The Zen of Cybersecurity

Cybersecurity

Cybersecurity Day 1

Class Objectives

By the end of class today, students will be able to:

- [ ] Explain the course structure and general direction of the program.
- [ ] Recognize the high-level security strategies and tools covered in class.
- [ ] Explain how cybersecurity is an assessment of threats and mitigation of risks.
- [ ] List different types of user, web, server, and database cybersecurity attacks.
- [ ] Identify risk mitigation plan framework for user, web server, and database attacks.

CompTIA Partnership

As part of the course, all students will receive:

- Access to CompTIA CertMaster Practice for Security+
  - An adaptive knowledge assessment and certification training companion tool that will help you gain knowledge and prepare for the Security+ CompTIA exam
  - Features question-first design, real-time learning analytics, and content refreshers - this will help reinforce and test what you know and close knowledge gaps
  - You will receive access partway through the course
- CompTIA Security+ exam voucher
  - Exam vouchers are good for 12 months
  - You will receive this at the end of course, in order to give the voucher the longest shelf-life possible and give you time to study

The Rising Cyber Threat

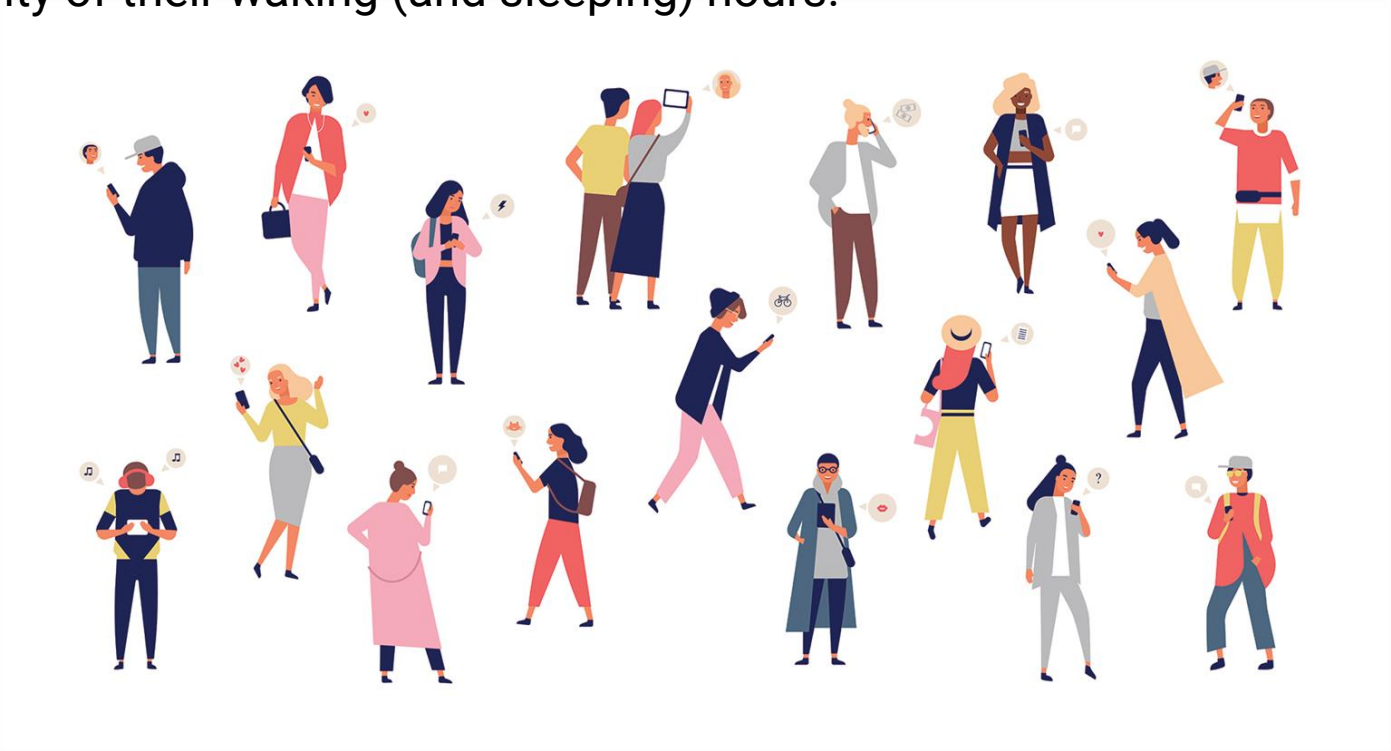
Why is cybersecurity such a desired skill these days?

Reason 1: Explosive Growth in Dependence of IT

Nearly every personal, social, and commercial aspect of our lives makes contact with **vulnerable IT infrastructure**.

Reason 2: More Users (Targets) on Connected Devices

More people than ever before are logged into connected devices- often for the majority of their waking (and sleeping) hours.



Reason 3: Better Tools for Bigger Damage

The Switch

Equifax's massive 2017 data breach keeps getting worse

(Michael Nagle/Bloomberg News)

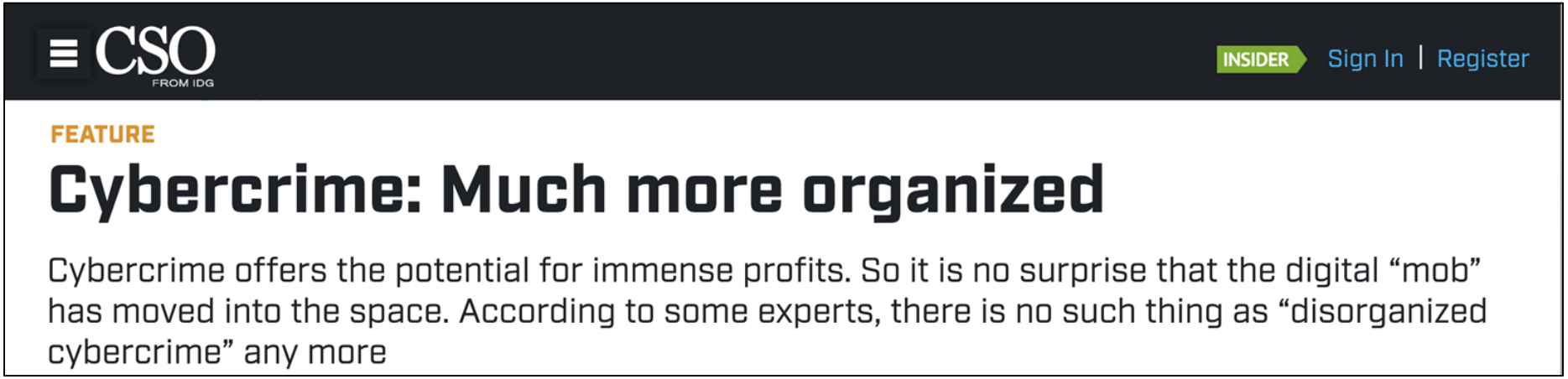
By **Brian Fung**
March 1, 2018

Equifax said Thursday that 2.4 million more consumers than previously reported were affected by the massive data breach the company suffered last year, adding to an already stunning toll.

Cyber Attacks today are becoming more sophisticated, aggressive and disruptive than ever before.

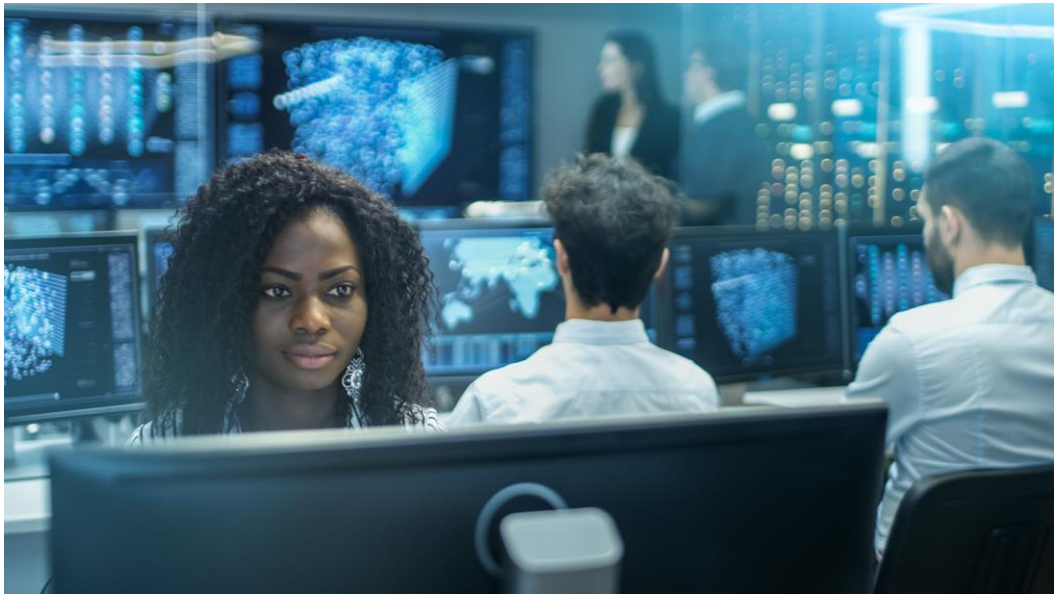
Reason 4: Significant Investment by Bad Actor

Where once the field was populated by individual “lone hackers”, today it has become a focal point for organized crime, nation states, and private enterprises.



Reason 5: Dire Shortage of Skilled Professionals

According to studies by $(ISC)^2$, there will be over 1.5 million unfilled cybersecurity positions by 2020.



“70% of cyber security professionals say that their organization has been impacted by the ongoing global cybersecurity skills shortage.”

Defining Cybersecurity

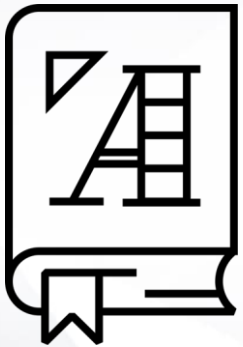
What is the first thing you think of when you hear “cybersecurity”?

Everyone’s First Thoughts:

Hackers and Complicated Code...

Everyone’s First Thoughts:

But cybersecurity isn’t about complicated code and hackers...



Cybersecurity is really about assessing threats and mitigating risks.

Assessing Threats:

Let’s say we found a USB drive laying on the ground…

How much of a threat could it *really* be?

Let’s find out!

Your Turn! The Case of the Crazy USB

Quick Activity:

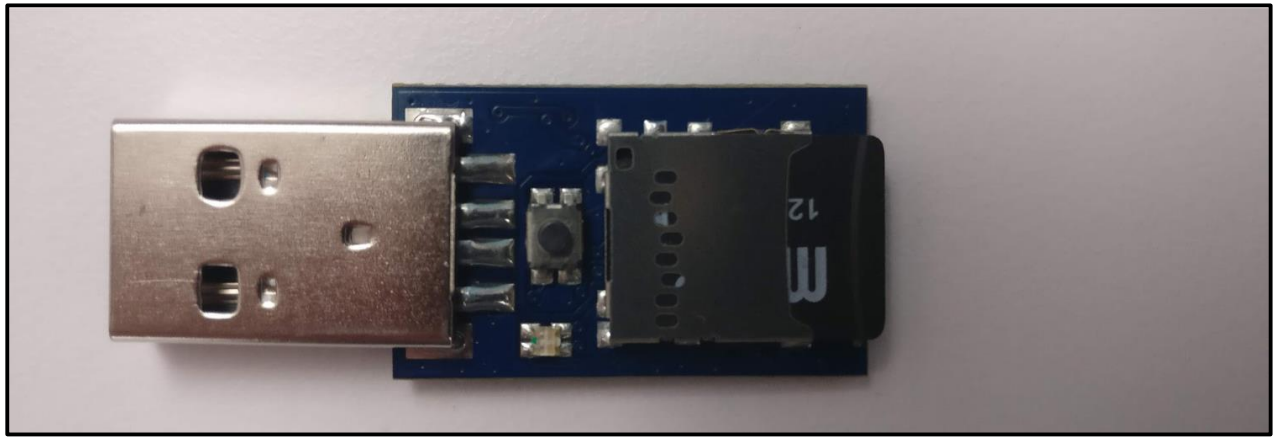
Turn to the person next to you and discuss what could happened.

1. How might it be that a USB drive was able to immediately execute running code?
2. Why didn’t our computer stop the drive from running?
3. How might we defend against malevolent USBs like this?

5 Minutes

A Harmless USB?

The USB is actually a mini keyboard-emulator. When connected, our computer registers it as a keyboard allowing it to kick off without restriction.



Like most threats, their appearances are deceptively safe-seeming.

Know Thy Threats

To the experienced cybersecurity professional, risks are everywhere.

Five nightmarish attacks that show the risks of IoT security

The Internet of Things is not going away -- and neither are the attacks that exploit device vulnerabilities. Here are five incidents that illustrate what users and device developers need to do to prevent breaches.

By Jack Wallen | June 1, 2017 -- 16:31 GMT (09:31 PDT) | Topic: Cybersecurity in an IoT and Mobile World

TECHNOLOGY

Email Is Dangerous

Electronic mail as we know it is drowning in spam, forged phishing mails, and other scams and hacks. It's going to get worse before it gets better.

