# CSE 484 / CSE M 584: Computer Security and Privacy

#### Spring 2023

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# Hello 😳

• Instructor: David Kohlbrenner (he/him)

#### TA Staff

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#### **Course Plan**

- Lectures and Sections and (most) Office Hours in-person
  - Lectures are recorded (please attend!)
    - \* Sections may be only partially recorded
    - \* Office hours will not be recorded
    - \* Recordings include student speech/video/chat (don't share if you don't want to!) and will not be shared outside the class
  - Access the links via Canvas
- Evaluation
  - Labs
  - Homeworks
  - Final project; no exams
  - Participation/in-class exercises

#### Discussion

- Everyone in this class deserves to be in this class!!
- We are all coming to this course with different backgrounds and experiences
- There are **no bad questions**; never belittle a questioner or their question; always be supportive
- Instructors / staff aren't always aware of everything, so please call our attention to things as needed
  - E.g., someone might harm someone else with what they say without ever realizing that what they said is harmful; that harm still exists, regardless of whether there was an intent to harm

#### **Course Resource Cheat Sheet**

- **Classrooms:** Lectures, sections, office hours
- **Zoom:** Limited office hours
- Canvas: Links to recordings, assignment submissions, grades
- Course website: Schedule, assignment details, readings, policies
- Ed: Discussion board, Announcements
- Email: Reach course staff privately

#### **Pollev and Canvas**

- We'll do a lot of breakouts in class
- Depending on the topic, we'll be using pollev or canvas

https://pollev.com/dkohlbre today

#### What Does "Security" Mean to You?

1) Spend a few minutes defining security in the context of computing/technology.

Try putting some answers in <a href="https://pollev.com/dkohlbre">https://pollev.com/dkohlbre</a>

# What Does "Security" Mean to You? 10: 46

- 1) Spend a few minutes defining security in the context of computing/technology.
- 2) Talk to your neighbors about your definitions
- 3) Come up with a group definition

Try putting some answers in <a href="https://pollev.com/dkohlbre">https://pollev.com/dkohlbre</a>

CSE 484 / CSE M 584 - Spring 2023

# What are topics you are excited about?

- It is also okay if you don't know what topics you are interested in yet!
- We can ask this question again at the end of the course, after you know more about different topics.

CSE 484 / CSE M 584 - Spring 2023

#### How Systems Fail

Systems may fail for many reasons, including:

- Reliability deals with accidental failures
- Usability deals with problems arising from operating mistakes made by users
- Design and goal oversights deals with oversights, errors, and omissions during the design process
- Security deals with intentional failures created by intelligent parties
  - Security is about computing in the presence of an adversary
  - But security, reliability, usability, and design/goals oversights are all related

# Challenges: What is "Security"?

- What does security mean?
  - Often the hardest part of building a secure system is figuring out what security means ("threat modeling")
  - Who are the **stakeholders** for which we are considering "security"?
  - What are the **assets** to protect?
  - What are the **threats** to those assets?
  - Who are the **adversaries**, and what are their **resources**?
  - What is the **security policy or goals**?
- Perfect security does not exist!
  - Security is not a binary property
  - Security is about risk management

Multiple assignments and activities are designed to exercise your thinking about these issues.

# Privacy?

• Privacy often strongly overlaps security

• Privacy may also consider when systems *work as intended*!

- Not a hard-and-fast distinction
  - Privacy and security are generally intertwined

# Two Key Themes of this Course

- 1. How to **think** about security and privacy
  - The "Security Mindset" a "new" way to think about systems
  - (This mindset will be valuable even outside of the security context, e.g., to consider diverse stakeholders of a system)

#### 2. Technical aspects of security and privacy

- Vulnerabilities and attack techniques
- Defensive technologies
- Topics including: software security, cryptography, malware, web security, web privacy, smartphone security, authentication, usable security, anonymity, physical security, security for emerging technologies

#### Theme 1: Security Mindset

- Thinking critically about designs, challenging assumptions
- Being curious, thinking like an attacker, exploring use cases not considered by the designers,
- "That new product X sounds awesome, I can't wait to use it!" versus "That new product X sounds cool, but I wonder what would happen if someone did Y with it; I wonder if the designers thought of Z..."
- Why it's important
  - Technology changes, so learning to think like a security person is more important than learning specifics of today's systems
  - Will help you design better systems/solutions
  - Interactions with broader context: law, policy, ethics, etc.

