary. (It's not checking to see if the string `username` is a key, but rather if the *value* of the `username` variable, like `thomas` or `rags`, is a key.)

If this user doesn't exist in the `user_posts` dictionary, the program adds a key to this dictionary and sets the value at that key to `1`, with the line `user_posts[username] = 1`. Otherwise, it increases the value by 1, with

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`user_posts[username] += 1`. By the time the `for` loop finishes running, the `user_posts` dictionary should be complete. The keys should be all of the usernames found in the messages, and the values should be the total number of messages for that user.

Use the following code to display the information inside the `user_posts` dictionary, viewing the data you just collected:

```
>>> for username in user_posts:
...     print(f"{username} posted {user_posts[username]} times")
...
```

You should get the following output:

```
weldon posted 64 times
patrick posted 62 times
rags posted 38 times
thomas posted 58 times
ryan posted 2 times
kermit posted 151 times
biggie posted 39 times
stanton posted 12 times
angelo posted 102 times
Garfield posted 61 times
jaime posted 2 times
grem posted 5 times
jefferson posted 1 times
elijah posted 6 times
chad posted 1 times
```

These are the users who posted in the Conti's #general chatroom, in their RocketChat server, on the day Russia invaded Ukraine in 2022. The user `kermit` posted 151 times, more than any other user.

In these examples, you looped through hundreds of chat messages, but the same concepts would work with millions or billions of messages or with data representing any sort of information.

REVELATIONS IN THE CONTI DATASET

This dataset includes far more chat logs than just a few messages worrying about a porn site getting blocked. The example I used in this section included the chat logs for the #general channel for a single day, but the logs for this RocketChat server span from July 24, 2021, to February 26, 2022. The leak also includes many logs from the chat service known as Jabber, including some where Conti hackers discuss hacking a contributor to the OSINT-based investigative journalism group Bellingcat. The hackers were hoping to find information about Alexei Navalny, the imprisoned Russian opposition leader who survived an FSB assassination attempt.

The anonymous Ukrainian researcher who leaked the Conti dataset told CNN, "I cannot shoot anything, but I can fight with a keyboard and mouse." According to CNN, a few weeks after leaking the data, the researcher successfully slipped out of Ukraine during Russia's invasion, laptop in hand.

From reading the chat logs, I learned that many of the Conti hackers are Russian ultranationalists. Many of them believe Putin's conspiratorial lies about Ukraine, like that it's run by a "neo-Nazi junta," while at the same time making antisemitic comments about Volodymyr Zelenskyy, Ukraine's Jewish president. You can see my full reporting on this dataset at *https://theintercept.com/2022/03/14/russia-ukraine-conti-russian-hackers/*.

In this section, you learned how to work with flexible data structures that combine dictionaries and lists, including how to pick out specific elements that you're interested in, and how to quickly traverse them by looping through them. These skills will often prove useful when you're writing Python scripts to help you analyze data.

Now that you're familiar with data structures that combine dictionaries and lists, it's time to create your own to map out the CSV files in BlueLeaks.

Exercise 8-5: Map Out the CSVs in BlueLeaks

Each folder in BlueLeaks includes data from a single hacked law enforcement website in the form of hundreds of CSV files. These files contain some of the most interesting information in all of BlueLeaks, such as the contents of bulk email that fusion centers sent to local cops, or "suspicious activity reports." In this exercise, you'll construct a map of the contents of the dataset.

By manually looking in different BlueLeaks folders, I noticed that each folder seems to have a file called *Company.csv* (each containing different content), but only one folder, *ncric*, has a file called *911Centers.csv*. Clearly, not all of the BlueLeaks sites have the same data. Which CSV files are in every folder in BlueLeaks, which are in some folders, and which are unique to a single folder? Let's write a Python script to find out.

As with most programming problems, there are multiple ways you could write a script that answers this question. If you feel comfortable enough with Python by now that you'd like a challenge, try writing one on your own. Otherwise, follow along with this exercise. Either way, the program must meet the following requirements:

- Make the script accept a CLI argument called `blueleaks_path` using Click.
- Create an empty dictionary called `csv_to_folders`. Your script should fill this dictionary with data. The keys should be CSV filenames, and

the values should be lists of BlueLeaks folders that contain this CSV data.

- Loop through all of the files and folders in `blueleaks_path`. For each folder, loop through all of the files it contains. For each CSV file, add data to the `csv_to_folders` dictionary.
- Display the contents of the `csv_to_folders` dictionary.

In each step that follows, I'll quote a snippet of code, explain how it works, and give you a chance to run it as is. You'll then add more features to that code and run it again. It's good practice to write code in small batches, pausing frequently to test that it works as you expect. This will help you catch bugs early, making the process of debugging much simpler.

Accept a Command Line Argument

Create an *exercise-8-5.py* file and enter the Python template:

```
def main():
    pass

if __name__ == "__main__":
    main()
```

Next, instead of hardcoding the path to the BlueLeaks data like you did in Exercise 8-2, let's use Click to pass in the path as a command line argument, `blueleaks_path`. To do so, make the following modifications to your code (the added syntax is highlighted in bold):

```
import click

@click.command()
@click.argument("blueleaks_path")
def main(blueleaks_path):
    """Map out the CSVs in BlueLeaks"""
    print(f"blueleaks_path is: {blueleaks_path}")

if __name__ == "__main__":
    main()
```

This code modifies the template to import the `click` module, adds the correct decorators before the `main()` function, adds the `blueleaks_path` argument to the `main()` function, and adds a simple docstring to the `main()` function so that running this script with `–help` will be more useful. Finally, it includes a line to display the value of `blueleaks_path`, so that you can confirm the code is working when you run it.

Try running your script with `–help` to see if the help text works, and with a value for `blueleaks_path` to see if the argument is successfully sent to the `main()` function:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py --help
Usage: exercise-8-4.py [OPTIONS] BLUELEAKS_PATH

  Map out the CSVs in BlueLeaks

Options:
  --help  Show this message and exit.
micah@trapdoor chapter-8 % python3 exercise-8-5.py test-path
blueleaks_path is: test-path
```

If your output looks like this, everything is working correctly so far.

Loop Through the BlueLeaks Folders

Now that you can use the `blueleaks_path` CLI argument, make the following modifications to your code to have it loop through all of the folders it finds in that path:

```
import click
import os

@click.command()
@click.argument("blueleaks_path")
def main(blueleaks_path):
    """Map out the CSVs in BlueLeaks"""
    for folder in os.listdir(blueleaks_path):
        blueleaks_folder_path = os.path.join(blueleaks_path, folder)

        if os.path.isdir(blueleaks_folder_path):
            print(f"folder: {folder}, path: {blueleaks_folder_path}")

if __name__ == "__main__":
    main()
```

First, you import the `os` module in order to be able to list all of the files in the *BlueLeaks-extracted* folder using the `os.listdir()` function. Inside the `main()` function, a `for` loop loops through the return value of `os.listdir(blueleaks_path)`, the list of filenames inside the folder at `blueleaks_path`.

Inside the loop, the code defines `blueleaks_folder_path` as the path of the specific BlueLeaks folder for the current loop. For example, if the value of `blueleaks_path` is */Volumes/datasets/BlueLeaks-extracted*, and at this point in the `for` loop, the value of `folder` is *icefishx*, then the value of `blueleaks_folder_path` will be */Volumes/datasets/BlueLeaks-extracted/icefishx*.

You want to look inside subfolders in the *BlueLeaks-extracted* folder, not inside files. If there are any files in that folder, you want to skip them. To meet these requirements, the code includes an `if` statement that checks whether `blueleaks_folder_path` is actually a folder. Finally, the code displays the current value of `folder` and `blueleaks_folder_path`.

Run your script again. This time, pass in the real path to your *BlueLeaks-extracted* folder:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py /Volumes/datasets/BlueLeaks-extracted
folder: bostonbric, path: /Volumes/datasets/BlueLeaks-extracted/bostonbric
folder: terrorismtip, path: /Volumes/datasets/BlueLeaks-extracted/terrorismtip
folder: ociac, path: /Volumes/datasets/BlueLeaks-extracted/ociac
--snip--
```

The output should show that the `folder` variable holds just the name of the folder, like *bostonbric*, and the `blueleaks_folder_path` variable includes the full path to that folder, like */Volumes/datasets/BlueLeaks-extracted/bostonbric*. When you run this on your own computer, you may see these values in a different order than what's shown here.

Fill Up the Dictionary

You now have a script that accepts `blueleaks_path` as a CLI argument and then loops through every folder in that path. This code creates the `csv_to_folders` dictionary and starts to fill it up with data:

```
import click
import os

@click.command()
@click.argument("blueleaks_path")
def main(blueleaks_path):
    """Map out the CSVs in BlueLeaks"""
    csv_to_folders = {}

    for folder in os.listdir(blueleaks_path):
        blueleaks_folder_path = os.path.join(blueleaks_path, folder)

        if os.path.isdir(blueleaks_folder_path):
            for filename in os.listdir(blueleaks_folder_path):
                if filename.lower().endswith(".csv"):
                    if filename not in csv_to_folders:
                        csv_to_folders[filename] = []

                    csv_to_folders[filename].append(folder)

if __name__ == "__main__":
    main()
```

Your goal with this script is to map out which CSV files are in which BlueLeaks folders. To store this data, the code creates the empty dictionary `csv_to_folders` at the top of the `main()` function. The next step is to fill up that dictionary.

The code loops through all of the filenames in `blueleaks_path`, checking each to see if it's a folder. Removing the `print()` statement in the previous iteration of the code, this code instead adds a second `for` loop that loops through all of the files in that specific BlueLeaks folder.

In this second `for` loop, an `if` statement checks whether the filename ends in *.csv*. This `if` statement calls `lower()` method on the `filename` string,

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which returns a lowercase-only version of the string. The code then calls the `endswith()` method on that lowercase string, which returns a Boolean describing whether the string ends with the string that was passed in. If the string `filename` ends with *.csv*, *.CSV*, *.cSv*, the `lower()` method will convert the file extension to *.csv*, and `endswith()` will return `True`. If `filename` ends with anything else, like *.docx*, then `endswith()` will return `False`.

Each time the code following this `if` statement runs, it means the program has found a CSV (called `filename`) in the current BlueLeaks folder (called `folder`). You want `csv_to_folders` to be a dictionary where the keys are CSV filenames and the values are lists of folders. This code checks to see if the key `filename` has been created in `csv_to_folders`, and if it hasn't, creates it and set its value to an empty list (`[]`). Finally, after the code has confirmed that the `filename` key has been created and is a list, it appends the value of `folder` to that list.

These last lines are tricky, so let's dig in a little more. The first time the script comes across a CSV filename (like *CatalogRelated.csv*), the script sets the value of that key in `csv_to_folders` to an empty list. If the same filename exists in another BlueLeaks folder later on, the expression `filename not in csv_to_folders` will evaluate to `False` (meaning `csv_to_folders["CatalogRelated.csv"]` already exists), so the code following the `if` statement won't run. Finally, the code appends `folder`, the name of the BlueLeaks folder it's currently looking in, to the list of folders that include that filename.

Pause and try running the script so far:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py /Volumes/datasets/BlueLeaks-extracted
```

This should take a moment to run but displays nothing, since you're not yet using the `print()` function anywhere. The code is simply creating the `csv_to_folders` dictionary and filling it up with data.

Display the Output

By the time the previous version of the script runs, the `csv_to_folders` dictionary should contain a complete set of CSV filenames, mapped to the BlueLeaks sites where they were found. The following code should show you what the program found:

```
import click
import os

@click.command()
@click.argument("blueleaks_path")
def main(blueleaks_path):
    """Map out the CSVs in BlueLeaks"""
    csv_to_folders = {}

    for folder in os.listdir(blueleaks_path):
        blueleaks_folder_path = os.path.join(blueleaks_path, folder)
```

```
        if os.path.isdir(blueleaks_folder_path):
            for filename in os.listdir(blueleaks_folder_path):
                if filename.lower().endswith(".csv"):
                    if filename not in csv_to_folders:
                        csv_to_folders[filename] = []

                    csv_to_folders[filename].append(folder)

    for filename in csv_to_folders:
        print(f"{len(csv_to_folders[filename])} folders | {filename}")

if __name__ == "__main__":
    main()
```

The added code loops through all of the keys (each a CSV filename) in `csv_to_folders`, then displays the number of BlueLeaks folders that contain that file (`len(csv_to_folders[filename])`) along with the filename itself.

You can find this final script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/exercise-8-5.py*. When you run it, the output should look like this:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py /Volumes/datasets/BlueLeaks-extracted
161 folders | CatalogRelated.csv
161 folders | Blog.csv
161 folders | EmailBuilderOptions.csv
--snip--
1 folders | HIDTAAgentCategory.csv
1 folders | Lost.csv
1 folders | AgencyContacts.csv
```

Since this script displays the number of folders at the beginning of each line of output, you can pipe the output into `sort -n` to sort it numerically in ascending order, like so:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py /Volumes/datasets/BlueLeaks-extracted | sort
-n
1 folders | 1Cadets.csv
1 folders | 1Mentors.csv
1 folders | 1Unit.csv
--snip--
161 folders | VideoDownload.csv
161 folders | VideoHistory.csv
161 folders | VideoOptions.csv
```

Most of the CSV files are in either a single folder or all 161 folders. However, there are a few exceptions: *Donations.csv* should be in 10 folders, *SARs.csv* should be in 25, and so on. This information would have taken you many hours of busywork to find manually.

At this point, you've learned the basics of navigating the filesystem in Python. You've seen how to loop through folders using `os.listdir()`, loop through entire folder structures using `os.walk()`, and look up information

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about the files and folders you find. In the next section, you'll learn how to actually read the contents of a file you find and create new files yourself.

Reading and Writing Files

To follow the rest of this book, you'll need to know one more major Python concept: how to read and write files. During a data investigation, you'll almost certainly need to read the contents of files, especially CSV and JSON files. You'll also probably want to be able to create new files, by calculating some data of your own and saving it to a spreadsheet, for example. In this section you'll learn how to open files and write or read content to them.

In programming, to work with a file, you first need to open it and specify the *mode*—that is, whether you're planning on *reading* from or *writing* to this file. To open an existing file and access its contents, open it for reading using mode `r`. To create a new file and put data in it, open it for writing using mode `w`.

Opening Files

To prepare to work with a file, whether for writing or reading, you use the built-in Python function `open()`. To open it for reading, you use the following code:

```
with open("some_file.txt", "r") as f:
    text = f.read()
```

This code uses a `with` statement, which tells Python that after the `open()` function is done running, it should set the variable `f` to that function's return value. The `f` variable is a *file object*, a type of variable that allows you to read or write data to a file. The first argument to the `open()` function is a path, and the second argument is the mode, which in this example is `"r"` for reading.

In the code block after the `with` statement, you can call methods on `f` to interact with the file. For example, `f.read()` will read all of the data in the file and return it, in this case storing it in the `text` variable.

To open a file for writing, you set the mode to `"w"` like so:

```
with open("output.txt", "w") as f:
    f.write("hello world")
```

The `open()` function returns the file object `f`. To write data into the file, you can use the `f.write()` method. Here, this code is opening a file called *output.txt* and writing the string `hello world` to it.

In the next two sections, you'll learn more about using `f.write()` to write to files, and `f.read()` and `f.readlines()` to read from files.

Writing Lines to a File

Text files are made up of a series of individual characters. Consider a text file with these contents:

```
Hello World
Hola Mundo
```

You could also represent the entire contents of this file as a Python string:

```
"Hello World\nHola Mundo\n"
```

The first character of the string is `H`, then `e`, then `l`, and so on. The 12th character (counting the space), `\n`, is a special character known as a *newline* that represents a break between lines. As with shell scripting, the backslash is the escape character in Python, so a backslash followed by another character represents a single special character.

Newlines are used to write lines to a file. Try running these commands in your Python interpreter:

```
>>> with open("output.txt", "w") as f:
...     f.write("Hello World\n")
...     f.write("Hola Mundo\n")
...
12
11
```

The `12` and `11` in the output represent the number of bytes written. The first `f.write()` call wrote 12 bytes, because the string `Hello World` takes 11 bytes of memory: it has 11 characters, plus 1 for the newline character. The second call wrote 11 bytes, since `Hola Mundo` takes 10 bytes of memory, plus 1 for the newline character.

In your terminal, use the following command to view the file you just wrote:

```
micah@trapdoor ~ % cat output.txt
Hello World
Hola Mundo
```

If you had written the same code but without the newlines, the output would have been `Hello WorldHola Mundo`, with no line breaks.

Reading Lines from a File

Run the following command to read the file you just created:

```
>>> with open("output.txt", "r") as f:
...     text = f.read()
...
```

This code reads all of the data from the file and saves it in the string text. In fact, this might look familiar: earlier in this chapter, in the "Exploring Dictionaries and Lists Full of Data in Python" section, we used similar code to load the leaked Conti chat logs into a Python dictionary.

Since splitting text files into multiple lines is so common, file objects also have a convenient method called readlines(). Instead of reading all of the data into a file, it reads only one line at a time, and you can loop over the lines in a for loop. Try this out by running the following commands:

```
>>> with open("/tmp/output.txt", "r") as f:
...     for line in f.readlines():
...         print(line)
...
Hello World

Hola Mundo
```

This code opens the file for reading, then loops through each line in the file. Each line is stored in the variable line, then displayed with the print() function. Because the line variable in each loop ends in \n (for example, the first line is Hello World\n, not Hello World), and the print() function automatically adds an extra \n, the output shows an extra hard return after each line.

If you don't want to display these extra newlines, you can use the strip() method to get rid of any whitespace (spaces, tabs, or newlines) from the beginning and end of the string. Run the same code, but this time strip out the newline characters on each line:

```
>>> with open("/tmp/output.txt", "r") as f:
...     for line in f.readlines():
...         line = line.strip()
...         print(line)
...
Hello World
Hola Mundo
```

You'll practice the basics of how to read and write files in Python in the following exercise.

Exercise 8-6: Practice Reading and Writing Files

In Exercise 7-5, you wrote a function that converts a string to an alternating caps version, like This book is amazing to ThIs bOoK Is aMaZiNg. To practice your newfound reading and writing files, in this exercise, you'll write a script to create an alternating caps version of all of the text in an entire text file.

If you'd like a challenge, you can try programming your own script to meet the following requirements:

- Accepts two CLI arguments, `input_filename` and `output_filename`, using Click.
- Opens the file `input_filename` for reading and loads its contents into the string `text`.
- Opens the file `output_filename` for writing and saves the alternating caps version of `text` to that new file.

Otherwise, follow along with my explanation of the following code, which implements this iNcReDiBlY uSeFuL command line program.

Start by copying the `alternating_caps()` function that you wrote in Exercise 7-5 into a new Python script called *exercise-8-6.py*. Next, make the modifications highlighted in bold here (or copy the final script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/exercise-8-6.py*):