The SIM Hijackers

Has someone hacked your webcam? Here's how to stop cyber-snoopers

New Hacking Technique Can Steal Info Through PC Speakers and Headphones

26TH JUNE 2018 2:54PM

DIGITAL DISRUPTION

What can be done to stop connected car hacking?

Critical Bluetooth Flaws Put Over 5 Billion Devices At Risk Of Hacking

A hacker gained access to 100 million Capital One credit card applications and accounts

By Rob McLean, CNN Business

Updated 8:46 AM ET, Tue July 30, 2019

Mitigating Risks

Historically, organizations viewed cybersecurity from the lens of the castle model. Walls were built and *managing risks* meant keeping the bad guys out.

Today, security professionals operate in a world where **breach is assumed**, and the risks associated with such events also **need to be mitigated**.

Course Overview

Our Future Tool Belt

Our Goals

Threat Assessment

Risk Mitigation

Our Tools

- ☐ Network Security
- ☐ Web Security
- ☐ OS Security
- ☐ Cryptography
- ☐ Penetration Testing
- ☐ Vulnerability Assessment
- ☐ Security Policy
- ☐ Risk Analysis
- ☐ Compliance Strategy
- ☐ Operational Security
- ☐ UNIX Command Line
- ☐ Wireshark
- ☐ Kali Linux
- ☐ Nmap
- ☐ Nessus
- ☐ Metasploit
- ☐ Burp Suite
- ☐ SIEMS *and more...*

Daily Routine

In class, we'll run through the follow:

- Set Objectives
- Brief Background Lecture
- Instructor Demonstrations
- Thought Exercises
- In-Class Skill Builders
- Project Work

Curriculum at a Glance

Weeks 1-7 Command Line and Programing

First, we will undertake a rigorous exposure to Unix, the command line, Python 3, Wireshark, networking, encryption, hashing, and malware analysis.

Weeks 8-13 System Admin and Web Vulnerabilities

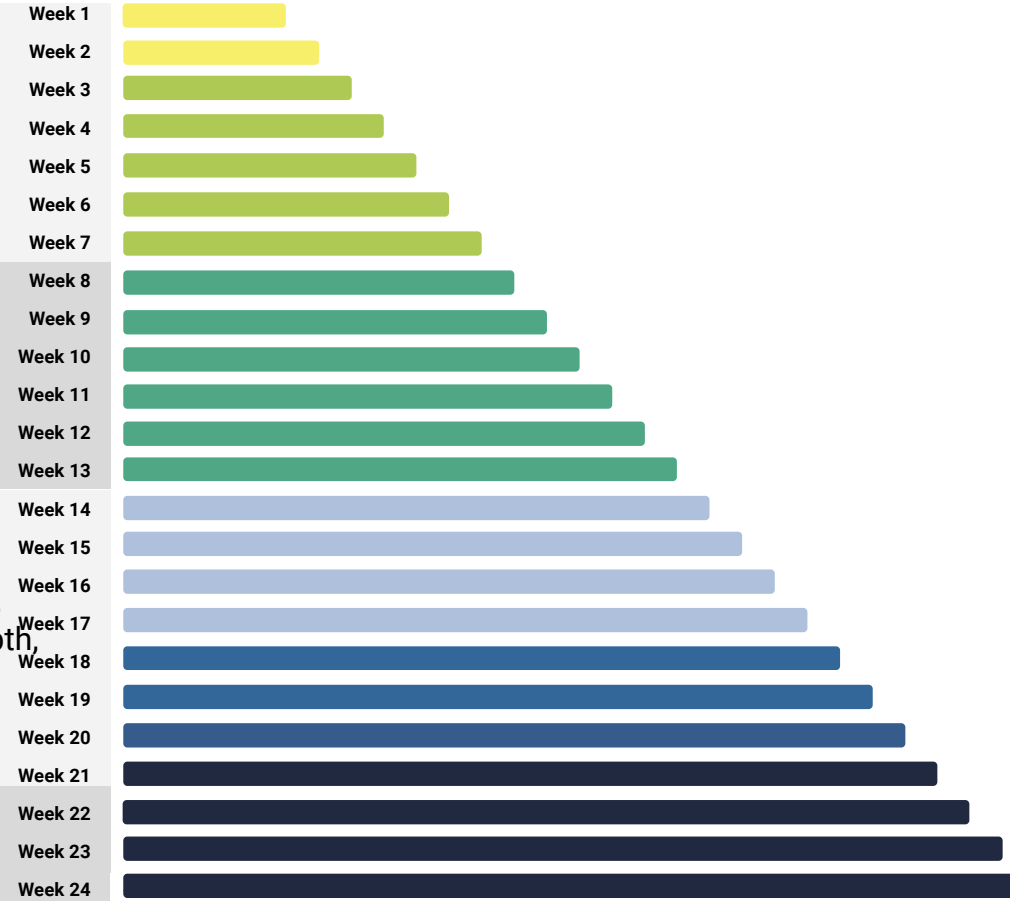
We will dive into Linux system administration, web development and website attacks. We will use Tools like Burp Suite, Snort, and Network Inspector.

Weeks 14-21 Defensive and Offensive Security

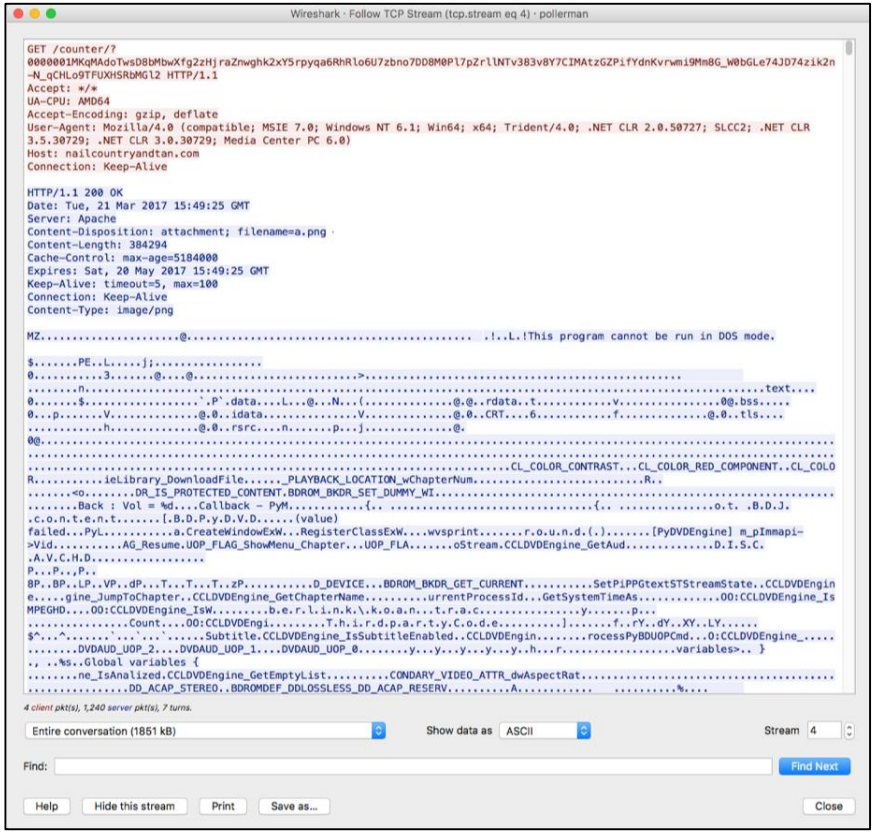
Security Information and Event Management (SIEM), Incident Response, and Forensics are covered in depth, Followed by three weeks of penetration testing.

Weeks 22-24 Governance, Risk, and Test Prep

We'll conclude with risk analysis, governance, and compliance. In the final weeks we'll focus on test prep and a final project.

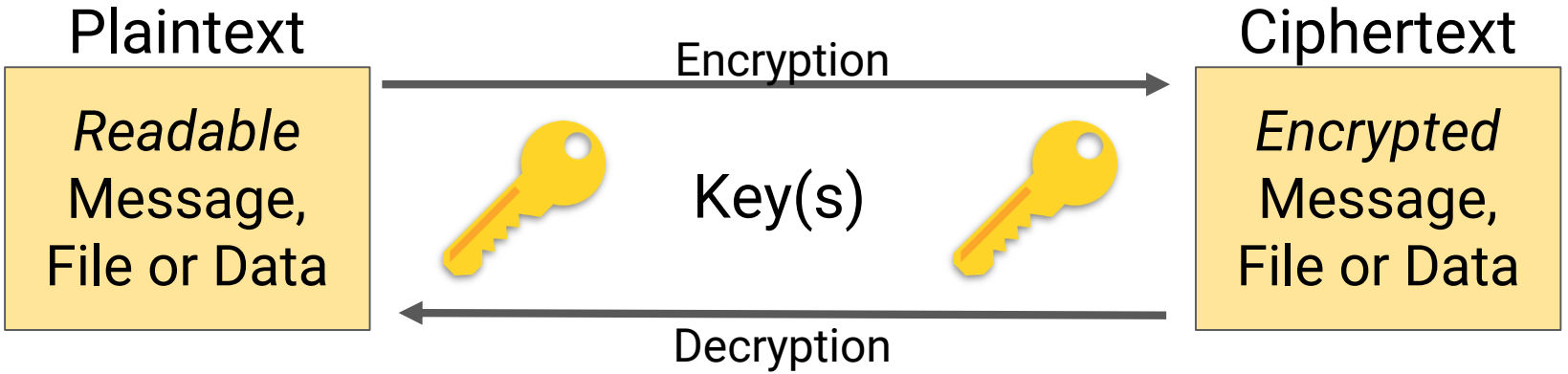


Example Activity: **Analyzing Web Traffic for Malware**



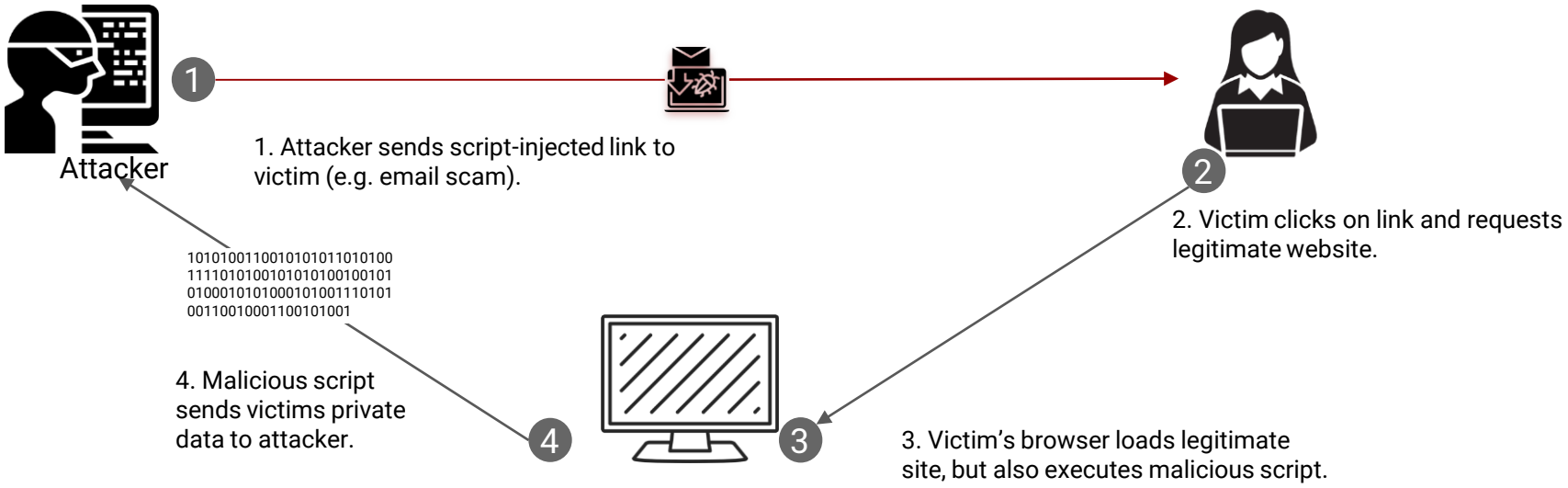
We'll learn to process complex network traffic logs to find evidence of malware being sent across networks.

Example Activity: **Encryption / Decryption Systems**



We'll learn how modern cryptography works and how historic methods of encryption could be broken through simple means.

Example Activity: **Web Application Hardening**

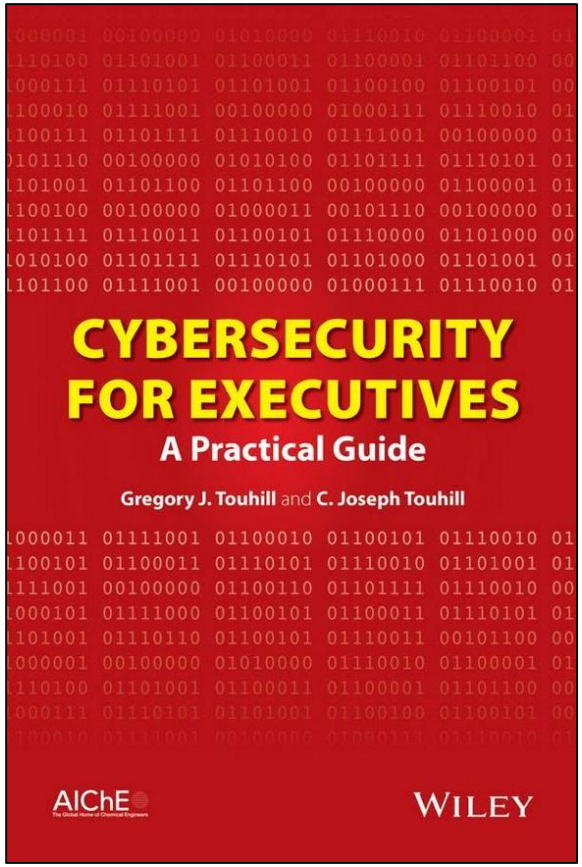


We'll learn how web applications can be defended against the most common attacks.

Example Activity: **Identify Vulnerabilities in Unpatched Systems**

We'll learn to use tools like Kali Linux, Nmap, and Metasploit to run penetration tests to identify known exploits.

Example Activity: **Cybersecurity Policy and Strategy**

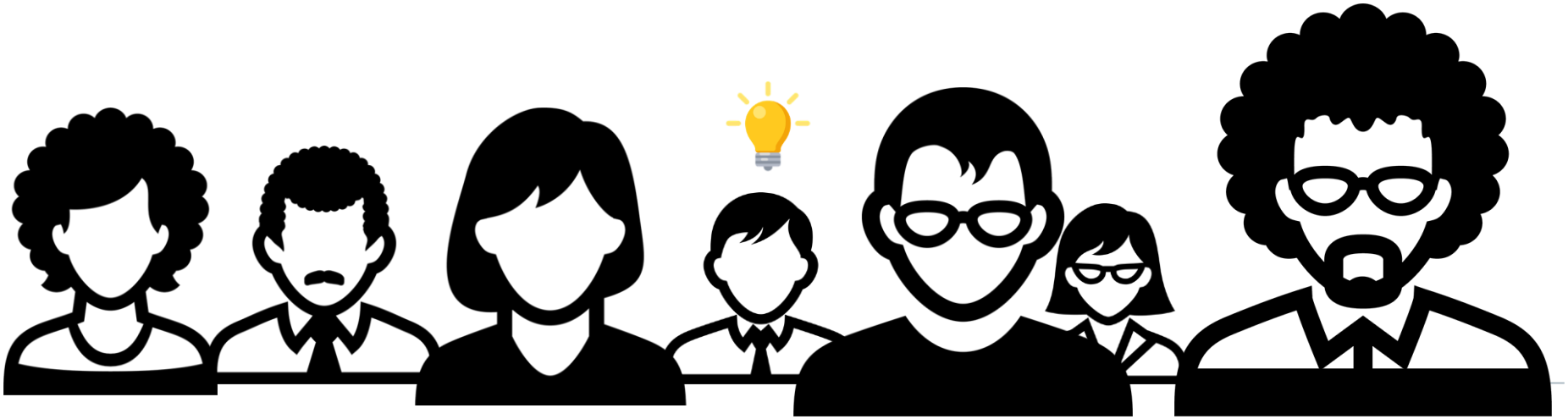


Lastly, we'll learn how to *talk* about cybersecurity risks, strategy, and policy in a way that extends away from the laptop and into the C-Suite.

Embrace Your Inner Toddler

Tip: *Embrace being a beginner.*

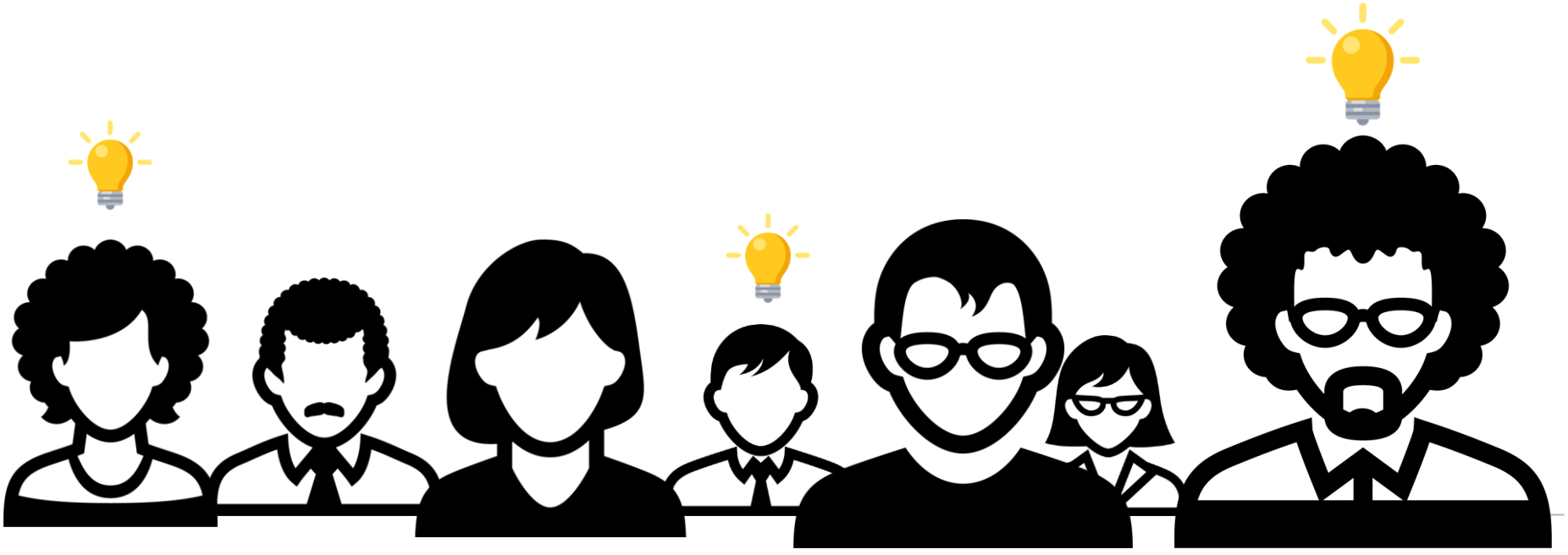
Once you admit you “know nothing” (*or little*) about the many subject areas we’ll covered in this bootcamp, you’ll be able to dig into these new topics and invest the time necessary to succeed.



Tip: *Find Your Community Now*

You and your classmates are in this process together. Use each other for help!

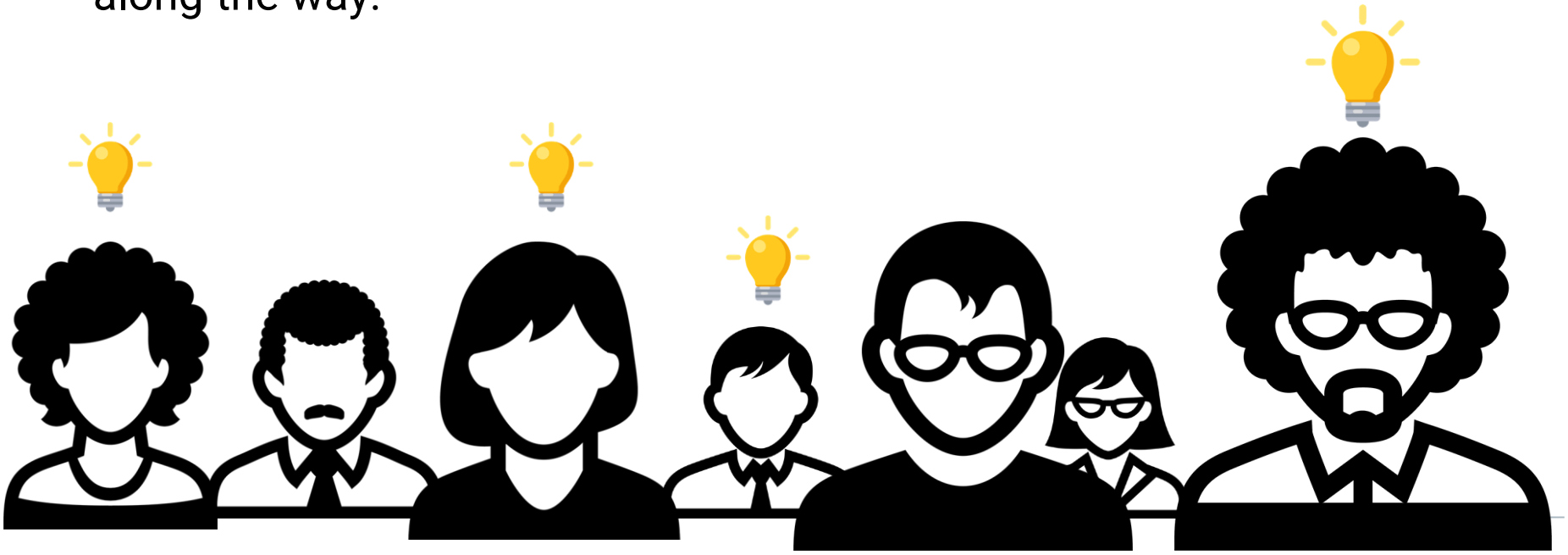
You all can bring value to the table. Don’t be afraid to speak up!



Tip: *You need to put in the hours!*

There is no magic pill. This bootcamp will require time and effort for you to learn and succeed.

This class will challenge you… Make sure to celebrate your progress along the way.



Take a Break!

Activity: Security Challenge #1: Attacking the Wall

In this security challenge, you and your group will play the role of security professional tasked with handling a real-world situation.

Let’s go over the scenario...

Suggested Time:
15 Minutes

Security Challenge #1

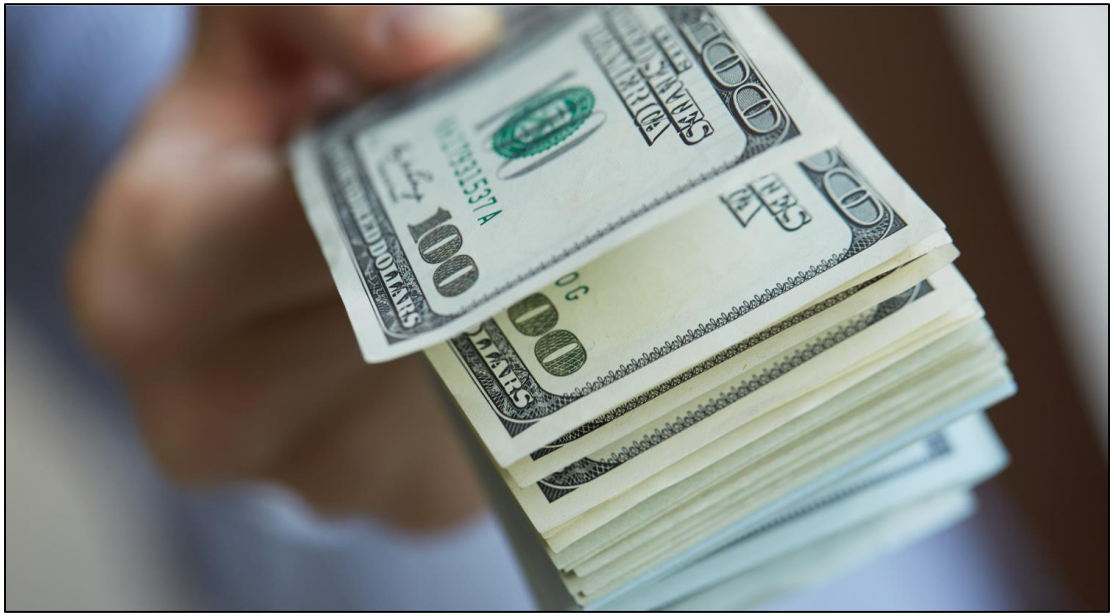
Congratulations!

You and your team have just been hired by a supremely successful startup that runs a Bitcoin Dating Exchange.

Security Challenge #1

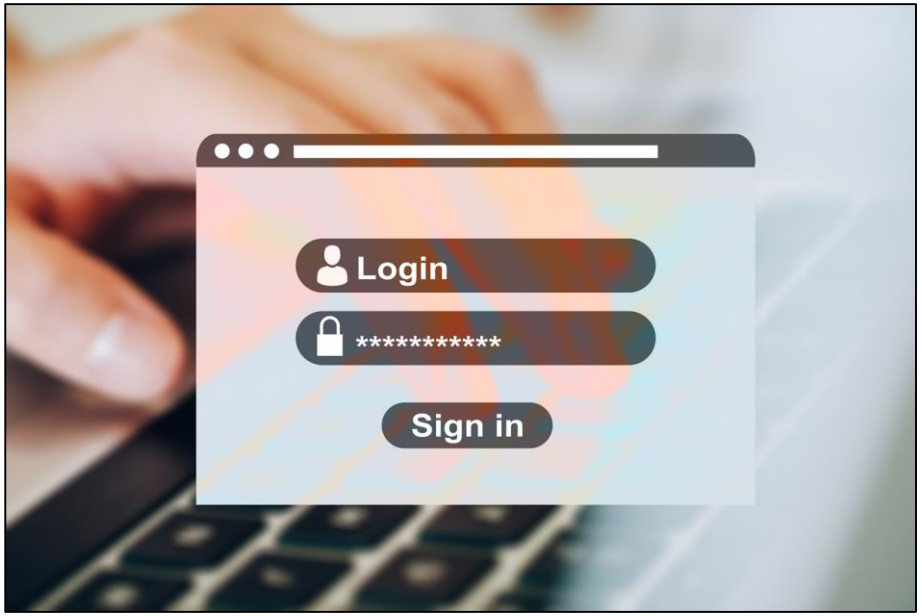
While their founding team is brilliant, like many start-ups, ***they don't know the first thing about security***.