```
import click

def alternating_caps(text):
    """Returns an aLtErNaTiNg cApS version of text"""
    alternating_caps_text = ""
    should_be_capital = True

    for character in text:
        if should_be_capital:
            alternating_caps_text += character.upper()
            should_be_capital = False
        else:
            alternating_caps_text += character.lower()
            should_be_capital = True

    return alternating_caps_text

@click.command()
@click.argument("input_filename")
@click.argument("output_filename")
def main(input_filename, output_filename):
    """Converts a text file to an aLtErNaTiNg cApS version"""
    with open(input_filename, "r") as f:
        text = f.read()

    with open(output_filename, "w") as f:
        f.write(alternating_caps(text))

if __name__ == "__main__":
    main()
```

This code first imports the `click` module, used for the CLI arguments, and then defines the `alternating_caps()` function. Again, the `main()` function is a Click command, but this time it takes two arguments, `input_filename` and `output_filename`.

Once the `main()` function runs, the section for reading and writing files runs. The code opens `input_filename` for reading and loads all of the contents of that file into the string `text`. It then opens `output_filename` for writing and saves the alternating caps version of that string into the new file. It does so by running `alternating_caps(text)`, which takes `text` as an argument and returns its alternating caps version, and then passes that return value directly into `f.write()`, writing it to the file.

To demonstrate how this script works, try running it on the famous "To be, or not to be" soliloquy from *Hamlet*. First, save a copy of the soliloquy found at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-8/shakespeare.txt* to a file called *shakespeare.txt*. Here are the original contents of *shakespeare.txt*, displayed using the `cat` command:

```
micah@trapdoor chapter-8 % cat shakespeare.txt
To be, or not to be, that is the question:
Whether 'tis nobler in the mind to suffer
The slings and arrows of outrageous fortune,
Or to take Arms against a Sea of troubles,
And by opposing end them: to die, to sleep
No more; and by a sleep, to say we end
--snip--
```

Next, pass that filename into your script to create an alternating caps version of that file. Here's what happens when I do it:

```
micah@trapdoor chapter-8 % python3 exercise-8-5.py shakespeare.txt shakespeare-mocking.txt
micah@trapdoor chapter-8 % cat shakespeare-mocking.txt
To bE, oR NoT To bE, tHaT Is tHe qUeStIoN:
wHeThEr 'TiS NoBlEr iN ThE MiNd tO SuFfEr
tHe sLiNgS AnD ArRoWs oF OuTrAgEoUs fOrTuNe,
Or tO TaKe aRmS AgAiNsT A SeA Of tRoUbLeS,
aNd bY OpPoSiNg eNd tHeM: tO DiE, tO SlEeP
No mOrE; aNd bY A SlEeP, tO SaY We eNd
--snip--
```

First, I ran the script, passing in *shakespeare.txt* as `input_filename` and *shakespeare-mocking.txt* as `output_filename`. The script itself displayed no output (it doesn't include any `print()` statements), but it did create a new file. I then used `cat` to display the contents of that new file, which is indeed an alternating caps version of Hamlet's soliloquy.

Summary

Congratulations on making it through a crash course in the fundamentals of Python programming! You've learned how to bring extra functionality to your scripts with built-in and third-party Python modules. You've also learned how to make your own CLI programs using Click, how to write code that traverses the filesystem, how to work with structured data using dictionaries and lists, and how to read and write files.

You'll use these skills throughout the following chapters as you dig through various datasets, uncovering revelations you'd never discover

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otherwise. In the next chapter, you'll write Python programs that loop through rows in the BlueLeaks CSV spreadsheets, transforming the data into a more workable format. You'll get practice writing the content of law enforcement bulk email messages to files, and you'll use Python to create your own CSV spreadsheets.

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PART IV

STRUCTURED DATA

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9

BLUELEAKS, BLACK LIVES MATTER, AND THE CSV FILE FORMAT

The BlueLeaks dataset is full of an overwhelming number of documents, but it's not immediately obvious where to start or how to make sense of the data they contain. Before beginning an investigation, I needed a way to efficiently determine the significance of these documents. After manually digging through many files, I discovered that the context I needed was in the hundreds of CSV spreadsheets in each BlueLeaks folder. In this chapter, you'll learn how to investigate CSV files like these yourself.

You'll view CSVs in both graphical spreadsheet and text editing software, write Python code to loop through the rows of a CSV, and save CSVs of your own. You'll then put this knowledge into practice by digging through the CSVs in the BlueLeaks dataset, focusing on data from the NCRIC fusion center. This is the data I myself have primarily focused on

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since BlueLeaks was published years ago, but there are over a hundred other folders in the dataset full of newsworthy revelations. By the end of this chapter, you'll have the tools to continue investigating these folders, as well as similar datasets loaded with CSVs.

Installing Spreadsheet Software

The most user-friendly way to view the contents of a CSV file is to open it using spreadsheet software such as LibreOffice Calc, Microsoft Excel, Apple Numbers, or Google Sheets. Spreadsheet software is a great option to see the data you're dealing with in an organized way, and it can also be a powerful tool to analyze CSVs. However, in many cases, depending on the data you're working with, you'll need to go beyond such software and write custom code to work with CSVs.

If you already have a favorite spreadsheet program, you can use that for the projects in this book. If not, I suggest using LibreOffice Calc since it's free, open source, and available for Windows, macOS, and Linux; it's also what I've used for the examples in this chapter. Installing LibreOffice (*https://www.libreoffice.org*) installs a whole suite of office software, including Calc.

Alternatively, Microsoft Excel is a good option, but it costs money and isn't available for Linux. If you have a Mac, you can also use Apple's free spreadsheet software, Numbers. Finally, you can consider using Google Sheets, the spreadsheet feature of Google Docs. Google Docs is free and works in Windows, macOS, and Linux, since it's web-based. The problem with Google Sheets and any other cloud-based spreadsheet software (like the web-based version of Microsoft Excel) is that you have to upload a copy of your CSV file to a third-party service before you can view it. For public datasets like BlueLeaks, this is okay. However, it's better to use desktop spreadsheet software when you're dealing with more sensitive datasets.

Spreadsheet software, when used with more complicated spreadsheet formats such as Microsoft Excel files (*.xlsx*) or ODF Spreadsheet files (*.ods*), is powerful and feature-rich. It can do math, like summing all of the values in a column, and visualize data, like creating pie charts or line graphs. None of these features are supported in CSV files, though, so I won't discuss them in this book.

Once you have your spreadsheet software installed, you're ready to learn more about the structure of CSV files.

Introducing the CSV File Format

You can think of spreadsheets as tables of data. The top row normally has headers for each column, and the rest of the rows represent data that matches those headers. CSV is the simplest spreadsheet format. You can open CSV files using software like Microsoft Excel or LibreOffice Calc, or you can view them in a text editor and use CLI tools like `grep` to search them.

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BlueLeaks is full of CSV files, but the original data from the fusion center websites wasn't in that format. The BlueLeaks dataset includes source code for those websites, and by reviewing that I discovered that each site had actually stored its data in a Microsoft Access database file. The BlueLeaks hacker exported tables from the Access databases and saved that data in CSV format before leaking it to DDoSecrets.

CSV files are simply text files made up of multiple lines representing rows in a table. Each line contains a list of values, usually separated by commas (hence the name *comma-separated values*), with each value representing a *cell* in the spreadsheet. Sometimes a spreadsheet row is referred to as a *record*, with each cell in that row referred to as a *field* in that record. Typically, each row contains the same number of cells.

Here's an example CSV file called *city-populations.csv*:

```
City,Country,Population
Tōkyō,Japan,37400000
Delhi,India,28514000
Shanghai,China,25582000
São Paulo,Brazil,21650000
Mexico City,Mexico,21581000
Cairo,Egypt,20076000
```

You can find a copy of this file in the book's GitHub repository at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-9/city-populations.csv*. I'll use this file as an example CSV later in this chapter, so download it now (or reenter it) and save it in a folder for this chapter's exercises.

Table 9-1 shows the data from the *city-populations.csv* file organized into rows and columns.

Table 9-1: City Populations

City	Country	Population
Tōkyō	Japan	37,400,000
Delhi	India	28,514,000
Shanghai	China	25,582,000
São Paulo	Brazil	21,650,000
Mexico City	Mexico	21,581,000
Cairo	Egypt	20,076,000

When a value includes commas, it must be surrounded by quotation marks. For example, the values "Hello, World" and "Hola, Mundo" both contain commas. Here's how they look in a CSV file along with fields for their respective languages:

```
Language,Greeting
English,"Hello, World"
Español,"Hola, Mundo"
```

Table 9-2 shows this data organized into rows and columns.

Table 9-2: Translations of "Hello, World"

Language	Greeting
English	Hello, World
Español	Hola, Mundo

It's common to enclose every value in quotes, regardless of whether or not it includes commas. Here's another version of the previous spreadsheet, now with every value in quotes:

```
"Language","Greeting"
"English","Hello, World"
"Español","Hola, Mundo"
```

As with shell scripting and Python programming, you can escape quotes in CSVs by using a backslash and double quotes (`\"`). For example, the value `"Not I," said the cow` contains both quotes and commas, so to add it to a CSV file you would surround the entire value in quotes and escape the inner quotes, like this:

```
"\"Not I,\" said the cow"
```

Because the CSV file format is so simple, it's one of the most commonly used spreadsheet formats, especially for anyone working with spreadsheets using code. Like CSVs, SQL databases also store *tabular data* (data that can be represented in a table), so CSVs are a convenient format for exporting tables from them. In fact, all of the CSVs in BlueLeaks are exported SQL tables from the databases that power law enforcement and fusion center websites. (You'll learn about SQL databases in Chapter 12; for now, you'll work with the exported CSVs.)

Now that you understand a bit about the CSV file format, let's take a look at some real CSV data from BlueLeaks.

Exploring CSV Files with Spreadsheet Software and Text Editors

In your graphical file browser (such as Explorer in Windows or Finder in macOS), browse to the *BlueLeaks-extracted* folder on your USB disk. You'll start by examining the *dediac* subfolder, which contains data from the Delaware Information Analysis Center. Scroll through the files in this folder—nearly all of them are CSVs—and open *Documents.csv* in your graphical spreadsheet software.

When you open a file in LibreOffice Calc or other spreadsheet software, you'll likely be presented with a window asking you to confirm the settings for this CSV. Figure 9-1 shows the window that pops up when I open *Documents.csv* in LibreOffice Calc on my Mac.

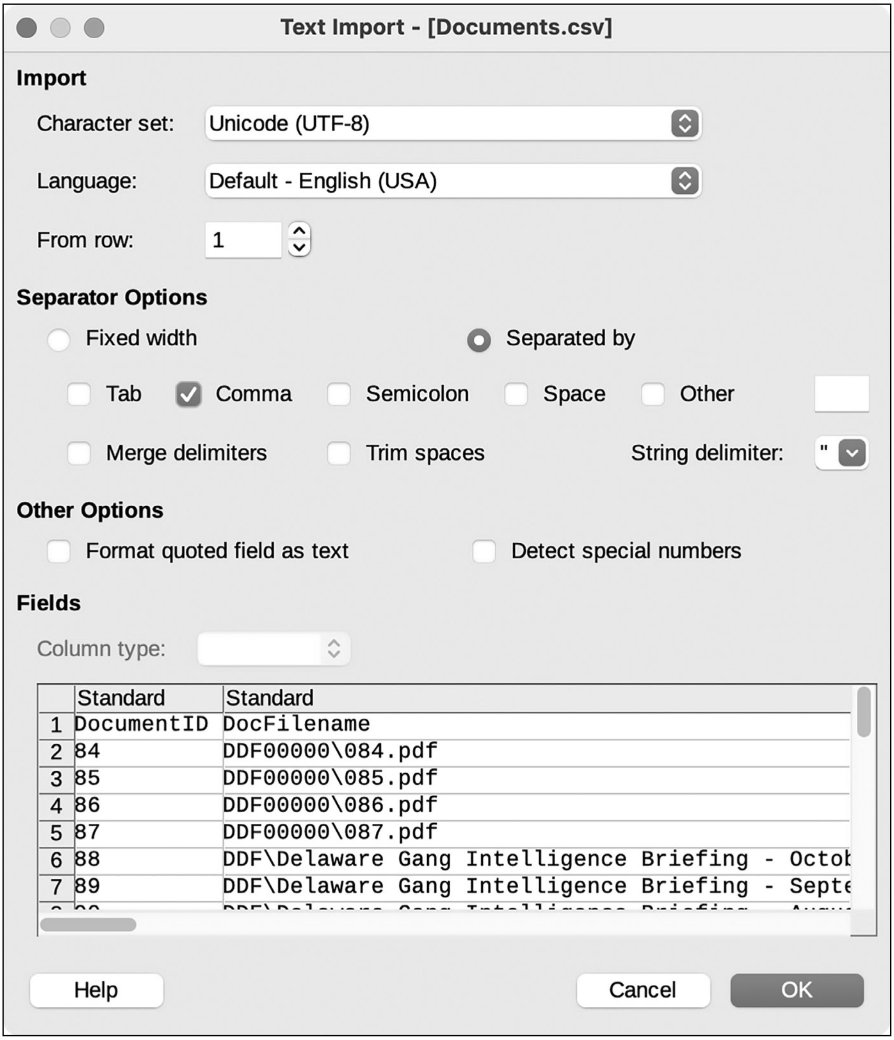
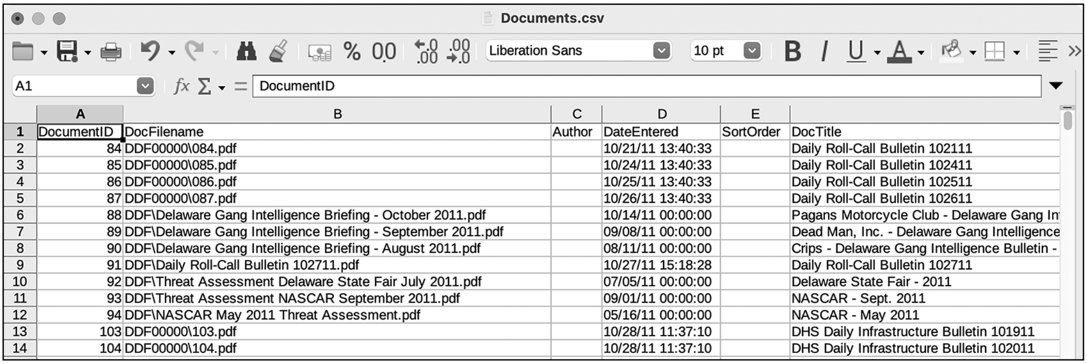


Figure 9-1: The LibreOffice Calc Text Import settings

The most important setting to select is the correct separator character, which is, in this and most cases, a comma (`,`). Some CSVs separate values with characters other than commas, like semicolons (`;`) or tabs (`\t`), though this is rare. In the future if you aren't sure which character your CSV uses, you can open the CSV in a text editor first to check.

Click **OK** to open the spreadsheet. This one should open quickly, but sometimes CSVs are huge—hundreds of mega- or gigabytes—so you may need to wait several seconds, or even minutes, for a large CSV to finish loading.

Figure 9-2 shows the *Documents.csv* spreadsheet in LibreOffice Calc.



	A	B	C	D	E	
1	DocumentID	DocFilename	Author	DateEntered	SortOrder	DocTitle
2	84	DDF00000\084.pdf		10/21/11 13:40:33		Daily Roll-Call Bulletin 102111
3	85	DDF00000\085.pdf		10/24/11 13:40:33		Daily Roll-Call Bulletin 102411
4	86	DDF00000\086.pdf		10/25/11 13:40:33		Daily Roll-Call Bulletin 102511
5	87	DDF00000\087.pdf		10/26/11 13:40:33		Daily Roll-Call Bulletin 102611
6	88	DDF\Delaware Gang Intelligence Briefing - October 2011.pdf		10/14/11 00:00:00		Pagans Motorcycle Club - Delaware Gang In
7	89	DDF\Delaware Gang Intelligence Briefing - September 2011.pdf		09/08/11 00:00:00		Dead Man, Inc. - Delaware Gang Intelligence
8	90	DDF\Delaware Gang Intelligence Briefing - August 2011.pdf		08/11/11 00:00:00		Crips - Delaware Gang Intelligence Bulletin -
9	91	DDF\Daily Roll-Call Bulletin 102711.pdf		10/27/11 15:18:28		Daily Roll-Call Bulletin 102711
10	92	DDF\Threat Assessment Delaware State Fair July 2011.pdf		07/05/11 00:00:00		Delaware State Fair - 2011
11	93	DDF\Threat Assessment NASCAR September 2011.pdf		09/01/11 00:00:00		NASCAR - Sept. 2011
12	94	DDF\NASCAR May 2011 Threat Assessment.pdf		05/16/11 00:00:00		NASCAR - May 2011
13	103	DDF00000\103.pdf		10/28/11 11:37:10		DHS Daily Infrastructure Bulletin 101911
14	104	DDF00000\104.pdf		10/28/11 11:37:10		DHS Daily Infrastructure Bulletin 102011

Figure 9-2: Viewing Documents.csv in LibreOffice Calc

This spreadsheet has 23 columns and 6,934 rows (one of which is the header row). At the top of the file, the dates in the DateEntered column are from 2011. You can find the most recent data in a spreadsheet by *sorting* it, either in ascending (from smaller to bigger) or descending (bigger to smaller) order. I'll show you how to sort this spreadsheet in LibreOffice Calc, but the instructions should be similar for other spreadsheet software and apply to any spreadsheet you want to sort.

First, since you don't want to sort the header row, click **View ▸ Freeze Cells ▸ Freeze First Row**. This should freeze the headers row, so now when you scroll up and down, the headers will remain at the top of the file.

Next, you need to pick which column you want to sort by. To see the most recent documents at the top, sort by DateEntered descending. Before sorting this column, you must tell the spreadsheet software that those fields are dates with times and specify how they're formatted (otherwise, the software might assume they're strings and sort them alphabetically). Click on column D to select all of the cells in that column and then click **Data ▸ Text to Columns**. This pops up a window that lets you define what type of data is in each column. At the bottom of the window, click the **DateEntered** column and choose **Date (MDY)** from the Column Type drop-down, because the dates in this data are formatted with month, then date, then year. Click **OK**.

Now that the spreadsheet software knows the correct format for the DateEntered cells, you can sort it by this column. Click the **DateEntered** header cell to select it (make sure not to select the whole column, just the header cell) and then click **Data ▸ Sort Descending**. This should reorder all of the rows so that the row with the most recent DateEntered is at the top and the one with oldest is at the bottom. In *Documents.csv*, the most recent documents are from June 6, 2020, during the Black Lives Matter protests. Some of the most recent document titles include "Special Bulletin Planned Protests 060620 1800 UPDATE," "ANTIFA Sub Groups and Indicators – LES," and "ANTIFA - Fighting in the Streets."

I often use graphical spreadsheet programs to search CSVs. In LibreOffice, as well as in other spreadsheet programs, you can find specific

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cells using the Find feature. Press CTRL-F (or, in macOS, ⌘-F), enter your search term, and press ENTER. This should search every cell in the spreadsheet for your term. You can use this method to find a row containing, for example, a specific ID number or email address.

When you close the spreadsheet, don't save your changes. It's good practice to avoid changing original documents in a dataset. If you want to keep a record of your changes, save the file as a copy in either the ODF Spreadsheet (*.ods*) or Excel (*.xlsx*) format.

Now let's look at the same CSV in a text editor instead of spreadsheet software. Here are the first few lines of the *Documents.csv* file, as viewed in a text editor like VS Code:

```
DocumentID,DocFilename,Author,DateEntered,SortOrder,DocTitle,Description,ShortDescription,
PageIdentifier,Keywords,DocumentCategoryID,URLLaunchNewBrowser,URL,Featured,YoutubeLink,
YoutubeVideoName,FrontPageText,YouTubeStartTime,DocFileName2,PreviewImage,ForceSaveAsDialog,
OpenInIframe,DeleteDate
84,"DDF00000\084.pdf",,"10/21/11 13:40:33",,"Daily Roll-Call Bulletin 102111",,,52,,36,0,,0,,,,
,,"DPI00000\084.png",0,0,
85,"DDF00000\085.pdf",,"10/24/11 13:40:33",,"Daily Roll-Call Bulletin 102411",,,79,,36,0,,0,,,,
,,"DPI00000\085.png",0,0,
86,"DDF00000\086.pdf",,"10/25/11 13:40:33",,"Daily Roll-Call Bulletin 102511",,,86,,36,0,,0,,,,
,,"DPI00000\086.png",0,0,
--snip--
```

Because text editors show you only the text when you view a CSV file, without lining up the columns like spreadsheet software does, it's less clear which value matches to which header for each row. There's no simple way to manipulate the data, either—you can't sort it by DateEntered like you can in LibreOffice Calc or Microsoft Excel. However, it's simple to write code that loads the data from CSVs into dictionaries, allowing you to manipulate it in any way you choose, as you'll do later in this chapter.

Now that you're familiar with the structure of CSVs, you're ready to see how I began my investigation into the BlueLeaks dataset.

How I Started Investigating BlueLeaks

I didn't even realize that my local police intelligence agency, the Northern California Regional Intelligence Center (NCRIC, pronounced "nick-rick"), existed until I discovered it in the BlueLeaks dataset in June 2020. In this section I describe how I went about my investigation into BlueLeaks, what I discovered in the NCRIC portion of the dataset, and a specific revelation I found in one of the NCRIC CSV files.

Picking a Fusion Center to Focus On

After downloading BlueLeaks, I indexed it in The Intercept's Intella server to make it easier to search. This allowed me and journalists I worked with to quickly search it for keywords and find interesting documents. However, I could tell that searching for keywords would only get me so far. There was so much data that if I only searched terms like *Black Lives Matter*, I was bound to miss a lot of it. Moreover, the searches I did make often led me to CSVs, which would take more work to untangle.

BlueLeaks was split into hundreds of folders, each one belonging to a different law enforcement organization. Since almost all of these organizations were unfamiliar to me, though, I couldn't tell from the names which folder belonged to which organization. I started my own spreadsheet to keep track of this, manually adding rows for each folder as I matched organizations and their websites to it. Eventually, I realized that I could automate this with a Python script.

I also used shell scripting to figure out which folders had the most data, because I guessed they were the largest or most active fusion centers. I quickly discovered that the *ncric* folder, one of the largest in the dataset, held documents for NCRIC, so that's where I decided to focus my digging.

Introducing NCRIC

NCRIC, based in San Francisco, shares information between federal agencies, local police departments across Northern California, and private industry partners, including tech companies. As I discovered by combing through the CSVs in this dataset, it also provides services to local cops, like monitoring social media or helping break into locked smartphones, and it hosts events and classes for law enforcement officers.

Using a custom tool I developed called BlueLeaks Explorer, which I'll discuss in detail in Chapter 10, I examined everything I could find in the *ncric* folder dated within the 13 days between George Floyd's murder and when NCRIC was hacked. I discovered that twice a day, NCRIC emailed over 14,000 cops an updated list of Black Lives Matter protests. Local police and other partners could also log into NCRIC's website and submit suspicious activity reports (SARs) to distribute to the fusion center's partners. Local police also requested NCRIC's help with monitoring the social media accounts of protest organizers and, in two instances, with identifying threats against white female teenagers who were facing harassment after making racist statements and using anti-Black slurs.

Investigating a SAR

By investigating a row from a CSV file, I found a PDF of a scanned letter that turned out to be newsworthy. The letter, written by an unhinged San Francisco–area lawyer to a local district attorney's office, called a polite student from Oregon an "antifa terrorist." In this section, I describe how I found this revelation in BlueLeaks, what it contains, and how the BlueLeaks CSVs reference other documents in the dataset.

When I grepped the CSV files in the *ncric* folder for the word *antifa*, I found that there were only a handful of references in the files *EmailBuilder.csv*, *Requests.csv*, *SARs.csv*, and *Survey.csv*. In particular, this row in *SARs.csv* stood out because it referenced a student protester, allegedly a member of an antifa group, and mentioned "Radicalization/Extremism":

```
micah@trapdoor ncric % grep -ri antifa *.csv
--snip--
SARs.csv:14277,"06/05/20 14:20:09","6/5/2020","Marin","The attached letter was received via US
Postal Service this morning. The letter was passed on from an anonymous party claiming to be a
lawyer who was contacted by [redacted name] who is a University of Oregon student. [Redacted
name] appears to be a member of the Antifa group and is assisting in planning protesting
efforts in the Bay Area despite living in Oregon.","[redacted IP address]",,"NCRICLawEnforceme
ntReporting",,"Unknown",,"[redacted phone number]","f14e1d15-a052-489c-968b-5fd9d38544e1",
"20200596","0820",,"Bay Area",,0,,0,0,0,,0,0,,,0,0,0,0,,,,,"[redacted name]",,,,0,,,,,,,"
[redacted name]","[redacted name]","[redacted name]",,,"Marin County District Attorney's
Office",,,,,"SARF100014\277.pdf",,,,,"- Other -",,,,,,"Letter.pdf",,,,,,,"[redacted]@marincounty
.org","AM","1",,,,,,0,0,"Radicalization/Extremism,Suspicious Incident",,"Emergency
Services,Government Facility",,,"No"
--snip--
```

Looking into the *SARs.csv* file, I found that it lists one month of SARs submitted to NCRIC. The earliest report was May 6, 2020, and the latest was June 6, 2020, so my guess is that NCRIC retains SARs only for a month.

Try opening this file, *ncric/SARs.csv*, in your spreadsheet software, and you'll see that it's difficult to parse. There are 91 different columns, and some of the cells are filled with so much text that even with a large monitor, you can see only part of a row at a time. To make it easier to read, I copied the content of the BriefSummary cell from the spreadsheet and pasted it into my text editor, something that I frequently needed to do with the CSVs in this dataset before I developed BlueLeaks Explorer. Here are the relevant fields from the row that caught my eye:

SARSid 14277

FormTimeStamp 06/05/20 14:20:09

IncidentDate 6/5/2020

ThreatActivity Radicalization/Extremism,Suspicious Incident

BriefSummary The attached letter was received via US Postal Service this morning. The letter was passed on from an anonymous party claiming to be a lawyer who was contacted by *[redacted name]* who is a University of Oregon student. *[Redacted name]* appears to be a member of the Antifa group and is assisting in planning protesting efforts in the Bay Area despite living in Oregon.

Subjects *[redacted name]*

AgencyOrganizationNameOther Marin County District Attorney's Office

File1 SARF100014\277.pdf

File1Name Letter.pdf

EmailAddress *[redacted]*@marincounty.org

PhoneNumber *[redacted phone number]*

The SAR listed the full name, email address, and phone number of the person who had submitted it. I looked them up online and discovered

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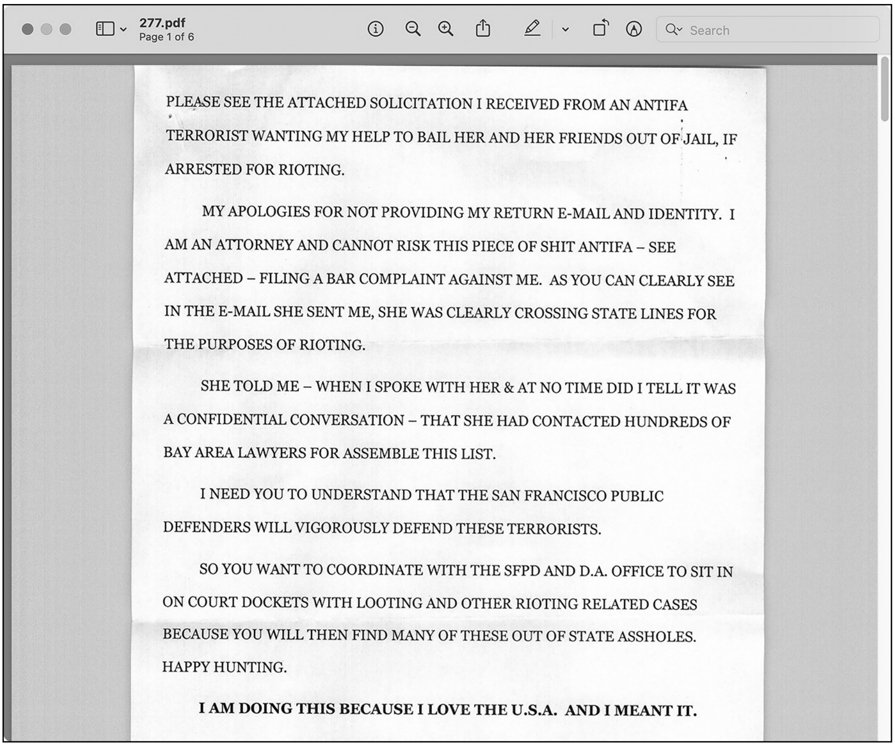
that they worked as an investigator for the district attorney's office in Marin County (just north of San Francisco). On June 5 at 2:20 PM (per the FormTimestamp field), the day before NCRIC was hacked, they logged into the NCRIC website and submitted the SAR form. They included a PDF called *Letter.pdf* (per the File1Name field), though the website saved it in the *SARF100014* folder as *277.pdf* (per the File1 field).

NOTE *The server that hosted NCRIC's website and all of the other BlueLeaks sites was running Windows, which is why folders in paths are separated by backslashes (\), like* SARF100014\277.pdf, *instead of forward slashes (/).*

Each BlueLeaks folder has a subfolder called *files*, where you can find the files referenced in the CSV. See if you can find the PDF referenced in the File1 field in the *ncric* folder. It should be at the path *ncric/files/SARF100014/277.pdf* (see Figure 9-3).



PLEASE SEE THE ATTACHED SOLICITATION I RECEIVED FROM AN ANTIFA TERRORIST WANTING MY HELP TO BAIL HER AND HER FRIENDS OUT OF JAIL, IF ARRESTED FOR RIOTING.

MY APOLOGIES FOR NOT PROVIDING MY RETURN E-MAIL AND IDENTITY. I AM AN ATTORNEY AND CANNOT RISK THIS PIECE OF SHIT ANTIFA – SEE ATTACHED – FILING A BAR COMPLAINT AGAINST ME. AS YOU CAN CLEARLY SEE IN THE E-MAIL SHE SENT ME, SHE WAS CLEARLY CROSSING STATE LINES FOR THE PURPOSES OF RIOTING.

SHE TOLD ME – WHEN I SPOKE WITH HER & AT NO TIME DID I TELL IT WAS A CONFIDENTIAL CONVERSATION – THAT SHE HAD CONTACTED HUNDREDS OF BAY AREA LAWYERS FOR ASSEMBLE THIS LIST.

I NEED YOU TO UNDERSTAND THAT THE SAN FRANCISCO PUBLIC DEFENDERS WILL VIGOROUSLY DEFEND THESE TERRORISTS.

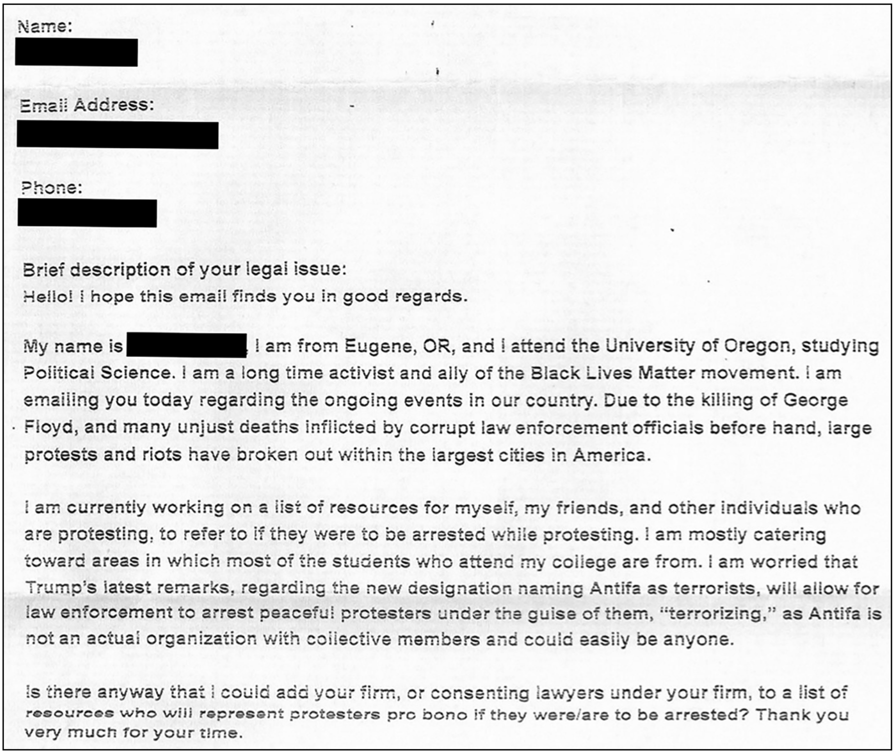
SO YOU WANT TO COORDINATE WITH THE SFPD AND D.A. OFFICE TO SIT IN ON COURT DOCKETS WITH LOOTING AND OTHER RIOTING RELATED CASES BECAUSE YOU WILL THEN FIND MANY OF THESE OUT OF STATE ASSHOLES. HAPPY HUNTING.

I AM DOING THIS BECAUSE I LOVE THE U.S.A. AND I MEANT IT.

Figure 9-3: A PDF attachment in the SAR submitted by an investigator from the Marin County DA's office

The PDF shows a letter in all caps mailed to the Marin County DA's office by a Bay Area attorney: "PLEASE SEE THE ATTACHED SOLICITATION I RECEIVED FROM AN ANTIFA TERRORIST WANTING MY HELP TO BAIL HER AND HER FRIENDS OUT OF JAIL, IF ARRESTED FOR RIOTING." He explained that he was remaining anonymous because he "CANNOT RISK THIS PIECE OF SHIT ANTIFA [. . .] FILING A BAR COMPLAINT AGAINST ME," and warned that "THE SAN FRANCISCO PUBLIC DEFENDERS WILL VIGOROUSLY DEFEND THESE TERRORISTS." He ended his letter, "HAPPY HUNTING."

Further down in the PDF, the attorney included the solicitation from the "antifa terrorist," shown in Figure 9-4.



Name:
[redacted]

Email Address:
[redacted]

Phone:
[redacted]

Brief description of your legal issue:
Hello! I hope this email finds you in good regards.

My name is [redacted], I am from Eugene, OR, and I attend the University of Oregon, studying Political Science. I am a long time activist and ally of the Black Lives Matter movement. I am emailing you today regarding the ongoing events in our country. Due to the killing of George Floyd, and many unjust deaths inflicted by corrupt law enforcement officials before hand, large protests and riots have broken out within the largest cities in America.

I am currently working on a list of resources for myself, my friends, and other individuals who are protesting, to refer to if they were to be arrested while protesting. I am mostly catering toward areas in which most of the students who attend my college are from. I am worried that Trump's latest remarks, regarding the new designation naming Antifa as terrorists, will allow for law enforcement to arrest peaceful protesters under the guise of them, "terrorizing," as Antifa is not an actual organization with collective members and could easily be anyone.

Is there anyway that I could add your firm, or consenting lawyers under your firm, to a list of resources who will represent protesters pro bono if they were/are to be arrested? Thank you very much for your time.

Figure 9-4: The letter that the Oregon student sent to the California lawyer

"I am a long time activist and ally of the Black Lives Matter movement," the Oregon student wrote. "Is there anyway[sic] that I could add your firm, or consenting lawyers under your firm, to a list of resources who will represent protesters pro bono if they were/are to be arrested? Thank you very much for your time." The Marin County DA investigator apparently believed that this was useful enough intelligence that they logged into their account on NCRIC's website and submitted it as "suspicious activity" for other law enforcement officers around Northern California to access. Under threat activity, they chose Radicalization/Extremism.

NOTE *You can read more about my findings from this SAR in the first article I wrote about BlueLeaks, at* https://theintercept.com/2020/07/15/blueleaks-anonymous

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-ddos-law-enforcement-hack/. *To learn more about what I discovered while researching NCRIC in general, check out my in-depth article at* https://theintercept.com/2020/08/17/blueleaks-california-ncric-black-lives-matter-protesters/.

In theory, I could have stumbled upon the PDF in Figure 9-3 on its own; I might have just randomly clicked through documents and happened to open *ncric/files/SARF100014/277.pdf*, the path to the PDF in question. I could also have indexed the *ncric* folder in Aleph, OCRing all of the documents, and searched for *antifa*. However, the PDF alone doesn't explain who uploaded it to the NCRIC website, when and why they uploaded it, and how they described the document. Moreover, if you're interested in focusing on activity in the fusion center from a specific time period, it's easier to find which documents are relevant by their timestamps in the CSV files. If you're researching BlueLeaks yourself, you can quickly find all of the documents associated with a time period by sorting the spreadsheets by date, reading all the rows in the CSVs for that time period, and looking at the documents that those rows reference.

Whenever you find an interesting document in BlueLeaks, search the CSVs for its filename to figure out why that document is there to begin with. It could be an attachment in a SAR, part of a bulk-email message the fusion center sent to thousands of local police, or included for other reasons. In the case of *277.pdf*, now you know this document was uploaded as an attachment to a SAR by an investigator in a DA's office. The CSV provides the investigator's summary of the document's contents, along with their contact information, which you can use to reach out to them for comment before publishing your findings.

Now that you've seen the type of data *SARs.csv* contains, you need a way to easily read the long blocks of text in those CSV cells without having to copy and paste them into a text editor. We'll cover that in Exercise 9-1, but first, let's have a quick tutorial on how to write code that works with CSV files.

Reading and Writing CSV Files in Python

As you learned in Chapter 8, Python modules bring extra functionality into the script that you're writing. It's easy to load CSVs and turn each row into a Python dictionary using Python's built-in `csv` module. You'll need `csv` for this chapter's exercises, so import it using the following command:

```
import csv
```

After importing it, you can take advantage of its functionality. The `csv` features I use the most are `csv.DictReader()`, which lets you parse rows of a CSV as dictionaries, and `csv.DictWriter()`, which lets you save your own CSVs from data stored in dictionaries.

The following code loads a CSV file and loops through its rows by using csv.DictReader():

```
with open(csv_path) as f:
    reader = csv.DictReader(f)
    for row in reader:
        print(row)
```

This code assumes the path to the CSV filename is in the `csv_path` variable, which could be a string that you hardcoded or a CLI argument you passed into your program. After opening the CSV file with `open(csv_path)` and storing the file objects as `f`, the code defines a new variable called `reader` and sets its value to `csv.DictReader(f)`, which prepares you to read rows from this CSV. The `reader` object acts a little like a list of dictionaries, where each dictionary represents a row. Although it's not actually a list, you can use a `for` loop to loop through it as if it were. Inside the `for` loop, `row` is a dictionary that represents the data in a row from the spreadsheet.

The process of saving new CSVs is similar, except you use csv.DictWriter(). For example, the following code uses Python to save the *city-populations.csv* file discussed in the "Introducing the CSV File Format" section earlier in the chapter:

```
headers = ["City", "Country","Population"]
with open(csv_path, "w") as f:
    writer = csv.DictWriter(f, fieldnames=headers)
    writer.writeheader()
    writer.writerow({"City": "Tōkyō", "Country": "Japan", "Population": 37400000})
    writer.writerow({"City": "Delhi", "Country": "India", "Population": 28514000})
    writer.writerow({"City": "Shanghai", "Country": "China", "Population": 25582000})
    writer.writerow({"City": "São Paulo", "Country": "Brazil", "Population": 21650000})
    writer.writerow({"City": "Mexico City", "Country": "Mexico", "Population": 21581000})
    writer.writerow({"City": "Cairo", "Country": "Egypt", "Population": 20076000})
```

This code first defines the headers of the spreadsheet in the list `headers`, then opens the output file (`csv_path`) for writing. Creating a `csv.DictWriter()` object allows you to save data into the CSV. You must pass the headers in as a keyword argument called `fieldnames`. You must also run `writer.writeheader()`, which saves the header row to the CSV file, before writing any of the data rows.

You can then add rows to the spreadsheet by running `writer.writerow()`, passing in a dictionary whose keys match your headers. For example, the first call of `writer.writer()` passes in the dictionary `{"City": "Tōkyō", "Country": "Japan", "Population": 37400000}`. The keys for this dictionary are the same as the headers for the CSV: `City`, `Country`, and `Population`.

In the following exercises, you'll use your new CSV programming skills to write scripts that make the data hidden in BlueLeaks CSVs easier to read and understand.

NOTE *To learn more about the* `csv` *module, you can find the full documentation, including plenty of example code, at* https://docs.python.org/3/library/csv.html.

Exercise 9-1: Make BlueLeaks CSVs More Readable

While it's easier to read *SARs.csv* in a spreadsheet program than in a text editor, it's still quite difficult. As mentioned earlier, there are 91 columns (though most of their values are blank), and some of the text fields, like `BriefSummary`, contain way too much text to see at one time in a spreadsheet cell. In this exercise, you'll write a script that makes *SARs.csv* (or any CSV with similar content) easier to read by showing you the data a single row at a time.

This exercise is designed not just to show you how to work with the *SARs.csv* file, but to give you practice looping through the rows and fields in a CSV. These skills will come in handy whenever you write code that reads data from CSVs.

For a challenge, you could try programming your own script to meet the following requirements:

- Make this script accept a CLI argument called `csv_path` using Click, which you first learned to use in Exercise 8-3.
- Import the `csv` module and loop through all of the rows in the CSV located at `csv_path`, loading each row as a dictionary, as discussed in previous section.
- For each row, display all of the *non-empty* values for its columns. If a value is empty, meaning it's an empty string (`""`), skip it. There's no reason to display all of the columns when so many of them have blank values.
- Display each field on its own line. For example, one line could show `SARSid: 14277` and the next line could show `FormTimeStamp: 06/05/20 14:20:09`.
- Output a separator line like `===` between each row so that you can tell rows apart.

Alternatively, follow along with the rest of this exercise and I'll walk you through the programming process. Start with the usual Python script template in a file called *exercise-9-1.py*:

```
def main():
    pass

if __name__ == "__main__":
    main()
```

Next, you'll modify your script to accept the `csv_path` CLI argument.

Accept the CSV Path as a CLI Argument

Instead of hardcoding the path to a specific CSV, let's use Click to accept the path as a CLI argument. Here's the code that does that (with modifications shown in bold):

```
import click

@click.command()
@click.argument("csv_path")
def main(csv_path):
    """Make BlueLeaks CSVs easier to read"""
    print(f"CSV path: {csv_path}")

if __name__ == "__main__":
    main()
```

Just like in Exercise 8-4, this code imports the `click` module, adds Click decorators before the `main()` function to turn it into a command that accepts the `csv_path` argument, and adds a docstring. For now, it also displays the value of `csv_path` so you can test if the program works. Run the code to test it as follows:

```
micah@trapdoor chapter-9 % python3 exercise-9-1.py some-csv-path.csv
CSV path: some-csv-path.csv
```

The script just displays the CSV path that was passed in. So far, so good.

Loop Through the CSV Rows

Next, you'll modify the code to open the CSV in `csv_path`, and, using the `csv` module, create a `csv.DictReader()` object to loop through the rows of that CSV:

```
import click
import csv

@click.command()
@click.argument("csv_path")
def main(csv_path):
    """Make BlueLeaks CSVs easier to read"""
    with open(csv_path, "r") as f:
        reader = csv.DictReader(f)
        for row in reader:
            print(row)

if __name__ == "__main__":
    main()
```

This code now imports the `csv` module at the top. When the `main()` function runs, the code opens the file at `csv_path` for reading, creating a file object variable called `f`. As noted in "Working with CSV Files in Python," you can use `csv.DictReader()` to loop through a CSV file, getting access to each row as a dictionary. The code does this next, creating a variable called `reader` and setting it equal to `csv.DictReader(f)`. Using `reader`, the code then loops through each row and displays the dictionary containing its data.

Test the code again, this time passing in the path to *SARs.csv* as the CLI argument. Make sure you use the correct path for your copy of the BlueLeaks dataset:

```
micah@trapdoor chapter-9 % python3 exercise-9-1.py /Volumes/datasets/BlueLeaks-extracted/ncric/
SARs.csv
{'SARSid': '14166', 'FormTimeStamp': '05/14/20 19:15:03', 'IncidentDate': '2020-05-11',
'County': 'Santa Clara', 'BriefSummary': '*INFO ONLY- no action required* \n\nThe San Francisco
PD was contacted by the CIA Threat Management Unit regarding a suspicious write-in to the
CIA\'s public website apparently by a subject [redacted name] (DOB: [redacted birthdate]). See
details below.\n\n-------- Original message --------\nFrom: ADAMCP4 \nDate: 5/13/20 12:17
(GMT-08:00)\nTo: "[redacted name] (POL)" \nSubject: CIA Passing Potential Threat Information\
nThis message is from outside the City email system. Do not open links or attachments from
untrusted sources.\nGood afternoon,\nPer our conversation, Mr. [redacted name] wrote in to
CIA's public website with the following two messages.  A CLEAR report showed Mr. [redacted
name]'s address to be in Dixon, CA.  Dixon, CA police made contact with the Subject's mother
who reported she has not had contact with him in quite some time and last knew him to be in the
Bay area, likely off his medication.  She reported he suffers from bi-polar disorder.
--snip--
```

The output shows that during each loop, the `row` variable is a dictionary containing the values for that row. So far, the code is simply displaying this whole dictionary. This is a good start, but it still doesn't make the text much easier to read. To do that, you'll display each field on its own row.

Display CSV Fields on Separate Lines

The following modified code displays each row separately:

```
import click
import csv

@click.command()
@click.argument("csv_path")
def main(csv_path):
    """Make BlueLeaks CSVs easier to read"""
    with open(csv_path, "r") as f:
        reader = csv.DictReader(f)
        for row in reader:
            for key in row:
                if row[key] != "":
                    print(f"{key}: {row[key]}")

            print("===")

if __name__ == "__main__":
    main()
```

Rather than just displaying the `row` dictionary, this code loops through all of its keys, storing each in the variable `key`. Since `key` is the key to the dictionary `row`, you can look up its value by using `row[key]`. You only want to

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display fields that aren't blank, so after making sure that this key doesn't have a blank value, the code displays both it and the value. Finally, after it has finished looping through all of the keys in each row, the code displays the separator === between the rows.

You can find a copy of the complete script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-9/exercise-9-1.py*. Run the final script like so:

```
micah@trapdoor chapter-9 % python3 exercise-9-1.py /Volumes/datasets/BlueLeaks-extracted/
ncric/SARs.csv
SARSid: 14166
FormTimeStamp: 05/14/20 19:15:03
IncidentDate: 2020-05-11
County: Santa Clara
BriefSummary: *INFO ONLY- no action required*

The San Francisco PD was contacted by the CIA Threat Management Unit regarding a suspicious
write-in to the CIA's public website apparently by a subject [redacted name] (DOB: [redacted
birthdate]). See details below.

-------- Original message --------
From: ADAMCP4
Date: 5/13/20 12:17 (GMT-08:00)
To: "[redacted name] (POL)"
Subject: CIA Passing Potential Threat Information
This message is from outside the City email system. Do not open links or attachments from
untrusted sources.
Good afternoon,
Per our conversation, Mr. [redacted name] wrote in to CIA's public website with the following
two messages.  A CLEAR report showed Mr. [redacted name]'s address to be in Dixon, CA.  Dixon,
CA police made contact with the Subject's mother who reported she has not had contact with him
in quite some time and last knew him to be in the Bay area, likely off his medication.  She
reported he suffers from bi-polar disorder.
--snip--
ThreatActivityOther: Suspicious write-in received by the CIA
ImpactedEntity: Government Facility
===
SARSid: 14167
FormTimeStamp: 05/15/20 10:46:00
IncidentDate: 5/14/2020
County: Sonoma
BriefSummary: Handheld radio went missing. Radio was in the dozer tender or in the office of
the Santa Rosa shop at station 41. The dozer tender was parked outside of the shop. There has
been unknown individuals seen passing on the compound near the shop. Dozer tender did not
appear to have been broken into. Dozer tender is usually locked but could have been missed
while the operator was off duty. Unsure of when exactly the radio went missing. Could of been
anytime within the last month.
--snip--
```

This time, the output should display === between the rows and display each field of a row on its own line. If there are any blank fields, the program skips them.

Using the command line skills you learned in Chapters 3 and 4, redirect the output into a file with the following command:

```
python3 exercise-9-1.py /Volumes/datasets/BlueLeaks-extracted/ncric/SARs.csv > SARs.txt
```

This should run your script again, this time saving the output into *SARs.txt* instead of displaying it in your terminal. Now you can easily scroll through the saved output in a text editor like VS Code and search it for keywords to learn about the "suspicious activity" that occurred in Northern California from May 6 to June 6, 2020.

Next we'll move on from SARs to explore another important spreadsheet in NCRIC: *EmailBuilder.csv*.

How to Read Bulk Email from Fusion Centers

The primary purpose of fusion centers is to share information between local, state, and federal law enforcement agencies. They do this, essentially, by sending bulk email to a large list of local police officers. You can find the content of this email for all sites in BlueLeaks, including NCRIC, in the *EmailBuilder.csv* file located in each site's folder. These files include the content of all of the bulk-email messages each fusion center sent until June 6, 2020, when it was hacked.

Some of these messages are security bulletins from federal agencies like the FBI or the Department of Homeland Security (DHS). Others contain content directly created by the fusion center—for example, NCRIC and other fusion centers around the US generated detailed daily lists of protests against police brutality during the summer of 2020. For the 13 days of NCRIC data I looked at in detail, over half of the bulk email contained information about largely peaceful protests.

The SARs spreadsheet contains plaintext data, so it's easy to read in a text editor. But the bulk-email spreadsheet contains data in HyperText Markup Language (HTML) format, making it difficult to read unless you use a web browser. In this section, you'll learn to more easily read the HTML content of NCRIC's bulk email, find the recipients of each email, and find the documents attached to the email messages. Open *ncric/EmailBuilder.csv* in your spreadsheet software to follow along.

Lists of Black Lives Matter Demonstrations

Most of the intelligence on Black Lives Matter protests flowed through NCRIC's Terrorism Liaison Officer (TLO) program, whose purpose is to keep the intelligence center's members "engaged & knowledgeable about current terrorist tactics, techniques & trends, regional crime trends & threats, and Officer safety information," according to the TLO page on NCRIC's website. During the summer of 2020, this counterterrorism program didn't focus on terrorism so much as upcoming racial justice protests.

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This section describes the twice-daily lists of upcoming protests that TLO sent to thousands of local cops. Not only is this incredibly newsworthy—a counterterrorism program abused to monitor racial justice protests—but these were the most common bulk-email messages that NCRIC sent during the 13-day period I examined.

For example, here are the most interesting fields from the most recent row in *ncric/EmailBuilder.csv* (this CSV has 81 columns in total, most of which didn't contain any relevant information):

EmailBuilderID 6170

EmailFrom NCRIC <info@ncric.net>

EmailSubject NCRIC TLO Bulletin LES

EmailBody <base href="https://ncric.ca.gov/"><div style="font-family: times; text-align: center;">UNCLASSIFIED//LAW ENFORCEMENT SENSITIVE</div> [. . .]

Attachment1 EBAT1\Events_060620_1800.pdf

DateSent 06/06/20 20:25:06

EmailTable Registrations

SentEmailList EBSE00006\170.csv

This row tells us that on the evening of June 6, 2020, NCRIC sent an email with the subject line "NCRIC TLO Bulletin LES" to the list of people described in *EBSE00006\170.csv* (LES stands for Law Enforcement Sensitive). The email included the PDF attachment located at *EBAT1\Events_060620_1800.pdf*.

The body of the email is the HTML in the EmailBody column. HTML is the markup language that describes web pages, so it can be hard to make sense of when you're not viewing it in a web browser. To read this email body, in your text editor, create a new file called *EmailBuilder-6170.html* (since 6170 is the EmailBuilderID). Copy the content of the EmailBody field from your spreadsheet software for this row, paste it into this file, and save it. You can now open this file in a web browser to view it, but before you do that, you may want to read the box "Covering Your Tracks with a VPN Service" to consider mitigating what information you might leak by opening it.

COVERING YOUR TRACKS WITH A VPN SERVICE

The BlueLeaks CSV files are full of HTML code, such as the EmailBody field in the *EmailBuilder.csv* files. Many of these blocks of HTML include embedded images. If you read through the HTML code in the EmailBody cell in the preceding example, you'll see that it loads an image hosted on NCRIC's server at the

(continued)

URL *https://ncric.org/html/Picture2.jpg?135653*. Viewing HTML from BlueLeaks in a web browser makes it much easier to read and understand compared to trying to read the HTML code directly, but it will also cause your computer to make an internet request to the law enforcement servers themselves. These servers will most likely log your IP address, leaving clues that you're investigating them.

For the BlueLeaks dataset, it doesn't matter much if the fusion center servers track your IP address. It's not illegal to load images off of law enforcement websites. For more sensitive datasets, however, it's prudent to hide your IP address from organizations you're investigating. You can load these images while hiding your real IP address by connecting to a *virtual private network (VPN)* service, which reroutes your internet traffic through its own server, then forwards your traffic to those websites. This leaves the VPN server's IP address, rather than your own, in the websites' web logs.

For example, say you load the *EmailBuilder-6170.html* file in your web browser from your home in San Francisco. If you load images hosted on *https://ncric.org*, a San Francisco IP address from a residential neighborhood will show up in the website's logs. The site might be able to determine that this IP address belongs to you by sending a data request to your internet service provider, for example. If you first connect to a VPN, however—one in New York, let's say—then they'll see a New York IP address from a data center in their logs instead. They'll still know that someone loaded the image, but it won't be immediately obvious that *you* loaded the image. Everyone using that VPN service shares its IP address, making it harder to track down individual users.

While VPNs may make you anonymous from the websites you're visiting, they don't make you anonymous from the VPN provider itself. Use a trustworthy VPN provider that you believe isn't logging your traffic and selling it. Additionally, contrary to popular opinion, commercial VPN services don't prevent websites from tracking your browsing habits; that's mostly done using a technology called cookies. In other words, VPNs don't stop the Googles and Facebooks of the world from following you around the web.

Consumer Reports publishes in-depth reviews of different VPN services, comparing them on overall privacy and security, whether they've had public security audits, whether they're open source, and whether they include misleading marketing. VPN services normally cost a few dollars a month. For the most part, I recommend avoiding free VPNs; they're nearly all scams set up to spy on their users and sell their data, or even to inject advertisements into web pages users visit. The only exception I know of are VPNs powered by the open source software Bitmask, like the one run by the Seattle-based tech collective Riseup. You can learn more about Bitmask from *https://bitmask.net*, and you can learn about Riseup's free VPN service at *https://riseup.net/en/vpn*.

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Whether or not you've connected to a VPN service (the choice is yours), open *EmailBuilder-6170.html* using a web browser by double-clicking on it in your file manager. Figure 9-5 shows what it looks like in a web browser.

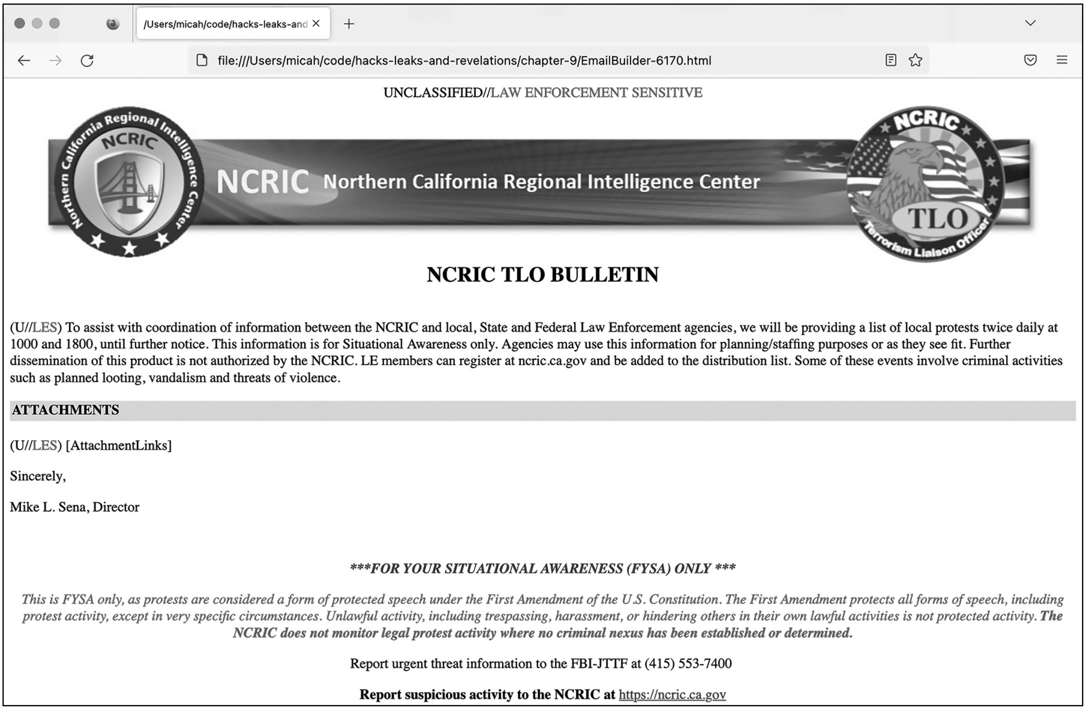
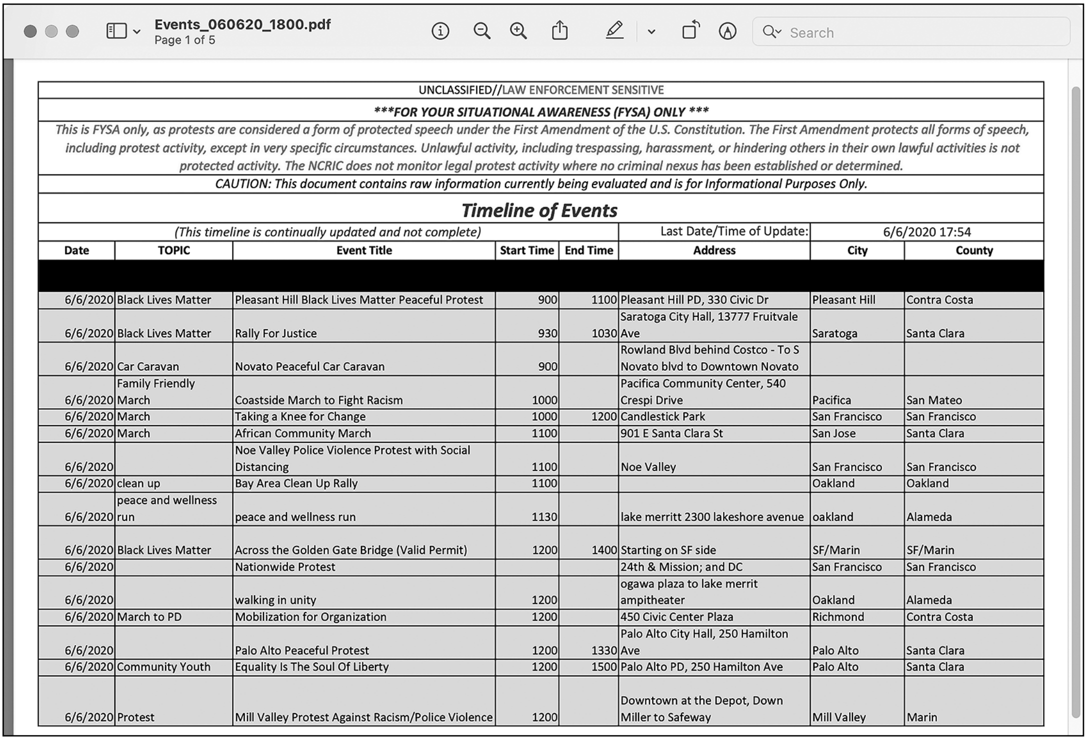


Figure 9-5: HTML from the EmailBody field in a row of EmailBuilder.csv, viewed in a web browser

As you can see from the screenshot, this email body is a template, not the email itself. The HTML files stored inside CSVs for BlueLeaks sites are all templates. When sending the email, the NCRIC site would replace [AttachmentLinks] with the actual links to the email attachments as well as replacing other placeholders in the template. The attachments themselves are listed as fields in the CSV.

This email contained one attachment, as noted in the Attachment1 field of the most recent row in *EmailBuilder.csv*: the PDF file *EBAT1\Events_060620_1800.pdf*. Figure 9-6 shows the first page of that document.

The NCRIC Terrorism Liaison Officer program distributed this list to local police across Northern California. The events included Novato Peaceful Car Caravan, Taking a Knee for Change, and the Noe Valley Police Violence Protest with Social Distancing (the protests took place during the COVID-19 pandemic, after all).



UNCLASSIFIED//LAW ENFORCEMENT SENSITIVE

***FOR YOUR SITUATIONAL AWARENESS (FYSA) ONLY ***

This is FYSA only, as protests are considered a form of protected speech under the First Amendment of the U.S. Constitution. The First Amendment protects all forms of speech, including protest activity, except in very specific circumstances. Unlawful activity, including trespassing, harassment, or hindering others in their own lawful activities is not protected activity. The NCRIC does not monitor legal protest activity where no criminal nexus has been established or determined.

CAUTION: This document contains raw information currently being evaluated and is for Informational Purposes Only.

Timeline of Events

(This timeline is continually updated and not complete) Last Date/Time of Update: 6/6/2020 17:54

Date	TOPIC	Event Title	Start Time	End Time	Address	City	County
6/6/2020	Black Lives Matter	Pleasant Hill Black Lives Matter Peaceful Protest	900	1100	Pleasant Hill PD, 330 Civic Dr	Pleasant Hill	Contra Costa
6/6/2020	Black Lives Matter	Rally For Justice	930	1030	Saratoga City Hall, 13777 Fruitvale Ave	Saratoga	Santa Clara
6/6/2020	Car Caravan	Novato Peaceful Car Caravan	900		Rowland Blvd behind Costco - To S Novato blvd to Downtown Novato		
6/6/2020	Family Friendly March	Coastside March to Fight Racism	1000		Pacifica Community Center, 540 Crespi Drive	Pacifica	San Mateo
6/6/2020	March	Taking a Knee for Change	1000	1200	Candlestick Park	San Francisco	San Francisco
6/6/2020	March	African Community March	1100		901 E Santa Clara St	San Jose	Santa Clara
6/6/2020		Noe Valley Police Violence Protest with Social Distancing	1100		Noe Valley	San Francisco	San Francisco
6/6/2020	clean up	Bay Area Clean Up Rally	1100			Oakland	Oakland
6/6/2020	peace and wellness run	peace and wellness run	1130		lake merritt 2300 lakeshore avenue	oakland	Alameda
6/6/2020	Black Lives Matter	Across the Golden Gate Bridge (Valid Permit)	1200	1400	Starting on SF side	SF/Marin	SF/Marin
6/6/2020		Nationwide Protest			24th & Mission; and DC	San Francisco	San Francisco
6/6/2020		walking in unity	1200		ogawa plaza to lake merrit ampitheater	Oakland	Alameda
6/6/2020	March to PD	Mobilization for Organization	1200		450 Civic Center Plaza	Richmond	Contra Costa
6/6/2020		Palo Alto Peaceful Protest	1200	1330	Palo Alto City Hall, 250 Hamilton Ave	Palo Alto	Santa Clara
6/6/2020	Community Youth	Equality Is The Soul Of Liberty	1200	1500	Palo Alto PD, 250 Hamilton Ave	Palo Alto	Santa Clara
6/6/2020	Protest	Mill Valley Protest Against Racism/Police Violence	1200		Downtown at the Depot, Down Miller to Safeway	Mill Valley	Marin

Figure 9-6: A list of upcoming Black Lives Matter protests in the file Events_060620_1800.pdf

You can use the SentEmailList and EmailTable values to discover how many, and exactly which, local police officers received these daily bulletins. The value of SentEmailList is the path to a CSV file itself: *EBSE00006\170.csv*. When you open that CSV file (it's in *ncric/files*), you can see that it has 14,459 rows (one of which is the header) and looks like this:

```
IDs,Registrations
63861
63862
63929
63930
--snip--
```

In short, this CSV contains a huge list of ID numbers. The value of EmailTable in the *EmailBuilder.csv* row is `Registrations`, which is a good hint. Since I knew that these IDs must match up to rows in some other table, I decided to check the file *Registrations.csv*.

Open that spreadsheet yourself at *ncric/Registrations.csv*. It has 185 columns and over 29,000 rows, apparently listing everyone who had an account on NCRIC's website. It includes each user's full name; the agency they work for and whether it's local, state, federal, or military; their email address, physical address, and cell phone number; their supervisor's name and contact information; their password hash; and other details.

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The first column of *Registrations.csv* is called RegistrationsID. Each ID in the *EBSE00006\170.csv* file can be cross-referenced with one of these registrations. For example, the person in *Registrations.csv* with the RegistrationsID 63861 works at the Santa Clara County Sheriff's Office, lives in San Jose, has an email address at the domain *pro.sccgov.org*, and has a phone number with a 408 area code. In other words, NCRIC sent the email to this list of 14,458 contacts, whose contact details can be found in the *Registrations.csv* file. The BlueLeaks dataset includes this information about everyone who received bulk email through any of the websites. In Exercise 9-3, when you read through bulk email found in BlueLeaks, you'll be able to look up exactly who received these email messages.

"Intelligence" Memos from the FBI and DHS

As mentioned earlier, in addition to detailed lists of upcoming protests, NCRIC also frequently forwarded memos from its federal partners—agencies like the FBI and DHS—to its list of over 14,000 local cops. These memos largely contained internet rumors, hoaxes that had already been debunked but that federal agencies apparently fell for, and warnings about violence from protesters that didn't materialize.

For example, in the row in *EmailBuilder.csv* with the EmailBuilderID of 6169, the email body says, "The NCRIC is disseminating this (U//LES) Update on behalf of the FBI." The Attachment1 value in that row is *EBAT1\SITREP-6-JUN-1300_OPE.pdf*, an unclassified FBI document dated June 6, 2020. The document is full of cherry-picked quotes from social media posts threatening violence, but without any context. There was no way of knowing how many followers an account had, how much engagement their post had, or even if they were parodies.

The "Social Media Exploitation (SOMEX)" section of this FBI document describes people using Facebook, Snapchat, and Instagram to post "flyers seeking to hire 'professional anarchists.'" This appears to reference an internet hoax from late May 2020. In fact, I found multiple articles debunking this hoax on fact-checking sites, including Snopes, PolitiFact, and *Reuters*, dated a week before the FBI distributed this memo. The fake recruitment flyer offers to compensate "professional anarchists" with $200 per direct action, and includes the text "Funded by George Soros." (Antisemitic right-wing Americans frequently and falsely claim that Soros, a Jewish billionaire, funds left-wing protesters.) The flyer also included the phone number for a local branch of the Democratic Party. Both this local Democratic Party branch and Soros's Open Society Foundations confirmed that the flyer was a fake, but this didn't stop the FBI from distributing it to NCRIC, which disseminated it to 14,458 local police across Northern California.

The DHS also sent several memos to NCRIC to distribute to the center's list. For example, take a look at the row in *EmailBuilder.csv* with the EmailBuilderID of 6144. The email body says, "The NCRIC is disseminating the Intelligence Note '(U//FOUO) Some Violent Opportunists Probably Engaging in Organized Activities' on behalf of DHS," and the attached document is *EBAT1\(U—FOUO) IN - Some Violent Opportunists Probably Engaging in Organized Activities 06012020.pdf*.

The attached PDF declares that "As the protests persist, we assess that the organized violent opportunists—including suspected anarchist extremists—could increasingly perpetrate nationwide targeting of law enforcement and critical infrastructure." (This didn't happen.) The memo goes on to say that an NYPD official "had strong evidence that suspected anarchist groups had planned to incite violence at protests, including by using encrypted communications." Incidentally, if you completed Exercise 2-2 and installed Signal, you too are now a user of encrypted communications.

As noted in Chapter 1, it's important to reach out to the people you're investigating to get their side of the story. Mike Sena, NCRIC's executive director, told me that his intelligence agency was monitoring Black Lives Matters protests in order to make sure that they remained safe. "We weren't keeping track of the protests themselves, but we were identifying where we were gonna have gatherings of people," he said. "That's our concern; we want to make sure the events are safe—and if there are any threats that come up that may be associated with any of those events that we're able to get that threat data to whatever agency may have protection responsibilities."

It's also good practice to contact outside experts—those who know more about the subject matter than you do—for comment. Vasudha Talla, a senior staff attorney with the American Civil Liberties Union of Northern California, told me, "Really what we have here is overbroad collection and dissemination of people's protected First Amendment activity, and it's untethered to any basis in the law."

As you can see, there are a lot of newsworthy details in *EmailBuilder.csv*. However, it's still somewhat difficult to work with, especially because of the HTML email bodies. Soon you'll write some code to make all of the bulk email easier to read. To do that, first you'll need to learn the basics of HTML.

A Brief Primer on HTML

In the following exercise, you'll write some Python code that in turn writes some HTML code. This section covers just enough HTML syntax to get you through this chapter.

HTML is made up of components called *tags*. For example, consider the following HTML:

```
<p>Hello world</p>
```

This code opens a `<p>` tag (which represents a paragraph), includes some content (the text `Hello world`), and then closes the `<p>` tag with `</p>`. You open a tag with `<tag-name>` and close it with `</tag-name>`.

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HTML typically includes tags inside of tags inside of tags. It's common to indent HTML code for legibility, but unlike in Python, indenting is completely optional. Here's an example of a simple web page in HTML, indented to make it easier to read:

```
<html>
    <head>
        <title>My Super Cool Web Page</title>
    </head>
    <body>
        <h1>Under Construction</h1>
        <p>This web page is under construction!</p>
    </body>
</html>
```

The whole page is wrapped in the <html> tag. Inside that, there's a <head> tag, which includes metadata about the web page, and then a <body> tag, which includes the content of the web page. The <title> tag is a metadata tag that describes the title of the web page, which is what's displayed in the browser tab itself. Inside the <body>, the biggest heading is <h1>, followed by a <p> paragraph.

There are plenty of other tags in HTML, but in the following exercise, you'll use just two more: <ul> and <li>. The <ul> tag stands for "unordered list," and it's how you make bulleted lists in HTML. Inside the <ul> tag are <li> tags, which stand for "list item." For example, here's some HTML for a simple bulleted list:

```
<ul>
    <li>Bash</li>
    <li>Python</li>
    <li>HTML</li>
</ul>
```

When displayed in a web browser, that HTML code would look like this:

- Bash
- Python
- HTML

The less than and greater than characters (< and >) are used to open and close tags in HTML. If you want to display literal less than or greater than characters in HTML, you have to *HTML escape* them. This is similar to escaping in shell scripts and Python code, but the syntax is different. Escape < by replacing it with < and escape > by replacing it with >. For example, here's some HTML code that displays the text I <3 you in a paragraph:

```
<p>I &lt;3 you</p>
```

There are a few other special characters in HTML that are each escaped in their own way. For example, you'd use & to escape an ampersand (&).

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In the next exercise, you'll make the email messages in *EmailBuilder.csv* easier to read by writing a script that automatically saves an HTML file for each one. This will also make it much simpler for you to find the newsworthy ones.

Exercise 9-2: Make Bulk Email Readable

For this exercise, you'll write a script similar to the one you wrote in Exercise 9-1, but instead of displaying text output to the screen, you'll save HTML output to files. This allows you to look through a folder full of HTML files, each one a different bulk email, open these files in a web browser, and read them in a more legible format. While this particular exercise is designed specifically for the *EmailBuilder.csv* files in BlueLeaks, it's common to find HTML in datasets, so being able to write a similar script could help you in the future.

For a challenge, you can try programming your own script to meet the following requirements:

- Make this script accept two CLI arguments called `emailbuilder_csv_path` and `output_folder_path` using Click. The `emailbuilder_csv_path` argument should be the path to an *EmailBuilder.csv* file, and the `output_folder_path` argument should be the path to a folder in which to save the HTML files.
- Make sure the folder at `output_folder_path` exists by importing the `os` module and running `os.makedirs(output_folder_path, exist_ok=True)`.
- Import the `csv` module and loop through all of the rows in the CSV located at `emailbuilder_csv_path`, loading each row as a dictionary.
- For each row, save a new HTML file. This file should include information from the bulk-email fields most relevant for your purposes: EmailBuilderID, EmailFrom, EmailSubject, DateSent, Attachment1, and SentEmailList. It should also include the HTML body of the email itself, EmailBody.

Otherwise, follow along with the rest of this exercise and I'll walk you through the programming process. Start with the usual Python script template in a file called *exercise-9-2.py*:

```
def main():
    pass

if __name__ == "__main__":
    main()
```

Next, you'll modify your script to make the script accept command line arguments using Click.

Accept the Command Line Arguments

The following code has been modified to import the Click module and accept some command line arguments:

```
import click

@click.command()
@click.argument("emailbuilder_csv_path")
@click.argument("output_folder_path")
def main(emailbuilder_csv_path, output_folder_path):
    """Make bulk email in BlueLeaks easier to read"""
    print(f"Path to EmailBuilder.csv: {emailbuilder_csv_path}")
    print(f"Output folder path: {output_folder_path}")

if __name__ == "__main__":
    main()
```

First, the code imports the `click` module, and then it uses Click decorators to make the `main()` function a Click command that accepts two arguments, `emailbuilder_csv_path` and `output_folder_path`. The code also has two `print()` statements that display the values of the two arguments. The `emailbuilder_csv_path` argument should point to the path of a BlueLeaks *EmailBuilder.csv*, which you'll load and loop through, and the `output_folder_path` argument should be the path to a folder in which you'll store the HTML files for the bulk-email messages.

Test your code and make sure it's working as expected so far, replacing the path to *EmailBuilder.csv* with the appropriate path for your computer:

```
micah@trapdoor chapter-9 % python3 exercise-9-2.py /Volumes/datasets/BlueLeaks-extracted/
ncric/EmailBuilder.csv output
Path to EmailBuilder.csv: /media/micah/datasets/BlueLeaks-extracted/ncric/EmailBuilder.csv
Output folder path: output
```

As expected, the script displays the values of the two arguments.

Create the Output Folder

Next, use Python to create the folder in `output_folder_path` where you'll save the HTML files:

```
import click
import os

@click.command()
@click.argument("emailbuilder_csv_path")
@click.argument("output_folder_path")
def main(emailbuilder_csv_path, output_folder_path):
    """Make bulk emails in BlueLeaks easier to read"""
    os.makedirs(output_folder_path, exist_ok=True)

if __name__ == "__main__":
    main()
```

To be able to use the `os.makedirs()` function, first the script imports the `os` module. Then it uses the `os.makedirs()` function to create a new folder in Python, passing in the path to the folder to create, `output_folder_path`.

The `exists_ok=True` keyword argument tells this function that it's fine if that folder already exists; otherwise, if the folder already existed, the script would crash with an error message. This way, the first time you run this script with a specific output folder, it will create that folder and use it to store the HTML files. If you run the script again in the future with that same output folder, it will use the folder that's already there.

When you run the complete script at the end of this exercise, you'll be able to browse the files in this folder to read through the bulk-email messages sent by a fusion center.

Define the Filename for Each Row

The goal of this script is to save an HTML file for each row in the spreadsheet. To do this, you'll need to load the CSV, loop through its rows, and figure out the filename for each HTML file that you're going to save. Next, define the `filename` variable, naming each HTML file based on data that you found in that row. To do so, make the following modifications:

```
import click
import os
import csv

@click.command()
@click.argument("emailbuilder_csv_path")
@click.argument("output_folder_path")
def main(emailbuilder_csv_path, output_folder_path):
    """Make bulk emails in BlueLeaks easier to read"""
    os.makedirs(output_folder_path, exist_ok=True)

    with open(emailbuilder_csv_path) as f:
        reader = csv.DictReader(f)
        for row in reader:
            filename = (
                f"{row['EmailBuilderID']}_{row['DateSent']}_{row['EmailSubject']}.html"
            )
            filename = filename.replace("/", "-")
            filename = os.path.join(output_folder_path, filename)
            print(filename)


if __name__ == "__main__":
    main()
```

The script starts by importing the `csv` module. As in the previous exercise, the code then opens the CSV file and creates a CSV reader using `csv.DictReader()`. Using a `for` loop, the code loops through each row in the CSV.

Rather than just displaying information, you ultimately want to save each row as an HTML file. To prepare to write the code that actually generates those files in the next section, this code defines a `filename` variable with the name of the unique HTML file to be generated for each row. In order to make it unique, the code defines `filename` using the current row's `EmailBuilderID`, `DateSent`, and `EmailSubject` fields, and ends it with the `.html` file extension. For example, according to this format, the filename for the bulk email described in the previous section would be *6170_06/06/20 20:25:06_NCRIC TLO Bulletin LES.html*.

The code defines `filename` as an f-string surrounded in double quotes (`"`). The variables inside it, like `row["EmailSubject"]`, have quotes of their own, but you can't use the double-quote character inside a double-quoted f-string without Python mistakenly thinking you're closing the f-string. Instead, this code uses single quotes (`'`) for the variables within the f-string: `row['EmailSubject']`.

The slash characters (`/`) contained in the DateSent column are invalid characters for filenames because slashes separate folders in a path. To address this, the line `filename = filename.replace("/", "-")` replaces any slashes it finds in the filename with dash characters (`-`). This generates the valid filename *6170_06-06-20 20:25:06_NCRIC TLO Bulletin LES.html*.

Finally, this code uses `os.path.join()`, discussed in Chapter 8, to append `filename` to the end of `output_folder_path`, giving you the complete path to the file you're going to write. You'll ultimately save the HTML file in this path. For example, if the filename `output_folder_path` is `output` and `filename` is `6170_06-06-20 20:25:06_NCRIC TLO Bulletin LES.html`, `os.path.join()` updates `filename` to be `output/6170_06-06-20 20:25:06_NCRIC TLO Bulletin LES.html`.

To make sure everything is working so far, the code displays this final filename. Pause and test your code, using the correct filepath for your operating system:

```
micah@trapdoor chapter-9 % python3 exercise-9-2.py /Volumes/datasets/BlueLeaks-extracted/
ncric/EmailBuilder.csv output
output/4867_09-04-18 09:13:49_2018 CNOA Training Institute.html
output/4868_09-04-18 14:33:27_SMS Important.html
output/4869_09-04-18 14:47:52_Brian SMS from Netsential.html
output/4870_09-05-18 12:57:23_(U--LES) Officer Safety-Welfare Check Bulletin - Wesley Drake
GRIFFIN.html
--snip--
```

The output should show a unique filename for each row in the *EmailBuilder.csv* spreadsheet. All you need to do now is actually write those HTML files.

Write the HTML Version of Each Bulk Email

The purpose of saving each row of *EmailBuilder.csv* as an HTML file is to more easily read these bulk-email messages by loading the HTML in a web browser. You'll obviously want to see the email body, but it would also be helpful to display some basic metadata about the email: the date it was sent, the subject, and so on. The following code writes the HTML files, automatically filling in both the metadata and the email body with data from the CSV:

```
import click
import os
import csv
import html

@click.command()
@click.argument("emailbuilder_csv_path")
@click.argument("output_folder_path")
def main(emailbuilder_csv_path, output_folder_path):
    """Make bulk emails in BlueLeaks easier to read"""
    os.makedirs(output_folder_path, exist_ok=True)

    important_keys = [
        "EmailBuilderID",
        "EmailFrom",
        "EmailSubject",
        "DateSent",
        "Attachment1",
        "SentEmailList",
    ]

    with open(emailbuilder_csv_path) as f:
        reader = csv.DictReader(f)
        for row in reader:
            filename = f"{row['EmailBuilderID']}_{row['DateSent']}_{row['EmailSubject']}.html"
            filename = filename.replace("/", "-")
            filename = os.path.join(output_folder_path, filename)

            with open(filename, "w") as html_f:
                html_f.write("<html><body>\n")
                html_f.write("<ul>\n")
                for key in important_keys:
                    html_f.write(f"<li>{key}: {html.escape(row[key])}</li>\n")
                html_f.write("</ul>\n")
                html_f.write(f"{row['EmailBody']}\n")
                html_f.write("</body></html>\n")
                print(f"Saved file: {filename}")

if __name__ == "__main__":
    main()
```

First, the code imports the `html` module, which will be used later on to escape HTML code. The code starts by defining a list, called `important_keys`, of all of the important keys to include in the final HTML file. This code is positioned near the top of the `main()` function, before the `for` loop, so that this variable will be available inside each loop, and therefore every HTML file will include these same fields.

Inside the `for` loop, the code stores each row of the spreadsheet in the dictionary `row`, so you can access its fields using keys. Then, the code opens the HTML file for writing with the command `with open(filename, "w") as html_f:` (as you saw in "Reading and Writing Files" in Chapter 7). The file object for the HTML file is the `html_f` variable. Inside this `with` statement, the code then starts writing the HTML file by calling `html_f.write()` and passing in a string containing HTML, first for `<html>` and `<body>` tags and then for a `<ul>` tag to represent a bulleted list.

Next, the code fills in the bulleted list with the important metadata. Using a `for` loop, it loops through the keys in `important_keys`, writing each piece of metadata to the HTML file in its own `<li>` tag, in the format

```
<li><strong>metadata_item:</strong> metadata_value</li>
```

where *`metadata_item`* is the name of an important piece of metadata in `key`, and *`metadata_value`* is the value of that piece of metadata in `row[key]`. For example, *`metadata_item`* might be `EmailBuilderID`, and *`metadata_value`* might be `6170`, as in the example CSV row in the "Lists of Black Lives Matter Demonstrations" section.

Instead of displaying the value with `row[key]`, though, this line of code uses `html.escape(row[key])`. This is necessary because some of the fields you want to include use angle brackets (< and >), which indicate tags in HTML. For example, if the value of the FromEmail field is `NCRIC <info@ncric.net>`, your web browser will interpret `<info@ncric.net>` as an HTML tag called `info@ncric.net`, which isn't a real tag so nothing will display. In Python, the `html.escape()` function lets you HTML escape a string. For example, `html.escape("NCRIC <info@ncric.net>")` returns the string `NCRIC <info@ncric.net>` and that's what gets saved to the HTML file, so that when you later view that file, the string displays correctly as `NCRIC <info@ncric.net>`.

When the `for` loop finishes running, all of the important metadata will have been written to the HTML file. The code then writes `</ul>` to close the bulleted list tag. After displaying the bulleted list of important fields, the code displays the EmailBody field in a `<div>` tag. This time, it doesn't HTML escape this field, because you want to load the email's HTML in a browser. Finally, the `<body>` and `<html>` tags are closed with `</body></html>`.

You can find the complete script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-9/exercise-9-2.py*. This is the most complicated Python script you've written so far in this book, but it's about to pay off. Run it on the NCRIC data, using the filepath appropriate for your operating system:

```
micah@trapdoor chapter-9 % python3 exercise-9-2.py /Volumes/datasets/BlueLeaks-extracted/
ncric/EmailBuilder.csv output
Saved file: output/4867_09-04-18 09:13:49_2018 CNOA Training Institute.html
Saved file: output/4868_09-04-18 14:33:27_SMS Important.html
Saved file: output/4869_09-04-18 14:47:52_Brian SMS from Netsential.html
Saved file: output/4870_09-05-18 12:57:23_(U--LES) Officer Safety-Welfare Check Bulletin -
Wesley Drake GRIFFIN.html
--snip--
```

This output looks similar to the last time you ran the script, except now it also creates a folder full of 5,213 new HTML files—one for every row of NCRIC's *EmailBuilder.csv* file—in the output folder you specified. The

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information now included in the filenames allows you to browse through the files in your file manager, exploring those that look most interesting.

Figure 9-7 shows the list of files generated when I ran this script.

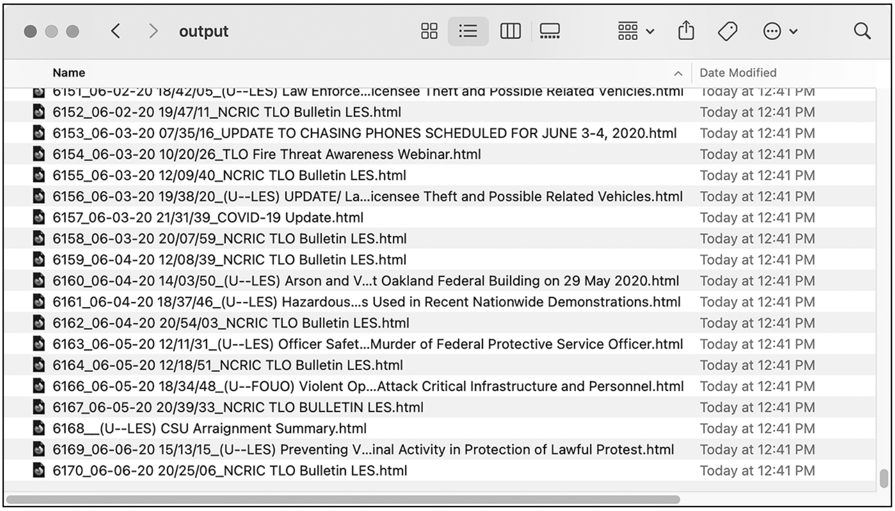

Figure 9-7: Viewing the HTML files generated by our Python script in macOS Finder

This folder contains the thousands of HTML files that your Python script just created. The first part of the filename is the EmailBuilderID, followed by DateSent, followed by EmailSubject. To read one of these bulk emails, just double-click the HTML file to open it in a web browser. If you want more information about a specific bulk email, you can always look it up by EmailBuilderID in the original spreadsheet.

To see what the final HTML output looks like, open one of these files in your text editor. For example, here's the final HTML output from the *6098_05-18-20 12/45/12_Chasing Cell Phones presented via Zoom Webinar.html* file:

```
<html><body>
<ul>
<li><strong>EmailBuilderID:</strong> 6098</li>
<li><strong>EmailFrom:</strong> NCRIC &lt;info@ncric.net&gt;</li>
<li><strong>EmailSubject:</strong> Chasing Cell Phones presented via Zoom Webinar</li>
<li><strong>DateSent:</strong> 05/18/20 12:45:12</li>
<li><strong>Attachment1:</strong> </li>
<li><strong>SentEmailList:</strong> EBSE00006\098.csv</li>
</ul>
<div><base href="https://ncric.org/">
<a style="font: bold 15px Arial" target="_blank" href="https://ncric.org/EBForms.aspx?EBID=5499
&EBType=R">- Click Here To Register -</a><br><br><div><div style="font-weight: bold">Chasing
Cell Phones</div>
--snip--
</div>
</body></html>
```

All of the bolded parts have been filled in automatically by the Python code. In the bulleted list at the top, EmailBuilderID, EmailFrom, and so on are keys from the important_keys list, and 6098, NCRIC <info@ncric.net>, and so on are HTML-escaped values from the row dictionary. Below the bulleted list, inside the <div> tag, is the email body—the value of row["EmailBody"].

Figure 9-8 shows what these bulk email messages look like in a web browser. In this case, I opened a bulk email sent out on May 18, 2020, advertising a course called Chasing Cell Phones hosted by the Northern California High Intensity Drug Tracking Area. The class was designed to teach police how to get valuable evidence directly off of suspects' cell phones or from third-party sources like cell phone providers.

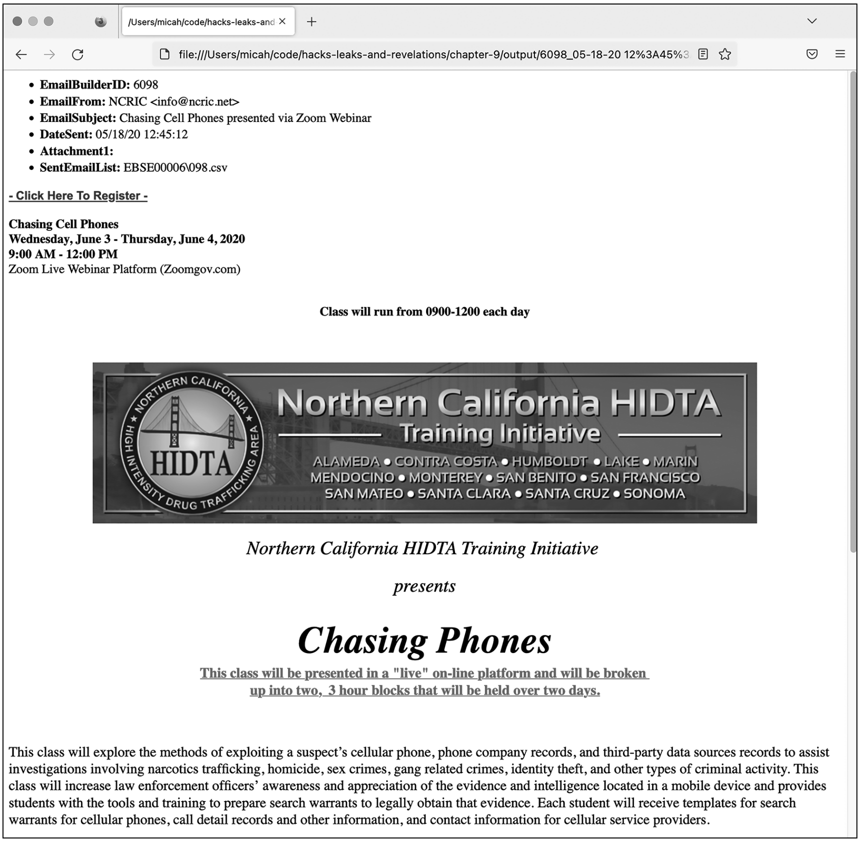

Figure 9-8: Viewing a NCRIC bulk email in a web browser

You can use the script from this exercise to make the bulk email from any BlueLeaks folder more readable; just run the script on the appropriate *EmailBuilder.csv* file.

The BlueLeaks folder names alone don't immediately make clear which folders belong to which organizations. Let's fix that by creating a spreadsheet that associates each BlueLeaks folder with its organization name, website title, and URL.

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Discovering the Names and URLs of BlueLeaks Sites

It's obvious what organization some BlueLeaks folders belong to based on the folder name. You can reasonably guess that the *alabamafusioncenter* folder has data from the Alabama Fusion Center. But most aren't so clear. Can you guess what *ciacco* is? How about *nvhidta* or *snorca*?

After manually looking through the CSV files in various BlueLeaks folders, I discovered that the file *Company.csv* contains, hidden among its 108 columns, the name and URL of each site. Some BlueLeaks folders, it turns out, host more than one site. For example, in Table 9-3, which shows these columns from NCRIC's *Company.csv* file, you can see that the *ncric* folder hosts 18 different sites at different URLs.

Table 9-3: Data from *ncric/Company.csv*

CompanyID	CompanyName	WebsiteTitle	URL
1	NCRIC.net	Northern California Regional Intelligence Center - NCRIC	ncric.net
2	NCRIC New	Northern California Regional Intelligence Center - NCRIC	upinsmoke.ncric.net
3	NCRIC	Northern California Regional Intelligence Center - NCRIC	ncric.org
4	NCHIDTA	Northern California Regional Intelligence Center - NCRIC	nchidta.org
7	NCHIDTA.net	Northern California Regional Intelligence Center - NCRIC	nchidta.net
8	NCRTTAC.org	Northern California Regional Intelligence Center - NCRIC	ncrttac.org
10	NCRTTAC.org	Northern California Regional Intelligence Center - NCRIC	www.ncrttac.org
11	Northern California Most Wanted	Northern California Most Wanted - Serving The Bay Area and Surrounding Counties	northerncaliforniamostwanted.org
12	Northern California Most Wanted	Northern California Most Wanted	northerncaliforniamostwanted.com
14	Northern California Most Wanted	Northern California Most Wanted	ncmostwanted.org
15	NCRIC Private Sector Mobile Registration	Northern California Regional Intelligence Center - NCRIC	psp.ncric.net
16	NCHIDTA.com	Northern California Regional Intelligence Center - NCRIC	nchidta.com
17	NCRIC	NCRIC Mobile	
19	NCRIC	Northern California Regional Intelligence Center - NCRIC	passwordreset.ncric.ca.gov
20	NCHIDTA	NCHIDTA Mobile	

CompanyID	CompanyName	WebsiteTitle	URL
21	NCHIDTA (New)	Northern California Regional Intelligence Center - NCRIC	new.nchidta.org
22	NCRIC	Northern California Regional Intelligence Center - NCRIC	ncric.ca.gov
23	NCRIC NEW	Northern California Regional Intelligence Center - NCRIC	new.ncric.ca.gov

As you can see here, the *ncric* folder hosts not only the NCRIC site but also the sites for the Northern California High Intensity Drug Trafficking Area (NCHIDTA); the Northern California Most Wanted, which lists wanted fugitives; and others. However, all these websites share the same code and databases.

Since almost every BlueLeaks folder contains a *Company.csv* file listing all of the sites associated with that folder, we can write a script to automatically extract this information and format it as a CSV file. This will open the door for you to pick which fusion center you want to research—perhaps there's one in a city near you.

Exercise 9-3: Make a CSV of BlueLeaks Sites

The script you write in this exercise will loop through each BlueLeaks folder, open its *Company.csv* file, and save information about the organizations whose websites are hosted in that folder into a CSV file that you create. For a challenge, you can try programming your own script to do the following:

- Accept two CLI arguments: `blueleaks_path`, the path to your extracted BlueLeaks data, and `output_csv_path`, the path to the new CSV file that the script will create.
- Include these headers: `BlueLeaksFolder` (the BlueLeaks folder name), `CompanyID`, `CompanyName`, `WebsiteTitle`, and `URL` (you'll find these latter fields in the various *Company.csv* files).
- Open `output_csv_path` for writing and create a `csv.DictWriter()` object (see "Working with CSV Files in Python" on page XX), passing in the file object and the headers.
- Loop through each folder in BlueLeaks. You can get a list of all the filenames with `os.listdir(blueleaks_path)`.
- Inside each BlueLeaks folder, open the *Company.csv* file if it exists, and loop through all of the rows in that CSV. For each row, select the information you want to save and then write it to your CSV.
- Map out exactly what websites each BlueLeaks folder hosts in your output CSV.

Otherwise, the rest of this exercise will walk you through the programming process. Start with the usual Python script template in a file called *exercise-9-3.py*:

```
def main():
    pass

if __name__ == "__main__":
    main()
```

Next, modify your script to accept the `blueleaks_path` and `output_csv_path` command line arguments:

```
import click

@click.command()
@click.argument("blueleaks_path")
@click.argument("output_csv_path")
def main(blueleaks_path, output_csv_path):
    """Make a CSV that describes all the BlueLeaks folders"""

if __name__ == "__main__":
    main()
```

You've done this enough times at this point that you can safely assume the CLI arguments are working properly without testing the script.

Open a CSV for Writing

The simplest way to program this script is to first open a CSV file for writing and then loop through each folder in BlueLeaks, adding rows to this CSV. Start by just opening the CSV file for writing, using the following code:

```
import click
import csv

@click.command()
@click.argument("blueleaks_path")
@click.argument("output_csv_path")
def main(blueleaks_path, output_csv_path):
    """Make a CSV that describes all the BlueLeaks folders"""
    headers = ["BlueLeaksFolder", "CompanyID", "CompanyName", "WebsiteTitle", "URL"]
    with open(output_csv_path, "w") as output_f:
        writer = csv.DictWriter(output_f, fieldnames=headers)
        writer.writeheader()

if __name__ == "__main__":
    main()
```

First, the code imports the `csv` module. It then defines what the headers of the output CSV will be in the variable `headers`. As noted in "Working with CSV Files in Python," in order to create a csv.DictWriter() object, you'll need to pass in this list of headers for your CSV file.

Next, the code opens the output CSV file for writing, this time calling it output_f, and creates the csv.DictWriter() object, saving it in the writer variable. Finally, the program writes the header row to the CSV. To write the remaining rows, you'll need to run writer.writerow(), passing in a dictionary that represents the row.

Try running the script so far:

```
micah@trapdoor chapter-9 % python3 exercise-9-3.py /Volumes/datasets/BlueLeaks-extracted sites
.csv
```

The script itself shouldn't display any output; it should just create an output CSV file, *sites.csv*. Try displaying its contents using cat:

```
micah@trapdoor chapter-9 % cat sites.csv
BlueLeaksFolder,CompanyID,CompanyName,WebsiteTitle,URL
```

You should see that the file currently contains only header rows.

Find All the Company.csv Files

Now that you can write rows to your CSV, the next step is to loop through the BlueLeaks sites, looking for *Company.csv* files, using the following code:

```
import click
import csv
import os

@click.command()
@click.argument("blueleaks_path")
@click.argument("output_csv_path")
def main(blueleaks_path, output_csv_path):
    """Make a CSV that describes all the BlueLeaks folders"""
    headers = ["BlueLeaksFolder", "CompanyID", "CompanyName", "WebsiteTitle", "URL"]
    with open(output_csv_path, "w") as output_f:
        writer = csv.DictWriter(output_f, fieldnames=headers)
        writer.writeheader()

        for folder_name in os.listdir(blueleaks_path):
            company_csv_path = os.path.join(blueleaks_path, folder_name, "Company.csv")
            if os.path.exists(company_csv_path):
                print(company_csv_path)

if __name__ == "__main__":
    main()
```

This code imports the os module. After creating the CSV writer, it loops through the return value of the os.listdir() function, which returns a list of all the files inside the BlueLeaks folder. It then defines a new company_csv_path variable as the path to the *Company.csv* file inside that BlueLeaks folder. Finally, the `os.path.exists()` function makes sure that this specific *Company.csv* file actually exists, and if so, the code displays its path.

Try running the code so far:

```
micah@trapdoor chapter-9 % python3 exercise-9-3.py /Volumes/datasets/BlueLeaks-extracted sites
.csv
/media/micah/datasets/BlueLeaks-extracted/vlnsn/Company.csv
/media/micah/datasets/BlueLeaks-extracted/njuasi/Company.csv
/media/micah/datasets/BlueLeaks-extracted/stopwesttexasgangs/Company.csv
--snip--
```

As you can see, the script displays paths for all of the *Company.csv* files in BlueLeaks. (Yours might display them in a different order than mine.)

Add BlueLeaks Sites to the CSV

The final step is to open all the *Company.csv* files whose paths you've just listed, loop through their rows, and add new rows to your output CSV file based on them:

```
import click
import csv
import os

@click.command()
@click.argument("blueleaks_path")
@click.argument("output_csv_path")
def main(blueleaks_path, output_csv_path):
    """Make a CSV that describes all the BlueLeaks folders"""
    headers = ["BlueLeaksFolder", "CompanyID", "CompanyName", "WebsiteTitle", "URL"]
    with open(output_csv_path, "w") as output_f:
        writer = csv.DictWriter(output_f, fieldnames=headers)
        writer.writeheader()

        for folder_name in os.listdir(blueleaks_path):
            company_csv_path = os.path.join(blueleaks_path, folder_name, "Company.csv")
            if os.path.exists(company_csv_path):
                with open(company_csv_path, "r") as input_f:
                    reader = csv.DictReader(input_f)
                    for row in reader:
                        output_row = {
                            "BlueLeaksFolder": folder_name,
                            "CompanyID": row["CompanyID"],
                            "CompanyName": row["CompanyName"],
                            "WebsiteTitle": row["WebsiteTitle"],
                            "URL": row["URL"],
                        }
                        writer.writerow(output_row)

                print(f"Finished: {folder_name}")

if __name__ == "__main__":
    main()
```

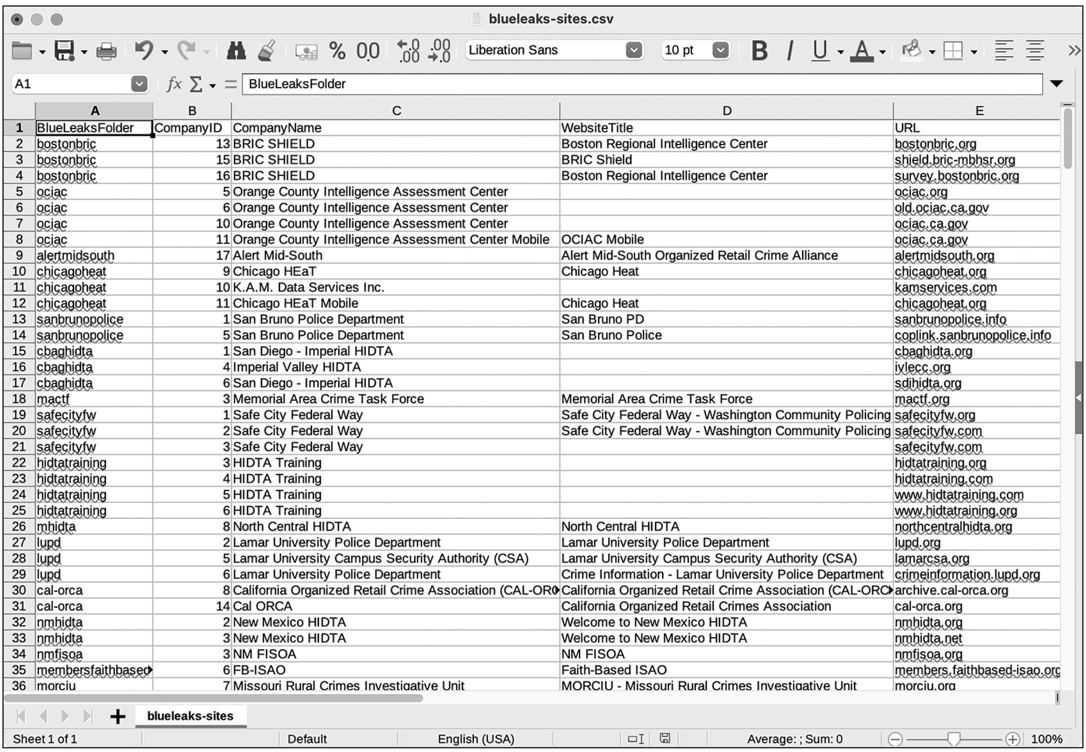
The added code opens the `company_csv_path`, this time for reading instead of writing, and now calling the file object `input_f`. It then creates a `csv.DictReader()` object to read the data from this CSV and loops through its rows.

For each row, the code creates a new dictionary called `output_row` that contains the name of the BlueLeaks folder you're currently working in, as well as `CompanyID`, `CompanyName`, `WebsiteTitle`, and `URL` from *Company.csv*. It then uses the CSV writer you created in the previous section to save that row to your output CSV file. When the code finishes looping through all of the rows in a *Company.csv* file, it displays a message to show it's done with that folder.

You can find the complete script at *https://github.com/micahflee/hacks-leaks-and-revelations/blob/main/chapter-9/exercise-9-3.py*. Run your final script like so:

```
micah@trapdoor chapter-9 % python3 exercise-9-3.py /Volumes/datasets/BlueLeaks-extracted sites
.csv
Finished: vlnsn
Finished: njuasi
Finished: stopwesttexasgangs
--snip--
```

When you run this script, the output displays a line for each BlueLeaks folder showing that it has finished running. But more importantly, it creates the file *sites.csv*. Figure 9-9 shows what that file looks like in LibreOffice Calc.



	A	B	C	D	E
1	BlueLeaksFolder	CompanyID	CompanyName	WebsiteTitle	URL
2	bostonbric	13	BRIC SHIELD	Boston Regional Intelligence Center	bostonbric.org
3	bostonbric	15	BRIC SHIELD	BRIC Shield	shield.bric-mbhsr.org
4	bostonbric	16	BRIC SHIELD	Boston Regional Intelligence Center	survey.bostonbric.org
5	ociac	5	Orange County Intelligence Assessment Center		ociac.org
6	ociac	6	Orange County Intelligence Assessment Center		old.ociac.ca.gov
7	ociac	10	Orange County Intelligence Assessment Center		ociac.ca.gov
8	ociac	11	Orange County Intelligence Assessment Center Mobile	OCIAC Mobile	ociac.ca.gov
9	alertmidsouth	17	Alert Mid-South	Alert Mid-South Organized Retail Crime Alliance	alertmidsouth.org
10	chicagoheat	9	Chicago HEaT	Chicago Heat	chicagoheat.org
11	chicagoheat	10	K.A.M. Data Services Inc.		kamservices.com
12	chicagoheat	11	Chicago HEaT Mobile	Chicago Heat	chicagoheat.org
13	sanbrunopolice	1	San Bruno Police Department	San Bruno PD	sanbrunopolice.info
14	sanbrunopolice	5	San Bruno Police Department	San Bruno Police	coplink.sanbrunopolice.info
15	cbaghidta	1	San Diego - Imperial HIDTA		cbaghidta.org
16	cbaghidta	4	Imperial Valley HIDTA		ivlecc.org
17	cbaghidta	6	San Diego - Imperial HIDTA		sdihidta.org
18	mactf	3	Memorial Area Crime Task Force	Memorial Area Crime Task Force	mactf.org
19	safecityfw	1	Safe City Federal Way	Safe City Federal Way - Washington Community Policing	safecityfw.org
20	safecityfw	2	Safe City Federal Way	Safe City Federal Way - Washington Community Policing	safecityfw.com
21	safecityfw	3	Safe City Federal Way		safecityfw.com
22	hidtatraining	3	HIDTA Training		hidtatraining.org
23	hidtatraining	4	HIDTA Training		hidtatraining.com
24	hidtatraining	5	HIDTA Training		www.hidtatraining.com
25	hidtatraining	6	HIDTA Training		www.hidtatraining.org
26	mhidta	8	North Central HIDTA	North Central HIDTA	northcentralhidta.org
27	lupd	2	Lamar University Police Department	Lamar University Police Department	lupd.org
28	lupd	5	Lamar University Campus Security Authority (CSA)	Lamar University Campus Security Authority (CSA)	lamarcsa.org
29	lupd	6	Lamar University Police Department	Crime Information - Lamar University Police Department	crimeinformation.lupd.org
30	cal-orca	8	California Organized Retail Crime Association (CAL-ORC	California Organized Retail Crime Association (CAL-ORC	archive.cal-orca.org
31	cal-orca	14	Cal ORCA	California Organized Retail Crimes Association	cal-orca.org
32	nmhidta	2	New Mexico HIDTA	Welcome to New Mexico HIDTA	nmhidta.org
33	nmhidta	3	New Mexico HIDTA	Welcome to New Mexico HIDTA	nmhidta.net
34	nmfisoa	3	NM FISOA	NM FISOA	nmfisoa.org
35	membersfaithbased	6	FB-ISAO	Faith-Based ISAO	members.faithbased-isao.orc
36	morciu	7	Missouri Rural Crimes Investigative Unit	MORCIU - Missouri Rural Crimes Investigative Unit	morciu.org

Figure 9-9: The CSV output created by the final Exercise 9-3 script

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Once you've created the CSV, you can use your graphical spreadsheet software to freeze the header row at the top and sort the columns however you'd like. If you live in the US, try finding the fusion center that covers your region; that might be a good place to start digging. You can use the skills you've learned in this chapter and the Python scripts you've written to make the files for your chosen fusion center easier to work with.

Before you get too deep into your BlueLeaks investigations, though, I recommend reading Chapter 10, where I'll introduce you to software that might save you time and allow you to uncover more interesting revelations.

Summary

In this chapter, you started investigating CSV spreadsheets. You've learned how to open and examine them using spreadsheet software, as well as how to read and write them using Python code, sharpening your programming skills along the way. You've also learned more about the BlueLeaks dataset structure and how to find hidden details, such as who posted which SARs and what documents were sent out as part of which bulk email messages, in the spreadsheets.

You've explored just a few CSVs in BlueLeaks so far, including *SARs.csv* and *EmailBuilder.csv* in NCRIC, and *Company.csv* in all of the folders, but there's still much more to investigate. In the next chapter, you'll learn how to research the BlueLeaks dataset in depth using my custom-built software, BlueLeaks Explorer.

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10

BLUELEAKS EXPLORER

In some ways, I spent the summer of 2020 like many other Americans. I mostly stayed at home, avoiding COVID-19 like the plague it is; I spent far too many hours doom-scrolling through social media feeds; and occasionally I put on an N95 mask, grabbed some hand sanitizer, and hit the streets to protest the police killings of George Floyd, Breonna Taylor, and countless other Black Americans. But I also spent much of that summer writing code that would make it easier for me and other journalists at The Intercept to make sense of the sprawling BlueLeaks dataset.

My efforts culminated in a piece of open source software, which I released as part of this book, called BlueLeaks Explorer. BlueLeaks Explorer is a web application that allows you to examine the BlueLeaks data almost as if you could log in as an admin on the actual websites that were

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hacked. BlueLeaks Explorer is a little like a large Python script that makes all of the CSVs in BlueLeaks easier to work with, like the scripts you wrote in Chapter 9.

In this chapter, you'll continue to investigate the BlueLeaks dataset, this time using BlueLeaks Explorer. I'll give you a thorough overview of the software, including how to set it up on your own computer and how to start researching BlueLeaks with it. I'll conclude the chapter by explaining the technology behind the app and pointing you to its Python source code on GitHub. If you ever need to develop an app to investigate a specific dataset, you can use this chapter as inspiration.

Undiscovered Revelations in BlueLeaks

As discussed in the previous chapter, my BlueLeaks investigation focused on the data from the *ncric* folder. Even within that folder, I concentrated on the final two weeks of data, focusing on police surveillance of the Black Lives Matter movement. Other journalists dug into different parts of the dataset, investigating fusion centers in places like Maine and Texas.

Notably, journalist Nathan Bernard broke several stories for the local news-and-arts magazine *Mainer* based on BlueLeaks documents from the Maine Information and Analysis Center (MIAC), Maine's fusion center. These included stories about MIAC disseminating unverified rumors, sometimes based on satirical social media posts, that were first spread by far-right activists on social media and then included in FBI and DHS intelligence reports, similar to the FBI warning discussed in Chapter 9 about a George Soros–funded group hiring "professional anarchists." "This bogus intel gives cops a dangerously distorted sense of what to expect during demonstrations by portraying peaceful protesters as highly trained, paid and organized criminal actors intent on causing mayhem," Bernard wrote in one article.

Additionally, John Anderson and Briant Bingamon wrote a series of articles for the *Austin Chronicle*, a local paper in Austin, Texas, based on BlueLeaks documents from the Austin Regional Intelligence Center (ARIC), Austin's fusion center. Anderson wrote about ARIC's practice of monitoring for and distributing lists of local Black Lives Matter protests (just like NCRIC did during the summer of 2020), and about several SARs posted to ARIC, including one where the "suspicious activity" was someone mailing a package of toys to Lebanon. Bingamon wrote stories revealing that ARIC had monitored local leftist groups in Austin, and that some ARIC courses for law enforcement teach junk science—including a technique for detecting deception, called Scientific Content Analysis (SCAN), which a 2016 study concluded has "no empirical support" (*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4766305/*).

MIAC, ARIC, and NCRIC are some of the BlueLeaks sites that have received the most interest, but many more haven't gotten any attention at all. By the end of this chapter, you'll have all the tools you need to do a deep dive on any BlueLeaks folder you choose and search for newsworthy revelations. To start, you'll install BlueLeaks Explorer in Exercise 10-1.

Exercise 10-1: Install BlueLeaks Explorer

You can find BlueLeaks Explorer's source code at *https://github.com/micahflee/blueleaks-explorer*. That GitHub page includes instructions on how to get it up and running locally on your computer, but I'll explain all the steps in this exercise as well.

The BlueLeaks Explorer app is packaged as a Docker image and published to Docker Hub at *https://hub.docker.com/r/micahflee/blueleaks-explorer*. You'll run it locally on your computer using Docker and point it at your BlueLeaks folder. Before you begin, make sure you've completed the exercises in Chapter 5 so that you understand how to use Docker and Docker Compose.

Create the Docker Compose Configuration File

Start by creating a new folder called *blueleaks-explorer*. This folder will require about 5GB of disk space. Create a new file in that folder called *docker-compose.yaml* and open it in your text editor.

NOTE *If you're using Windows, I recommend that you follow this chapter in Ubuntu with WSL rather than PowerShell (see Appendix A for information about performance issues you might encounter when using Docker in Windows). You can open an Ubuntu terminal, create the* blueleaks-explorer *folder in your Linux filesystem using* `mkdir blueleaks-explorer`*, and edit the* docker-compose.yaml *file in VS Code by running* `code docker-compose.yaml`*, all from Ubuntu.*

Here's how I created the folder, and made the *docker-compose.yaml* file, on my Mac. You can do the same in Linux or Windows with WSL:

```
micah@trapdoor ~ % mkdir blueleaks-explorer
micah@trapdoor ~ % cd ~/blueleaks-explorer
micah@trapdoor blueleaks-explorer % code docker-compose.yaml
```

Add the following code to your *docker-compose.yaml* file, replacing `/Volumes/datasets/BlueLeaks-extracted` with the path that maps to */data/blueleaks* in your own *BlueLeaks-extracted* folder:

```
version: "3.9"
services:
  app:
    image: micahflee/blueleaks-explorer:latest
    ports:
      - "8000:80"
    volumes:
      - /Volumes/datasets/BlueLeaks-extracted:/data/blueleaks
      - ./databases:/data/databases
      - ./structures:/data/structures
```

This file describes the settings for the BlueLeaks Explorer Docker container. The container is called `app` and is set to use the latest version of the `micahflee/blueleaks-explorer` Docker container image, which you'll download from Docker Hub. The `ports` section maps port 8000 on your computer to port 80 inside the container. This means that once the BlueLeaks Explorer app is running, you can load it on your browser at *http://localhost:8000*. The `volumes` section maps folders on your machine to folders inside the container.

Save the *docker-compose.yaml* file.

Bring Up the Containers

In a terminal window, change to the *blueleaks-explorer* folder that you just made, then run this command to download the BlueLeaks Explorer Docker image and start the server:

```
docker-compose up
```

The first time you run the command, the output should end with something like this:

```
blueleaks-explorer-app-1  |  * Serving Flask app 'app'
blueleaks-explorer-app-1  |  * Debug mode: off
blueleaks-explorer-app-1  |    WARNING: This is a development server. Do not use
                               it in a production deployment. Use a production
                               WSGI server instead.
blueleaks-explorer-app-1  |  * Running on all addresses (0.0.0.0)
blueleaks-explorer-app-1  |  * Running on http://127.0.0.1:80
blueleaks-explorer-app-1  |  * Running on http://172.19.0.2:80
blueleaks-explorer-app-1  | Press CTRL+C to quit
```

At this point, BlueLeaks Explorer is running on your computer, but it hasn't been initialized. If you load *http://localhost:8000* in your browser, you should get an error telling you as much.

Initialize the Databases

The first time you use BlueLeaks Explorer, you must run a script to convert the many CSV files in BlueLeaks into SQLite databases. SQLite is lightweight SQL database software that can store a whole database in a single file (you'll learn more about SQL databases in Chapter 12). All of the CSVs in BlueLeaks were originally formatted as SQL tables, which the hacker exported into CSV format. Converting these CSV files back into database tables makes it easier for the Python code that runs BlueLeaks Explorer to query for and access items within those tables, then display them in the web app. For example, when searching for SARs that contain a specific string, BlueLeaks Explorer might search all the BriefSummary fields in the SARs table, trying to find reports that mention that string.

To initialize BlueLeaks Explorer, open a separate terminal window, change to your *blueleaks-explorer* folder, and run this command:

```
docker-compose exec app poetry run python ./initialize.py
```

This will run `poetry run python ./initialize.py` in your already running `app` container. The *initialize.py* Python script will take a while to finish running, since it's transforming thousands of CSV files into hundreds of SQLite database; it took my computer about 50 minutes.

NOTE *If you're curious about the details of what the initialization script is doing, take a look at the source code. BlueLeaks Explorer is open source, meaning you can check out the* initialize.py *file in the project's git repository at* https://github.com/micahflee/blueleaks-explorer/blob/main/src/initialize.py.

When *initialize.py* finishes running, refresh *http://localhost:8000* in your web browser to pull up BlueLeaks Explorer, as shown in Figure 10-1.

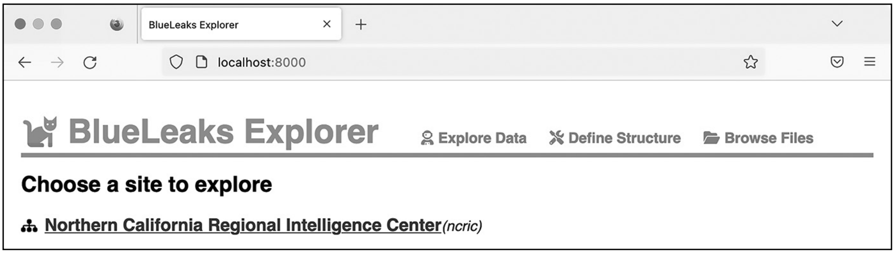

Figure 10-1: The freshly installed BlueLeaks Explorer app

Each fusion center is unique: it's run by different people, has different priorities and goals, and keeps track of different data. To make the best use of BlueLeaks Explorer, you need to spend some time understanding how the data in your target fusion center is laid out. I call this layout the *structure* of a BlueLeaks site. This refers to which tables contain useful information (some tables are empty or contain irrelevant data about the website layout), which columns in those tables are useful, and how the various tables are related.

The top of every page in BlueLeaks Explorer includes three links, as shown in Figure 10-1: Explore Data, Define Structure, and Browse Files. It would be difficult to automatically figure out the structure of a BlueLeaks site, in part because it's subjective—individual users determine what information is interesting or useless for their purposes. Therefore, the Define Structure page brings you to an editor where you can define your own structures for BlueLeaks sites. Under Explore Data, you can find structures you've already created for individual BlueLeaks sites. Since you're running BlueLeaks Explorer locally on your own computer, you'll have access only to structures you've made yourself or that are included in the BlueLeaks Explorer Docker image. Finally, Browse Files lists all of the files in BlueLeaks, enabling you to link to specific documents or embed images; it's simply a web interface to the raw BlueLeaks data, as if you were looking at it in a file browser.

NOTE *If you set up a VPN to hide your IP address from fusion center websites as described in "Covering Your Tracks with a VPN Service" in Chapter 9, you may want to use a VPN for this chapter as well. Though BlueLeaks Explorer is hosted on your own computer, viewing content within it might load images from fusion center sites, and clicking links could bring you to those sites.*

In the following section, you'll begin by exploring the data for the NCRIC site using a structure that I've already created.

The Structure of NCRIC

BlueLeaks Explorer allows you to browse and search all of the tables in any BlueLeaks site that you have a structure for. To demonstrate the features of the app—including listing the tables in a BlueLeaks site, viewing and searching the data in those tables, viewing data from related tables, and viewing images and documents associated with rows of data—you'll start by exploring the NCRIC data. This will help you understand how structures are constructed before you make your own.

Exploring Tables and Relationships

As directed in Exercise 10-1, make sure your BlueLeaks Explorer Docker container is running and load *http://localhost:8000* in your browser. From the Explore Data section, click **Northern California Regional Intelligence Center**. Figure 10-2 shows this page.

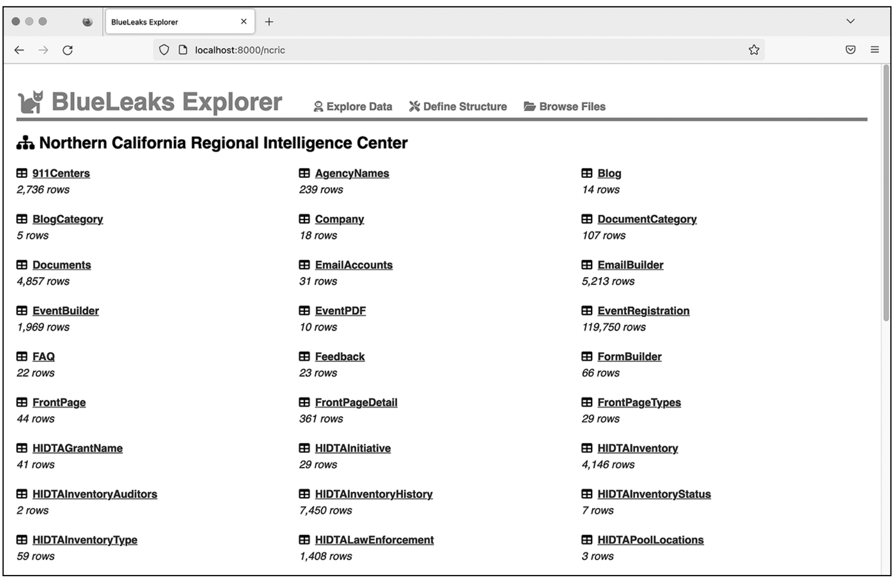

Figure 10-2: Viewing the NCRIC tables in BlueLeaks Explorer

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Here, you can see a list of tables in the *ncric* folder, as well as the number of rows of data in each table. The EmailBuilder table has 5,213 rows, for example. I've hidden all of the tables that are empty or contain information I considered irrelevant so that they don't show up here.

When I first defined the NCRIC structure, I started by exploring the data in each table, one at a time (I'll explain how you can do this for other parts of BlueLeaks later in the chapter). I found that the following tables contained the most interesting and potentially newsworthy data:

EmailBuilder Contains all of the bulk email NCRIC sends out to its large list of local police and private industry partners

EventBuilder Describes events that NCRIC put on, complete with their descriptions, PDF flyers, and lists of who attended

FormBuilder Contains a list of forms on NCRIC's website for a variety of purposes, like submitting SARs, requesting technical help, or even registering for an account with the fusion center

Requests Includes requests from local police for the fusion center's assistance with tasks like monitoring social media and breaking into locked phones

SARs Contains suspicious activity reports, which, as you learned in the previous chapter, are files submitted to NCRIC in which people report behavior that they believe could be criminal or otherwise suspicious

SurveyForm Includes surveys that NCRIC requests from attendees of events it has hosted

Different tables within BlueLeaks relate to each other in various ways. For example, as you know from the previous chapter, many of the BlueLeaks sites include the tables Documents and DocumentCategory. Both of these tables contain a field called DocumentCategoryID. One row in the Documents table in the *ncric* folder, for instance, describes a document titled *FBI NSIR Tradecraft Alert Voter Suppression*. The DocFilename field contains the path of a PDF. The DocumentCategoryID is 167. Looking at the row with that DocumentCategoryID in the DocumentCategory table, you can see that the CategoryName is Elections. Now you know that NCRIC put this document in the Elections category. In database-speak, two tables that are connected via a shared field have a *relationship*. The SurveyForm table, which lists surveys for attendees of NCRIC-hosted events to fill out, is also related to the Survey table, which includes the actual survey feedback.

BlueLeaks Explorer makes it easy to quickly find related information within a BlueLeaks site. Click the Documents table from the list of tables shown in Figure 10-2. You should see a list of documents, each on its own row in the Documents table. In the Search field, enter **Voter Suppression** to bring up the *FBI NSIR Tradecraft Alert Voter Suppression* document, shown in Figure 10-3.

Figure 10-3: Viewing the FBI NSIR Tradecraft Alert Voter Suppression document in BlueLeaks Explorer

When you view a document row using the NCRIC structure I defined, BlueLeaks Explorer will show you a link to the file itself, in this case a PDF. It also shows a preview of the file if it's available (the path to the preview image is listed in the PreviewImage field), along with the document category, in this case Elections.

If you click the filename link, the PDF will open. Dated October 16, 2018, the document warns, "The FBI assesses threat actors may use social media, namely Facebook and Twitter, to suppress voter turnout by posting disinformation on when and how to vote in the 2018 midterm election." It points out examples of voter suppression tactics on social media from the 2016 election, such as a Spanish-language meme claiming that you can vote for Hillary Clinton by texting "Hillary" to a specific phone number—tricking voters into falsely believing they voted for Clinton.

Next, click **Permalink** under the Elections category to get to the category itself. Your URL should now be *http://localhost:8000/ncric*

/DocumentCategory/167, and from here you should see all 11 documents categorized in Elections. You can click Permalink under any of those documents to view it. You can easily flip between documents and their categories in this way because I defined a relationship in the NCRIC structure between the Document and DocumentCategory tables. The permalink brings you to a unique URL just for that row. During an investigation, you can keep track of any interesting items in the dataset using their permalinks so you can easily refer back to them later on. The Show All link will show all of the hidden fields for this row. I've configured the Documents table to show only a handful of fields: DocTitle, DateEntered, DocFilename, URL, PreviewImage, and the DocumentCategory relationship. Clicking Show All will show you the remaining hidden fields as well.

Searching for Keywords

For a concrete example of how BlueLeaks Explorer makes it easier to investigate the BlueLeaks documents, let's revisit the SAR described in "Investigating a SAR" in Chapter 9 in which a lawyer reported a student protester. This time, instead of manually grepping CSV files and copying and pasting big blocks of text from fields in spreadsheets for easier reading, you'll do it all in BlueLeaks Explorer.

Go back to the NCRIC list of tables, click **SARs**, and search for **antifa** to find that specific row. Figure 10-4 shows the record. The File1 row should display a clickable link to the PDF originally attached to the SAR, allowing you to quickly open the document. If you click it, you'll immediately be able to read the PDF in another browser tab.

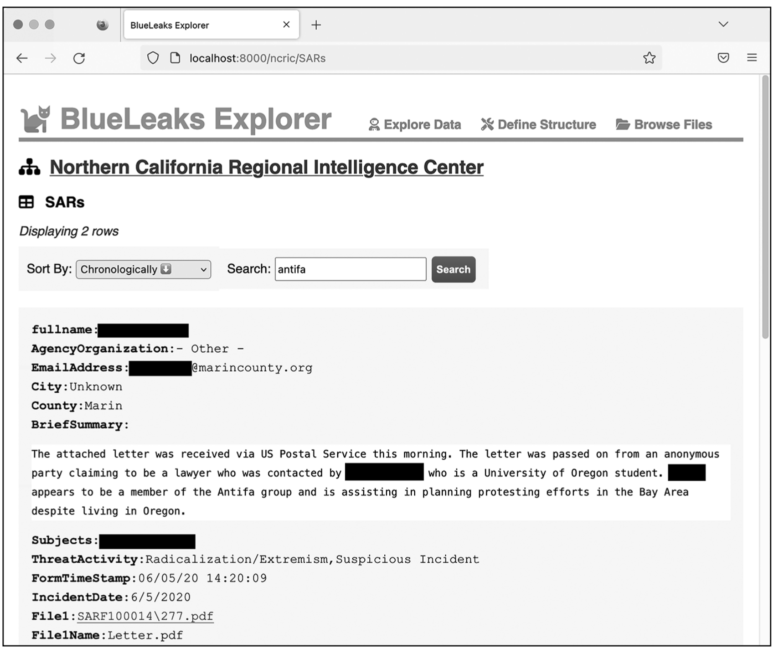

Figure 10-4: Viewing a SAR in BlueLeaks Explorer

Now that you have an idea of how to navigate BlueLeaks Explorer, it's your turn to explore other parts of the BlueLeaks dataset beyond NCRIC.

Building Your Own Structure

In this section, you'll learn how to define your own structure for another BlueLeaks site, the Los Angeles Joint Regional Intelligence Center (JRIC). By the end of this section, you'll have the tools you need to create structures for all of the BlueLeaks sites.

Building out a BlueLeaks Explorer site structure takes work, but it also helps you gain a much clearer understanding of the data. Once you've started cleaning up a few of the tables, you can spend time reading them, looking for newsworthy revelations. As you read, you'll probably end up tweaking the structure to help you in your research, and you'll also likely start cleaning up new tables as you discover relationships to them.

Defining the JRIC Structure

Some structures, like the one I constructed for NCRIC, are already included with BlueLeaks Explorer. To either edit existing structures or define new ones, load BlueLeaks Explorer in your browser and click **Define Structure** at the top of the screen. Figure 10-5 shows the page that should pop up.

On the Define Structure page, every structure that is already defined is listed under Edit Structures. In Figure 10-5, this is just a single structure, NCRIC. To edit a structure, simply click its name. The BlueLeaks sites that don't yet have a structure are listed by their folder name under Define a New Structure, along with a button to create that new structure. Scroll down until you see the listing for *jric*, and click **Create**.

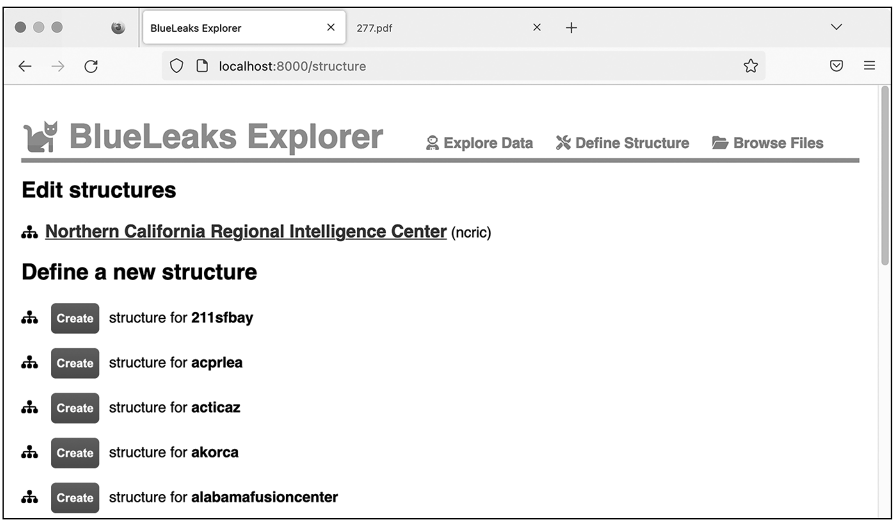

Figure 10-5: Viewing the Define Structure page in BlueLeaks Explorer

In the page that opens, you can configure exactly how BlueLeaks Explorer should work when you investigate the JRIC data, as shown in Figure 10-6. The top of the page displays the name of the site, which defaults to the BlueLeaks folder name, *jric*.

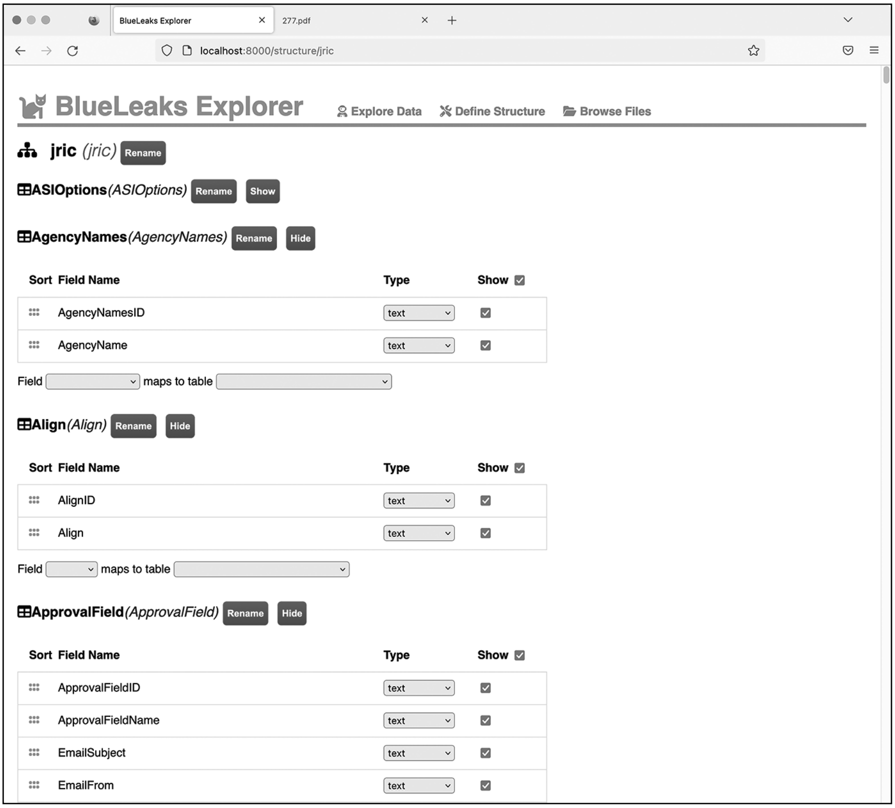

Figure 10-6: Editing the JRIC structure in BlueLeaks Explorer

Click **Rename** next to the site name and enter **Los Angeles Joint Regional Intelligence Center**. Every time you make a change like this, you should see the message "You have unsaved changes," with a Save button, in the bottom-right corner. Click **Save**.

Below the site name, the Edit Structure page lists all of the tables in this BlueLeaks site. Next to each table name is the Rename button, as well as buttons to show or hide the table. BlueLeaks Explorer automatically detects tables that don't have any rows and hides them by default; this is why the ASIOptions table starts out hidden. You can also manually hide tables that you don't care about to reduce clutter when you're actually investigating this site later on.

Now that you've created the JRIC structure, open the **Explore Data** link at the top in a separate browser tab. You should see that the Los Angeles

Joint Regional Intelligence Center site has been added to the list of sites to explore. Figure 10-7 shows the new Explore Data page.

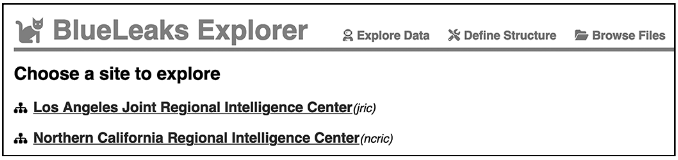

Figure 10-7: The Explore Data page after you've created the JRIC structure

Any additional structures you create for other BlueLeaks sites will also appear on this page.

Click the JRIC link to pull up all the tables in this site. As you work through the rest of the section, and when building a structure in BlueLeaks Explorer in general, keep two tabs open: the Explore Data and Define Structure pages. This way, when you save changes in the Define Structure tab, you can refresh the Explore Data tab to see them implemented.

Showing Useful Fields

In Exercise 9-3, you wrote a Python script to automatically create a spreadsheet mapping the names of BlueLeaks folders to their associated organizations. You found this information in *Company.csv*, a spreadsheet with 108 different columns. Only a few fields in this spreadsheet proved to be relevant, which makes this a good table for practicing showing only useful fields.

In your Explore Data tab, click the Company table. You should see the page shown in Figure 10-8. There are 7 rows displayed, each containing all 108 different fields, some of which include lots of HTML. Because each row has so many fields, this figure shows only the fields at the beginning of the first row of data.

The text in these fields isn't very readable yet, but that's easy to fix. Back in your Define Structure tab, scroll down until you find the Company table. For each field, you can choose the type from a drop-down menu and toggle a checkbox to set whether or not you want it to appear in the Explore Data page. For example, you probably don't care about the value of BannerAdHeight, so you'd want to hide that field.

You can also click the checkbox next to Show at the top of the table to toggle all the checkboxes at once. Click it now to uncheck—that is, hide—all of the fields in the Company table. From here, you can scroll through and select only the most useful fields to display.