Security Challenge #1



*They just handed you a bucket load of cash to solve their **single most pressing problem.***

Security Challenge #1



Their log-in process is ***totally insecure.***

Today, hackers are ***routinely logging in as users*** *(and administrators) and gaining access to company data and financial*

Your Turn! Attacking the Wall

Instructions:

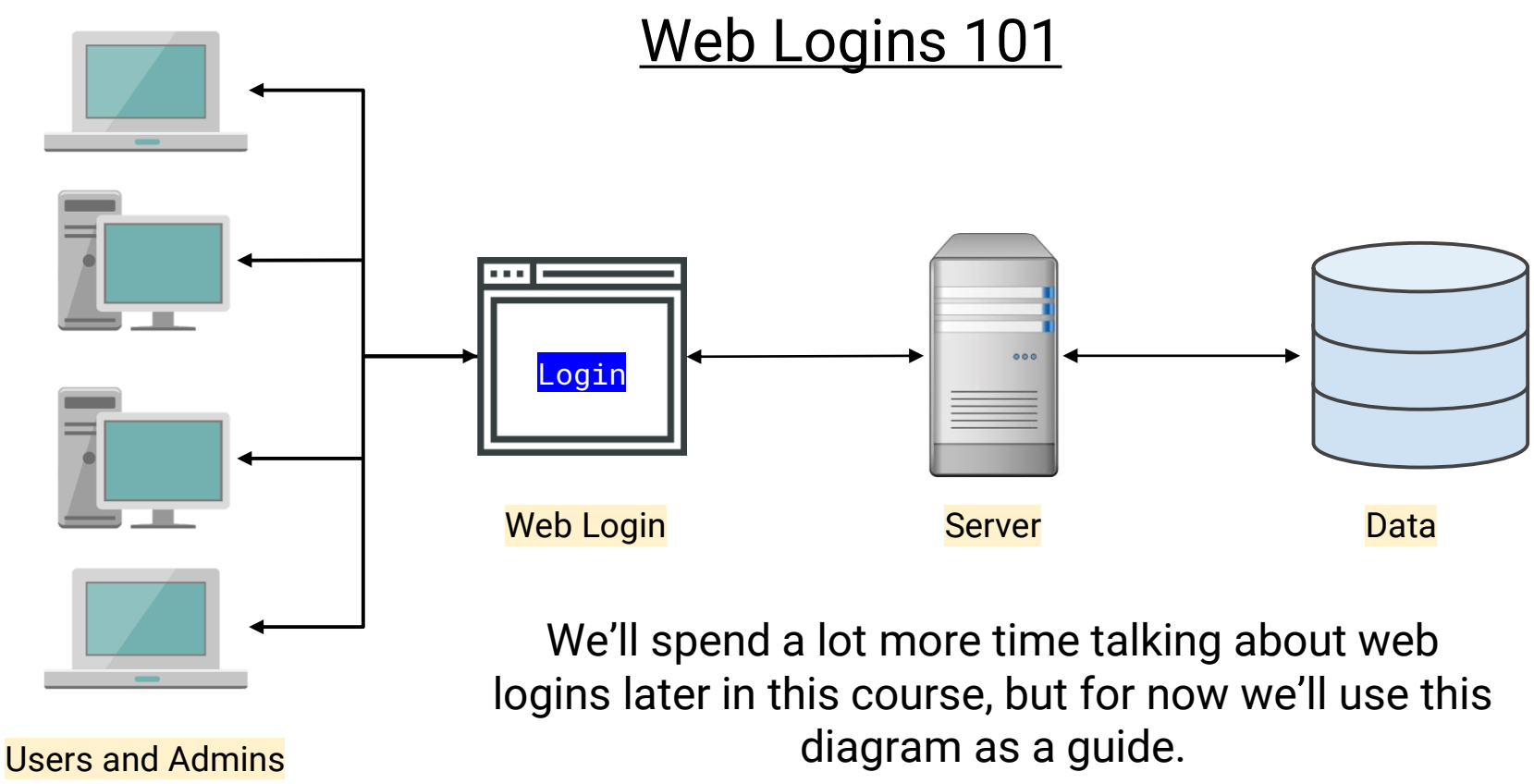
With your group, develop a list of 15 different ways that a malicious actor could penetrate the system and login as a user or administrator.

With each method, be prepared to describe the following:

- ☐ Who (or what) is the initial target?
- ☐ How would the actor implement the attack?

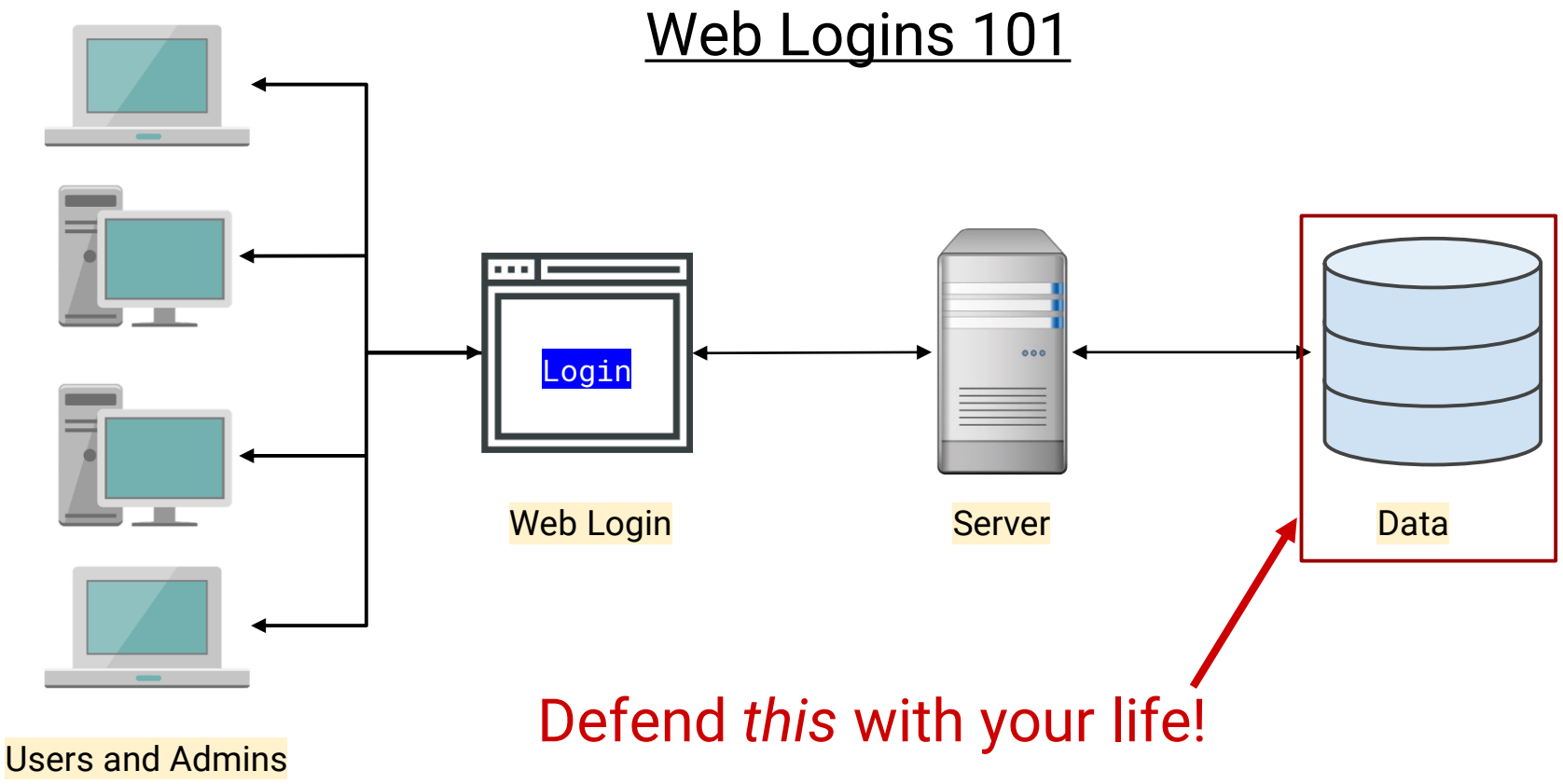
Be Prepared to Share!

Your Turn! Attacking the Wall



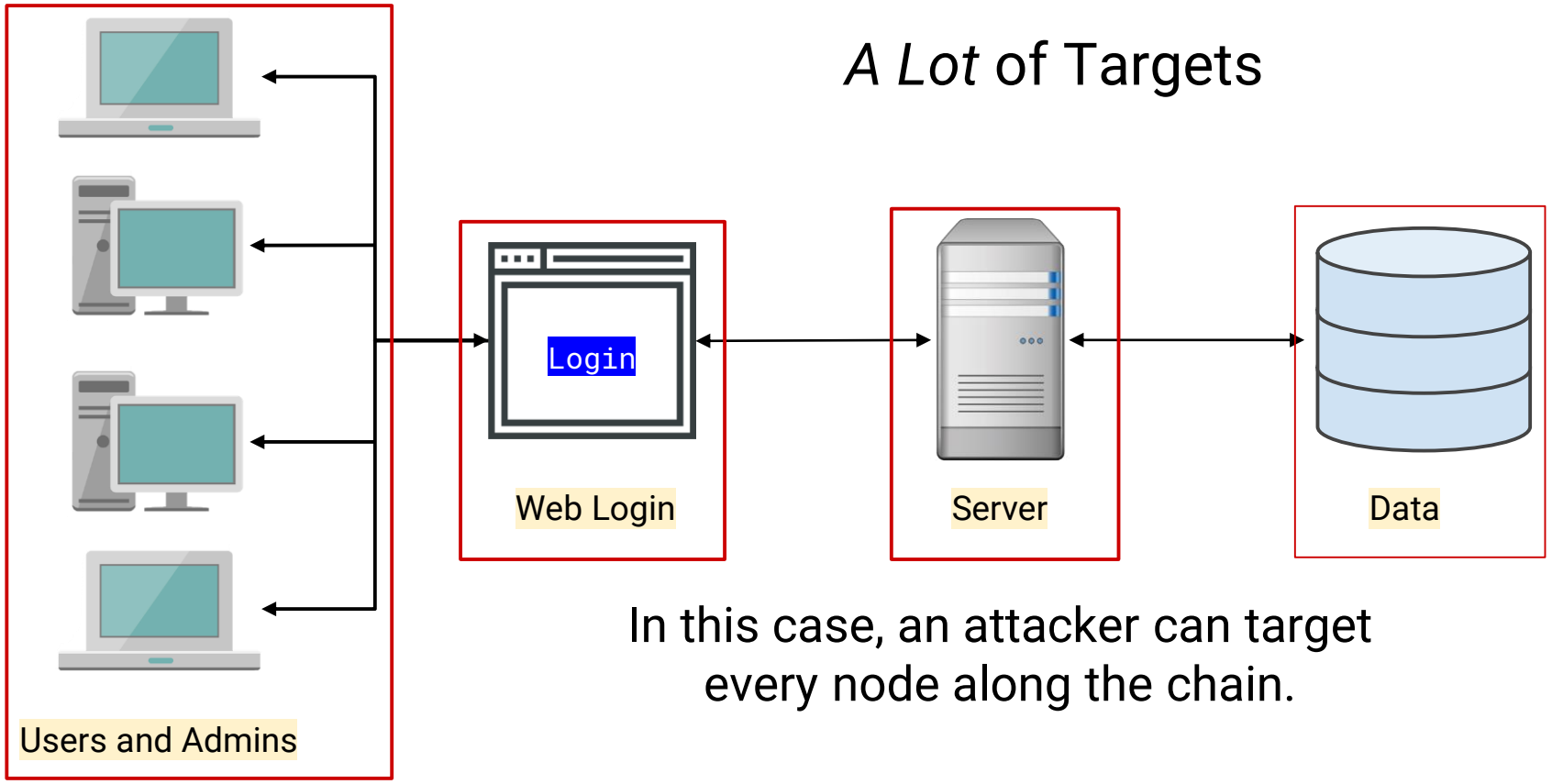
We'll spend a lot more time talking about web logins later in this course, but for now we'll use this diagram as a guide.

Your Turn! Attacking the Wall



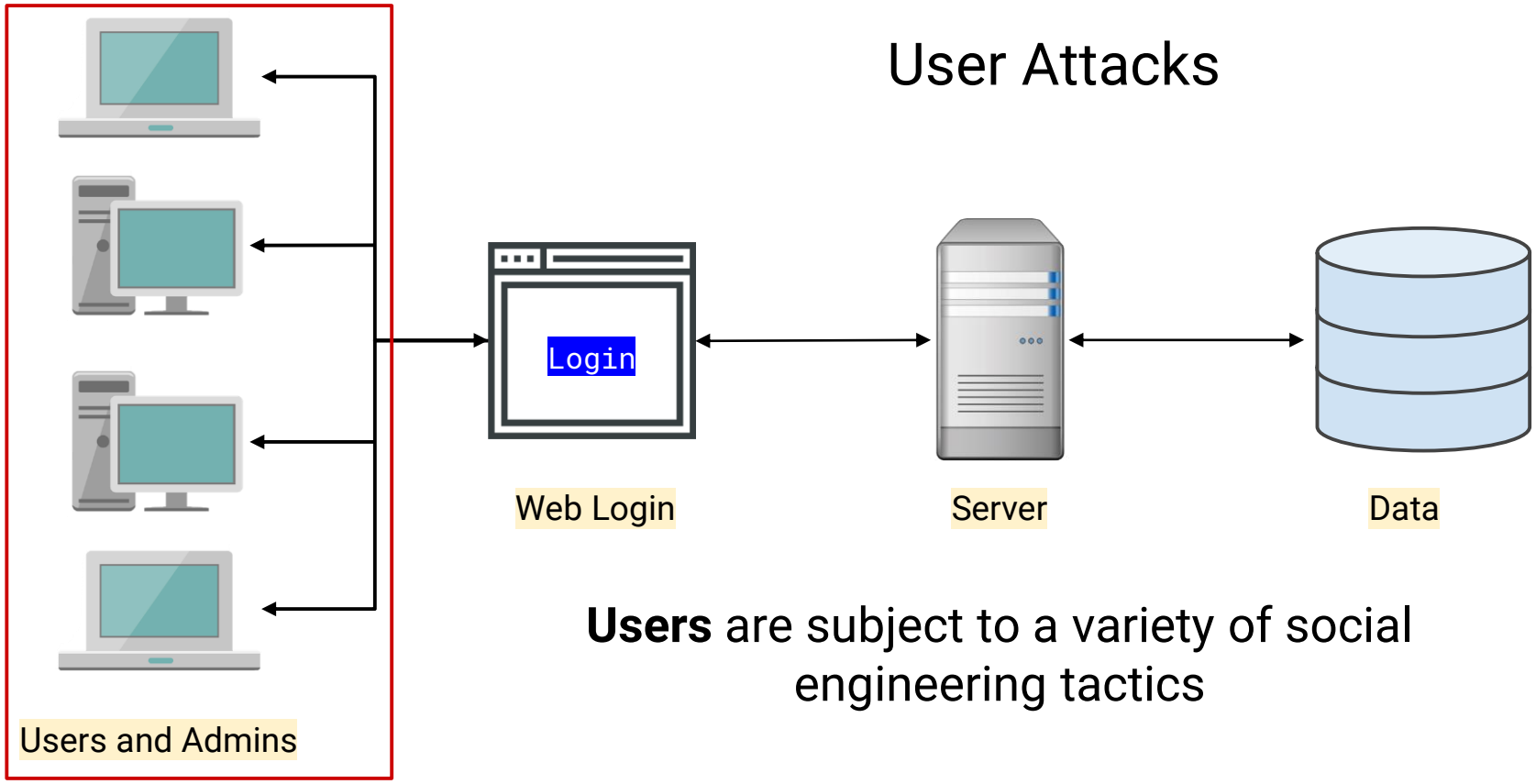
Step #1:
Assess the Target

Your Turn! Attacking the Wall



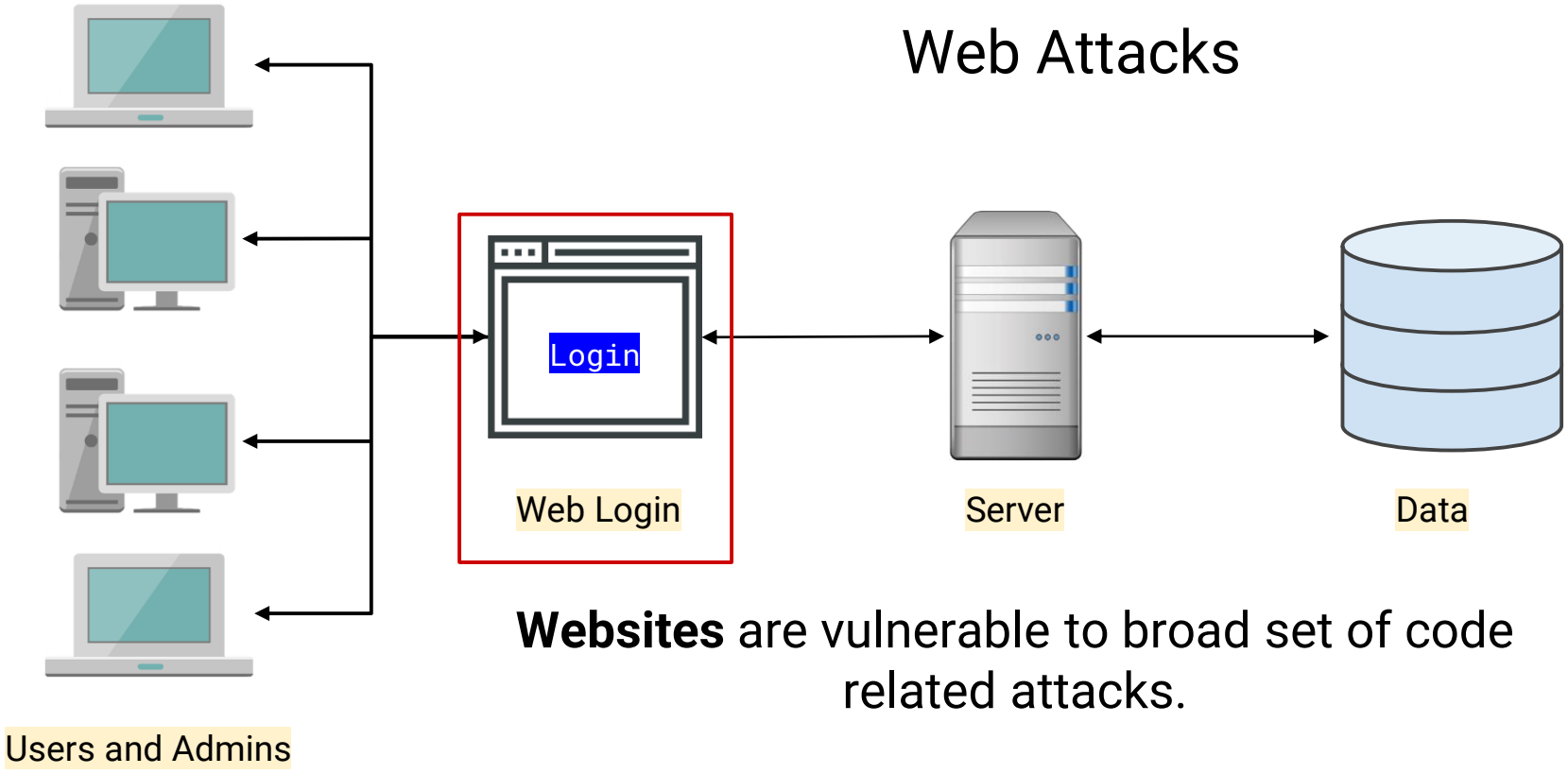
In this case, an attacker can target every node along the chain.

Your Turn! Attacking the Wall



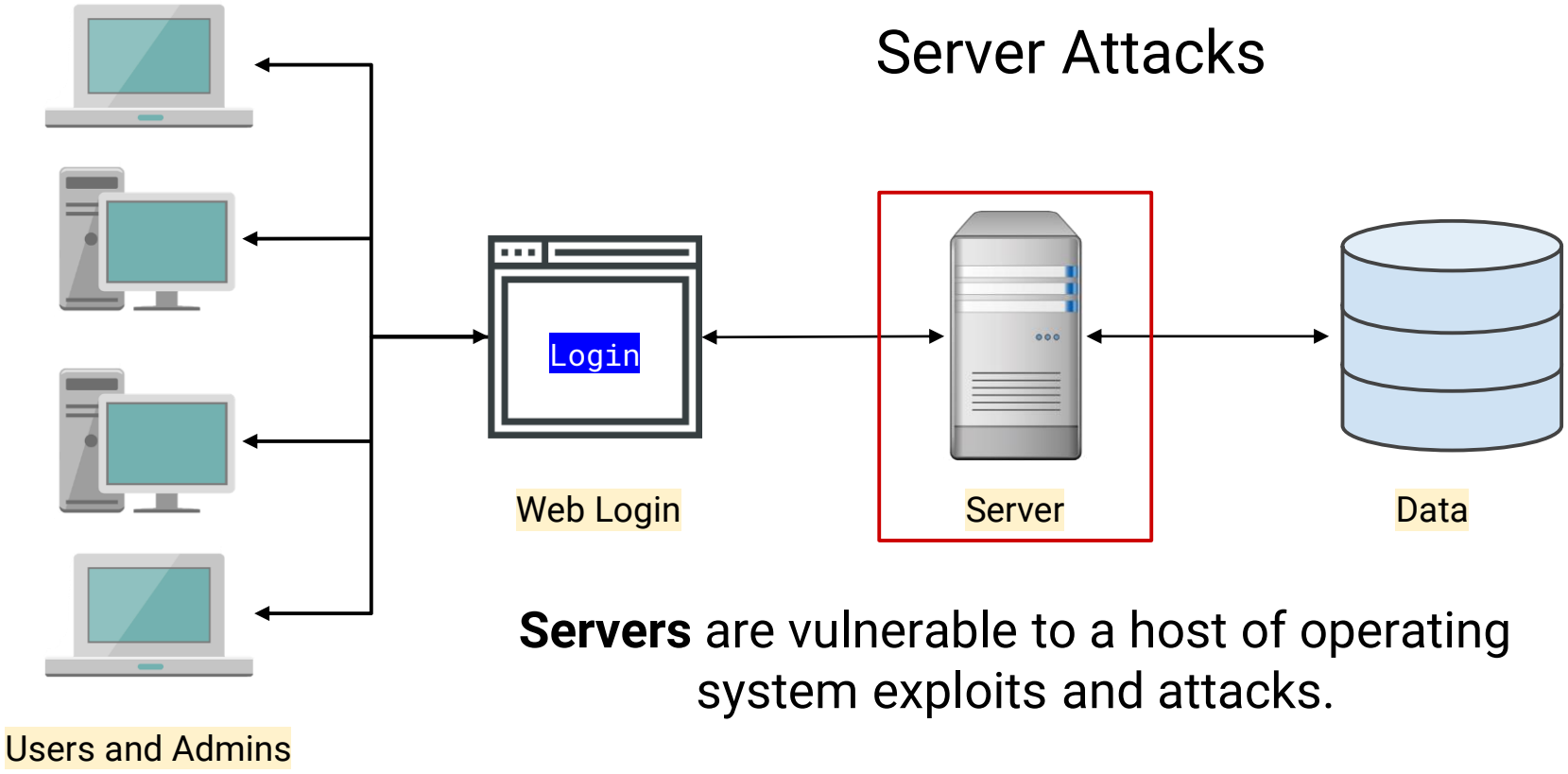
Users are subject to a variety of social engineering tactics

Your Turn! Attacking the Wall



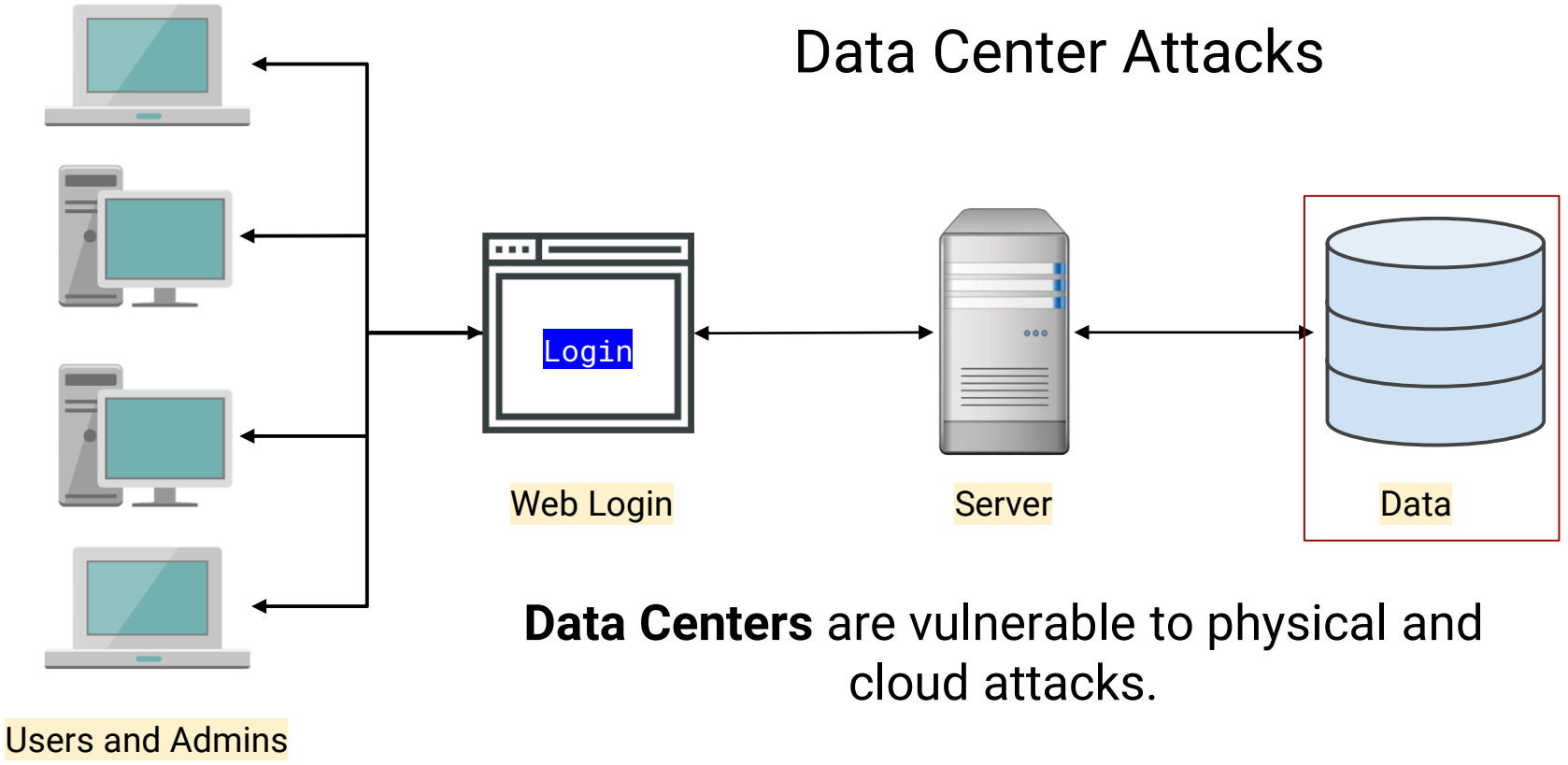
Websites are vulnerable to broad set of code related attacks.

Your Turn! Attacking the Wall



Servers are vulnerable to a host of operating system exploits and attacks.

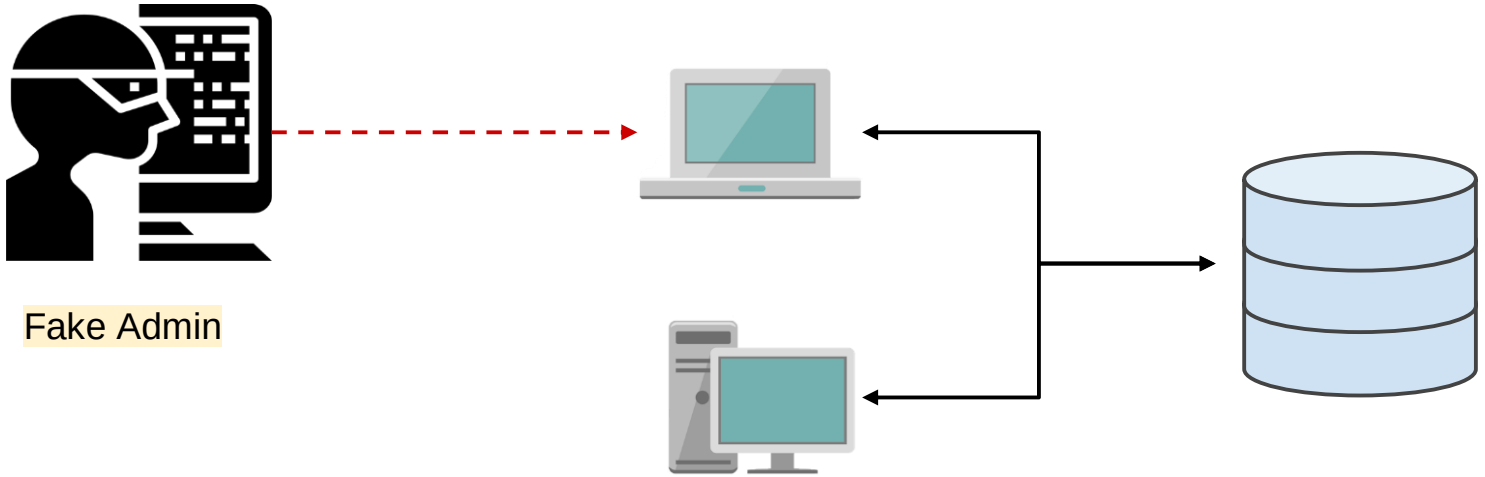
Your Turn! Attacking the Wall



Data Centers are vulnerable to physical and cloud attacks.

Step #2:
Define Attack Strategy

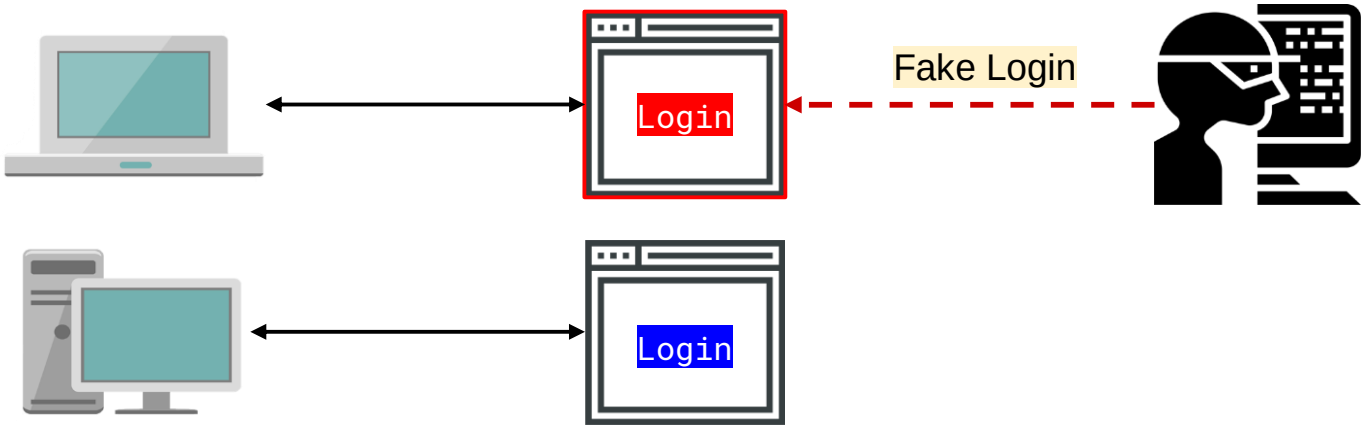
Step 2: Defining Attack Strategies



Attack Option #1: Social Engineering

A hacker can ask users for their credentials by falsely pretending to be an administrator.

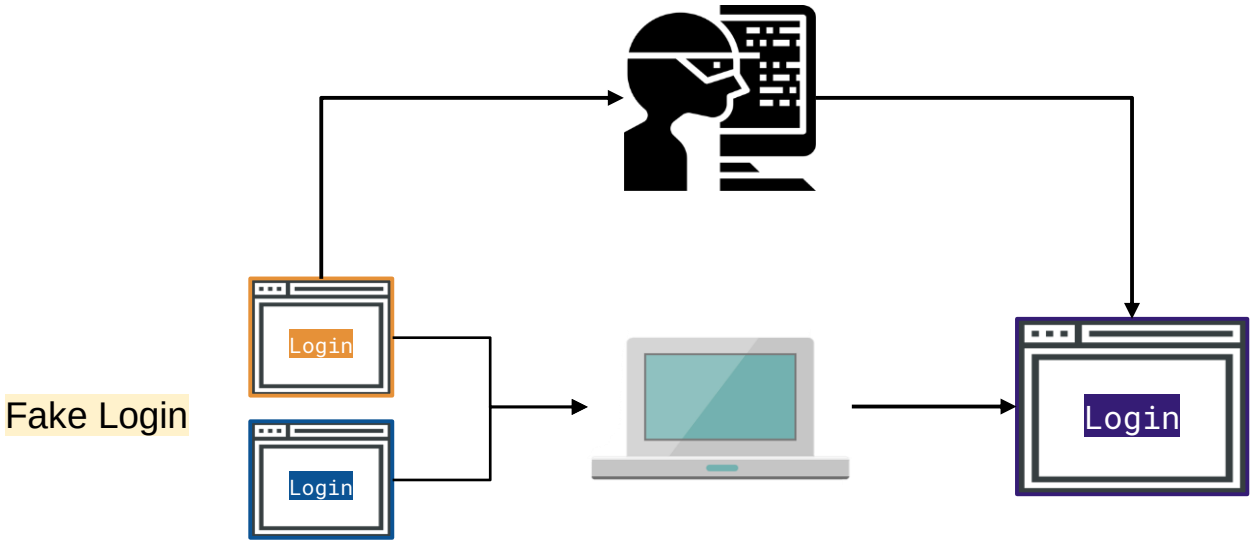
Step 2: Defining Attack Strategies



Attack Option #2: Phishing

A hacker can attempt a phishing attack where users are redirected to fake login pages to capture user credentials.

Step 2: Defining Attack Strategies



Attack Option #3: Credential Reuse

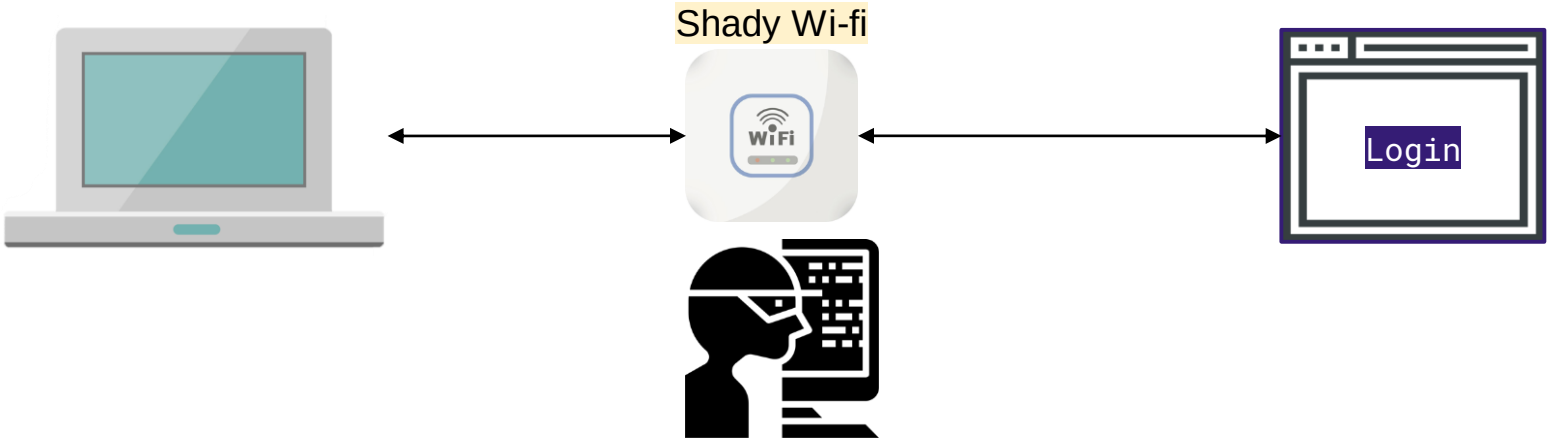
A hacker can find users' login and password information from other websites.

Step 2: Defining Attack Strategies

Attack Option #4: Malware

A hacker could deploy malware such as spyware or keyloggers to capture daily user activity.

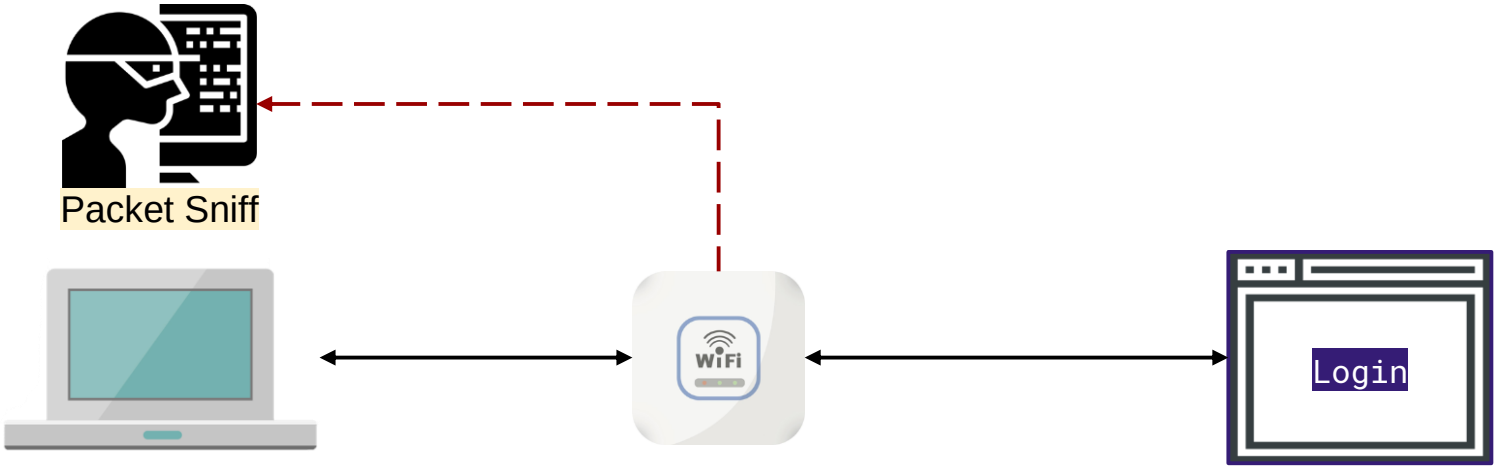
Step 2: Defining Attack Strategies



Attack Option #5: Man in the Middle Attack

A hacker can create a man in the middle attack by providing a free Wi-Fi hotspot to capture user credentials.

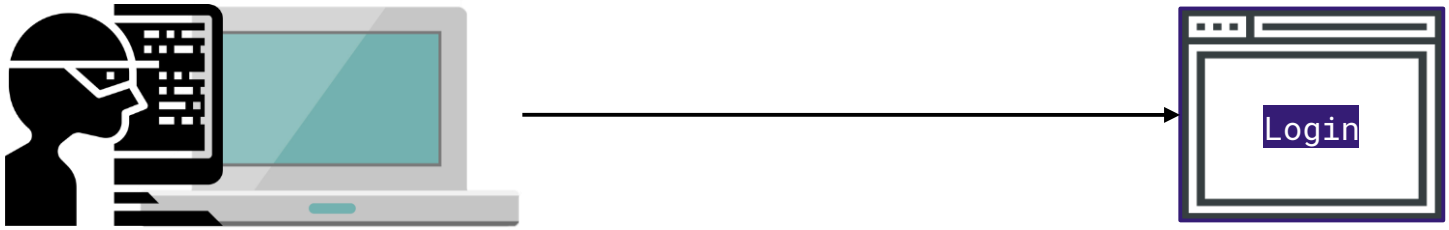
Step 2: Defining Attack Strategies



Attack Option #6: Sniff Packet

A hacker can sniff packet traffic across insecure wireless networks such as a cafe or restaurant.

Step 2: Defining Attack Strategies



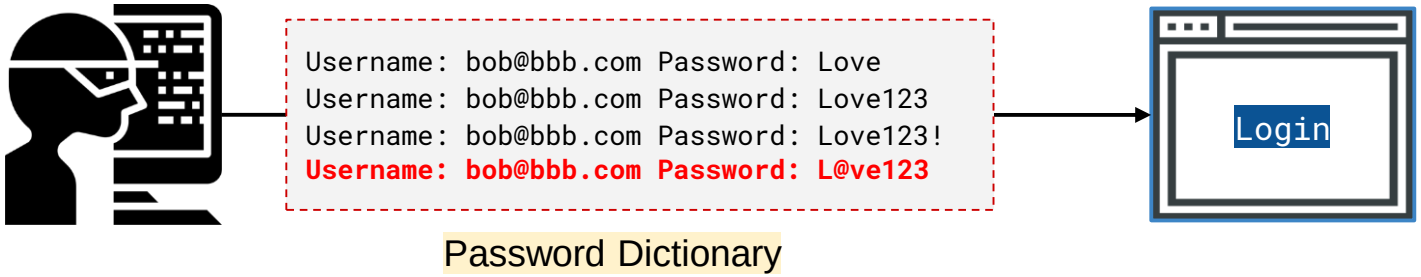
Stolen Laptop

Attack Option #7: Stolen Hardware

A hacker can simply **steal a computer** and use the saved credentials to login.

Next up,
website attacks.

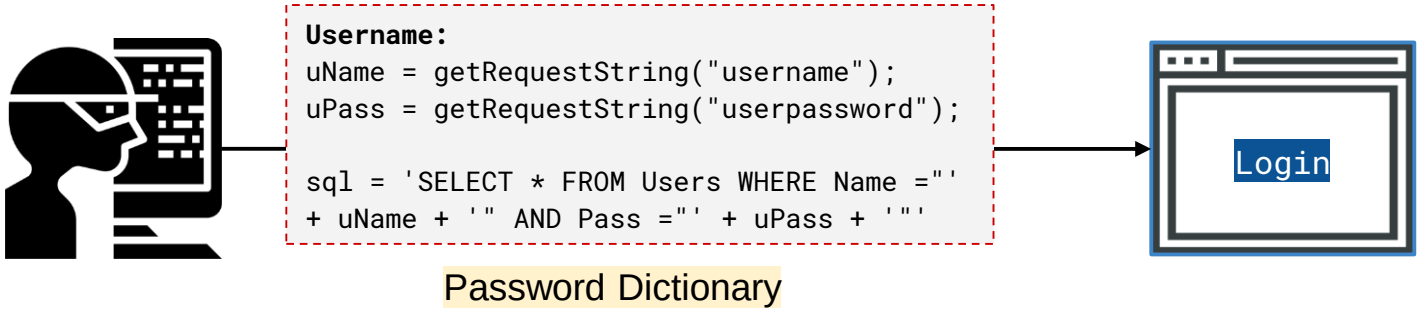
Step 2: Defining Attack Strategies



Attack Option #8: Brute Force Attack

A hacker could simply utilize a **Brute-Force Attack** to attempt a continual battery of username and password combinations.

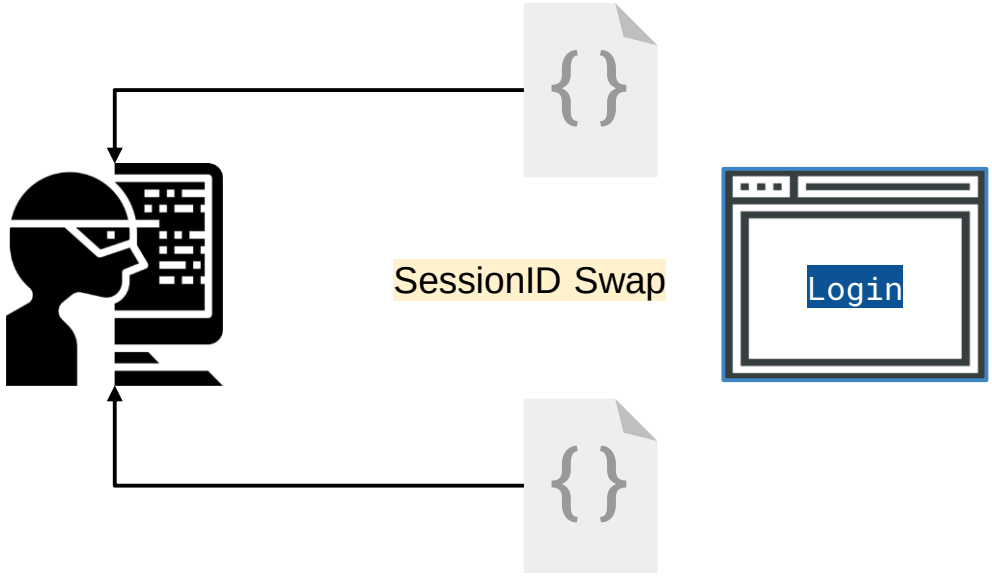
Step 2: Defining Attack Strategies



Attack Option #9: Code-Injection

A hacker could utilize a **code-injection attack** in which malicious code is directly injected into the username or password fields.

Step 2: Defining Attack Strategies

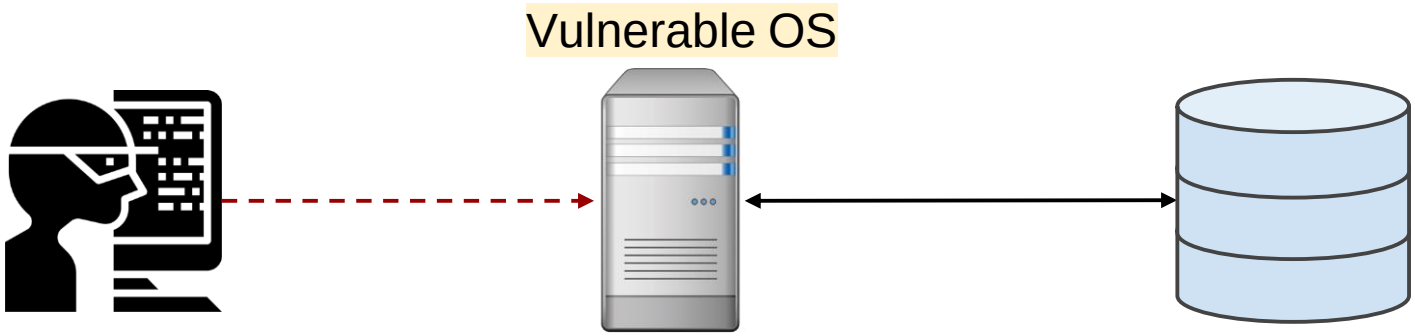


Attack Option #10: Faulty Session Management

A hacker could exploit fault session management when developers incorrectly implement code for maintaining login and logouts.

Next up,
server attacks.

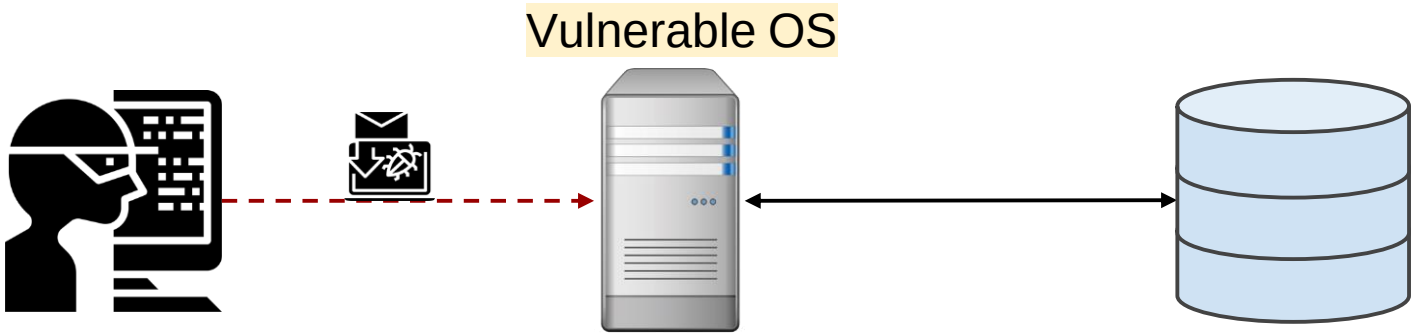
Step 2: Defining Attack Strategies



Attack Option #11: OS Exploits

Serves, which run on operating systems like Windows and Linux, are subject to OS exploits when incorrectly patched.

Step 2: Defining Attack Strategies

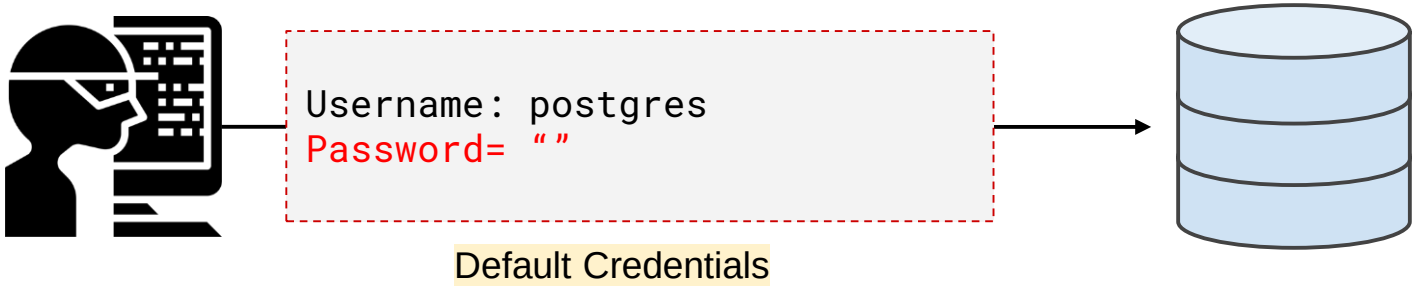


Attack Option #11: Malicious Software

Malicious software can be directly loaded onto the server by USB or other means.

Finally,
database attacks.

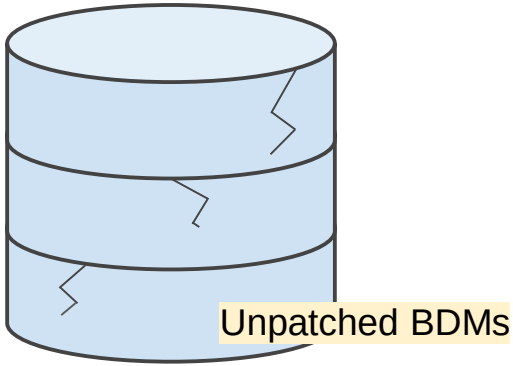
Step 2: Defining Attack Strategies



Attack Option #13: Default Credentials

Database management systems often come with **default credentials** that may not be changed.

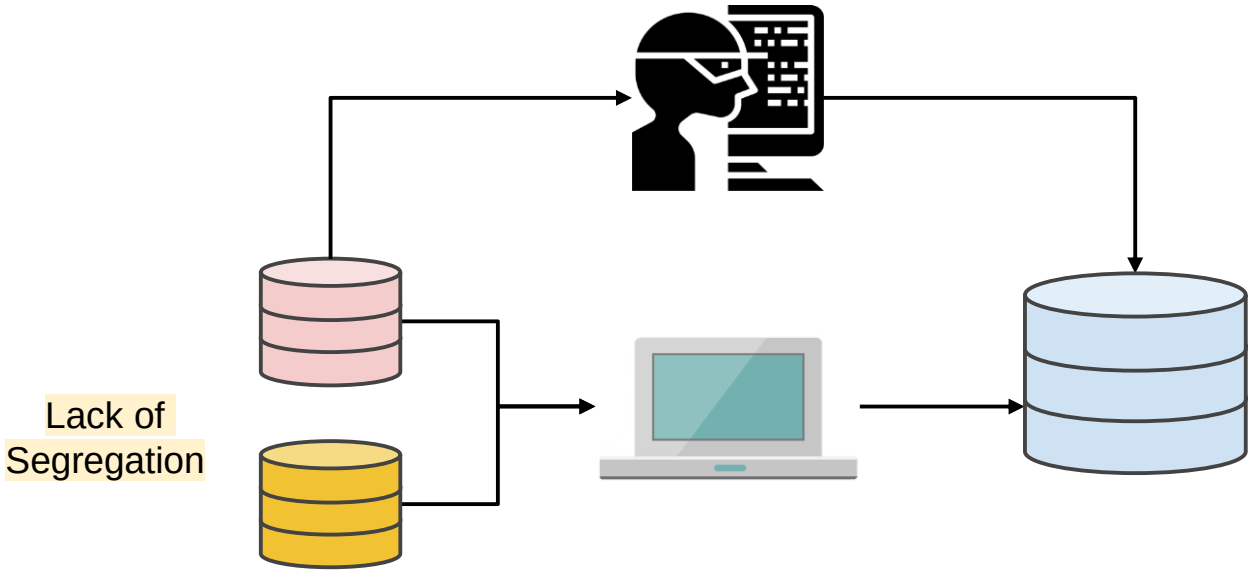
Step 2: Defining Attack Strategies



Attack Option #14: Unpatched Database

Database management systems may be unpatched against publicly known vulnerabilities.

Step 2: Defining Attack Strategies



Attack Option #15: Lack of Segregation

The Database may be set up to **let a client peek at another** client's data.

Security Challenge #2

Activity: Security Challenge #2: Defending the Wall

Now that we've assembled a list of potential attacks, your next task is to develop a list of at least 10 strategies to mitigate the website's risk of unauthorized access.

Be Prepared to Share!

Suggested Time:
15 Minutes

Your Turn: Defending the Wall

User Attacks

- Social Engineering
- Phishing Attacks
- Credential Reuse
- Malware Attacks
- Man in the Middle
- Packet Sniffing
- Computer Theft

Web Attacks

- Brute-Force Attacks
- Code Injection
- Faulty Sessions

Server Attacks

- OS Exploit
- Malicious Software

Database Attacks

- Default Credentials
- Unpatched Database
- Lack of Segregation

To help you get started, review this list of identified attack types.

Step Three:
Risk Mitigation Plan

Step 3: Risk Mitigation Plan

User Attacks

- Social Engineering
- Phishing Attacks
- Credential Reuse
- Malware Attacks
- Man in the Middle
- Packet Sniffing
- Computer Theft

Web Attacks

- Brute-Force Attacks
- Code Injection
- Faulty Sessions

Server Attacks

- OS Exploit
- Malicious Software

Database Attacks

- Default Credentials
- Unpatched Database
- Lack of Segregation

Risk Mitigation begins by assessing all risks and looking for parallels.

Step 3: Risk Mitigation Plan

User Attacks

- Social Engineering
- Phishing Attacks
- Credential Reuse
- Malware Attacks
- Man in the Middle
- Packet Sniffing
- Computer Theft

User Risk Mitigation

1. Educate all users on the danger of phishing and social engineering.
2. User randomly generated passwords.
3. Ensure users are using multifactor authentication (password + phone confirmation)
4. Use HTTPS and only access sensitive content over secure channels.

Step 3: Risk Mitigation Plan

Web Attacks

Brute-Force Attacks

Code Injection

Faulty Sessions

Server Attacks

OS Exploit

Malicious Software

Web and Server Risk Mitigation

1. Ensure *strong* passwords are used (i.e., alphanumeric +symbol + special characters).
2. Sanitize any input in the web application form fields and filter out.
3. Ensure users are immediately logged out when closing a browser. (No preservation of login after 30 seconds of inactivity.)
4. Ensure that all servers are routinely patched against latest know vulnerabilities.
5. Antivirus and User Education.

Your Turn: Defending the Wall

User Attacks

- Social Engineering
- Phishing Attacks
- Credential Reuse
- Malware Attacks
- Man in the Middle
- Packet Sniffing
- Computer Theft

Web Attacks

- Brute-Force Attacks
- Code Injection
- Faulty Sessions

Server Attacks

- OS Exploit
- Malicious Software

Database Attacks

- Default Credentials
- Unpatched Database
- Lack of Segregation

To help you get started, review this list of identified attack types.

Step 3: Risk Mitigation Plan

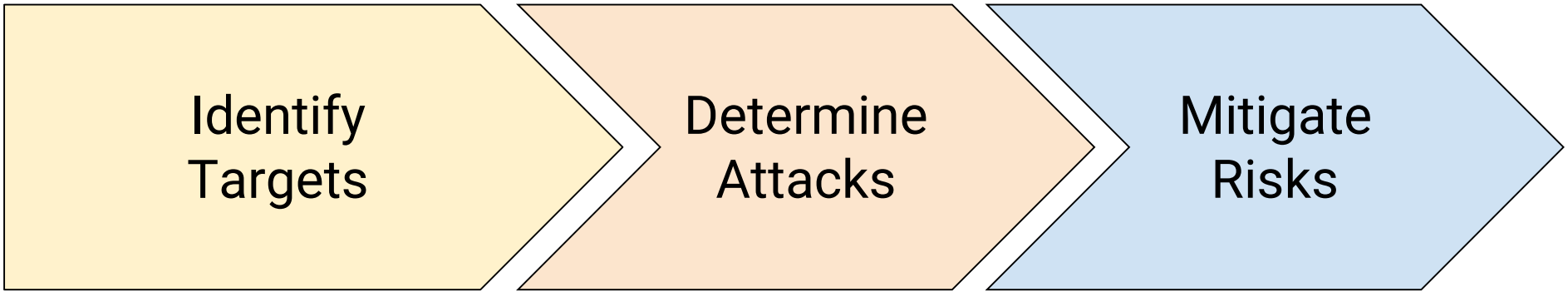
Suggested Plan

1. Educate all users on the dangers of phishing and social engineering.
2. Require randomly generated passwords passwords.
3. Ensure users are using multifactor authentication (password + phone confirmation).
4. Use HTTPS and only access sensitive content over secure channels.
5. Ensure *strong* passwords are used (alphanumeric + symbols).
6. Sanitize any input in the web application form fields and filter the output.
7. Ensure users are immediately logged off when closing a browser. (No preservation of login after 30 seconds of inactivity).
8. Ensure all servers are routinely patched against latest known vulnerabilities.
9. Ensure physical access to servers is protected by multiple forms of authentication (login + biometric).
10. Ensure that all data stored in the database is encrypted and cannot be read without additional login information.
11. Provide database access on need-to-know basis.
12. Log and monitor all database access.
13. Ensure that all cloud security platforms follow best practices for security implementation.

Cybersecurity Framework

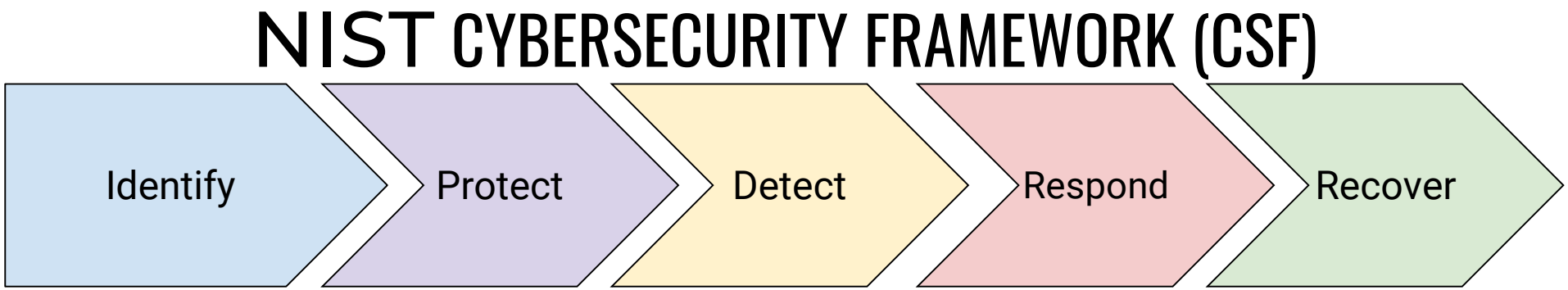
Our Cybersecurity Framework

Even in our simple exercise, we begin to see an emerging framework for addressing cybersecurity threats.



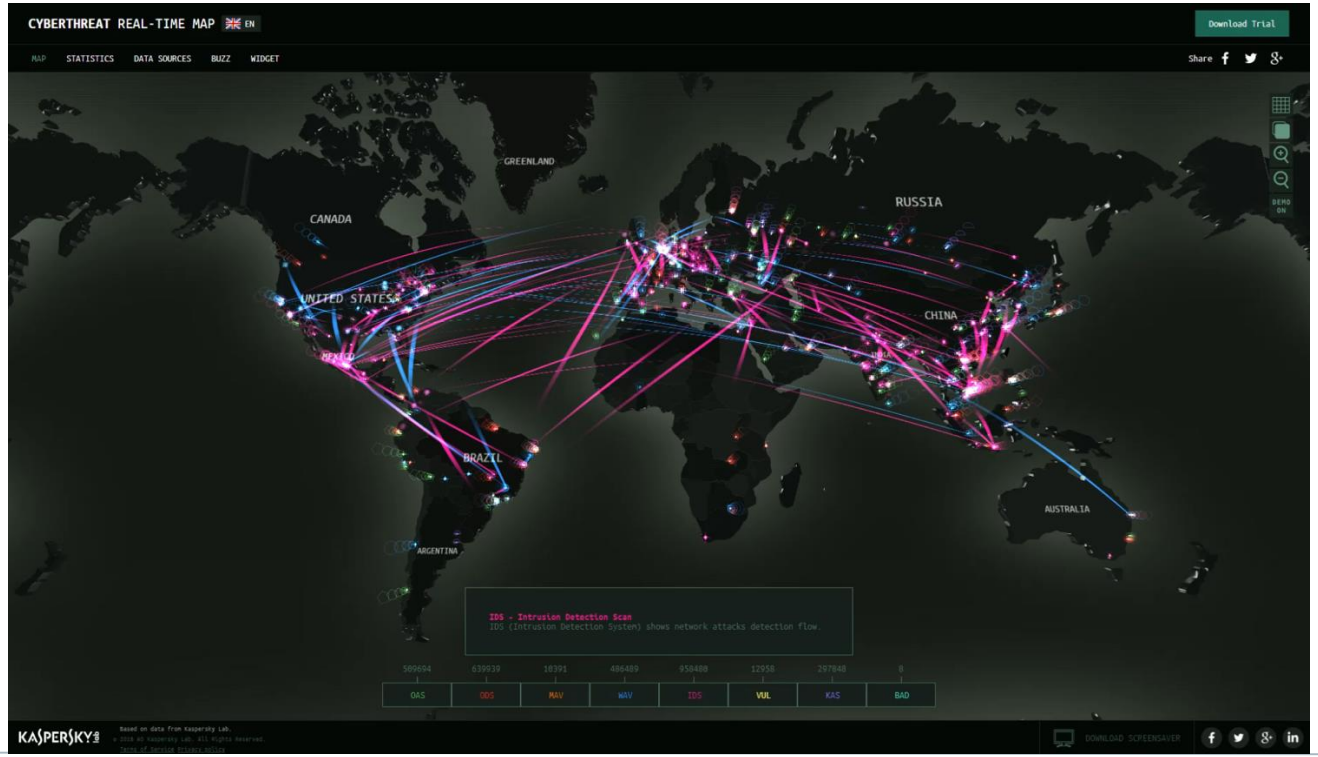
NIST Cybersecurity Framework

As we progress through class, we'll begin to understand larger frameworks for addressing cybersecurity threats.



Next Class...

We'll dive deeper into today's threat landscape and discuss modern day tasks we'll be tasked with handling.



Any Questions?