#### Security Mindset Example



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#### Security Mindset Example



# Learning the Security Mindset

- Several approaches for developing "The Security Mindset" and for exploring the broader contextual issues surrounding computer security
  - Homework #1
    - Security reviews and ethics reflections
    - May work in groups of up to 3 people (groups are encouraged lots of value in discussing security with others!)
  - In class discussions and activities
  - Participation in Ed discussion board (e.g., asking about news stories, technologies)

# A Word on Groupwork

- We require it\*
  - Need to learn how to work in groups
    - Especially if you don't like it ③
  - Attack-based labs require some creativity, where group interactions can help generate ideas



- Make sure everyone works on \_all\_ parts of the labs/HWs
  - Don't split up problems and assign them out!

\*contact course staff ASAP if this isn't going to work for you

#### What This Course is Not About

- <u>Not</u> a comprehensive course on computer security
  - Computer security is a broad discipline!
  - Impossible to cover everything in one quarter
  - So be careful in industry or wherever you go!
- <u>Not</u> about all of the latest and greatest attacks
  - Read news, ask questions, discuss on Ed
- <u>Not</u> a course on ethical, legal, or economic issues
  We will touch on these issues, but the topic is huge
- <u>Not</u> a course on how to "break into" systems
  - Yes, we will learn about attacks ... but the ultimate goal is to develop an understanding of attacks so that you can build more secure systems

#### Security: Not Just for PCs



smartphones

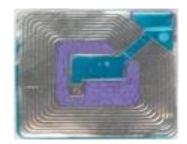


wearables





voting machines



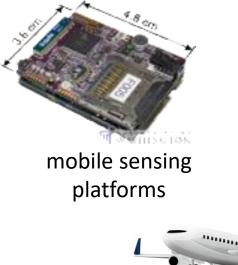
RFID

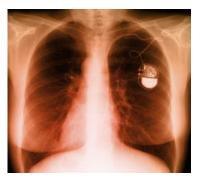


game platforms



EEG headsets





medical devices



cars



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#### Communication

- dkohlbre@cs
  - Use this if something is sensitive, personal, confidential, etc.
- <u>cse484-tas@cs.washington.edu</u>
  - Use this to reach all course staff (including instructor)
- Ed Discussion Board
  - Use this if other students in the class would benefit from your question/answers
    [common case]
- We will do our best to be responsive, but **please be professional**, and plan ahead!

#### **Course Materials**

- Readings:
  - I'll be posting reading materials as we go
  - Feel like we're missing something? Let me know!
- Attend lectures
  - Lectures will <u>not</u> follow any textbooks
  - Lectures will focus on "big-picture" principles and ideas
- Attend sections (if you have questions about assignments, best to attend rather than watch later)
  - Details not covered in lecture, especially about homeworks and labs
  - More opportunity for discussion

#### **Guest Lectures**

- We will have a few guest lectures throughout the quarter
  - Useful to give you a different perspective: research, industry, government, legal

# Course Logistics (CSE 484)

#### Security is a contact sport!

- Labs (45% of the grade)
- Homework (25% of grade)
- Participation and in-class activities (10% of the grade)
- Final project (20% of the grade)

## Course Logistics (CSE M 584)

#### Same as before, but...

- Labs (42% of the grade) [-3%]
- Homework (22% of grade) [-3%]
- Research readings (10%) [+10%]
- Participation and in-class activities (10%)
- Final project (16% of the grade) [-4%]

#### Labs

- General plan:
  - 3 labs
    - First lab out next week
  - Topics:
    - Software security (Buffer overflows, ...)
    - Web security (XSS attacks, SQL injections, ...)
    - Finding + fixing vulnerabilities
  - Submit to Canvas/gradescope
  - Groups must be configured on Canvas

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#### Homework

- A homeworks distributed across quarter
  - <u>http://courses.cs.washington.edu/courses/cse484/23sp/assignments</u>
  - First homework out shortly

# Ethics

• To learn to defend systems, you will learn to attack them. You must use this knowledge ethically.

#### **In-Class Participation**

- Trying to bring the best of online, in-person
  - In-class discussions, polls, and other online tools
  - More use of the online discussion board
  - Questions live and via pollev
- Main component: Lightly graded in-class activities
  - Canvas "quiz" submission (intended for use during class, but can be submitted up until start of next lecture); not a "quiz" in the traditional sense

# Late Submission Policy

- 5 free late days, no questions asked
  - Cumulative, throughout the quarter
  - Use up to 3 for one submission
  - All group members use days at once
- After that, late assignments will be dropped 20% per calendar day.
  - Late days will be rounded up
  - So an assignment turned in 26 hours late will be downgraded 40%
  - See website for exceptions -- a small number of assignments must be turned in on time

#### **Discussion Board**

- We've set up a Ed Discussion Board for this course
- Please use it to discuss the homework assignments and labs and other general class materials
- You can also use it to exercise the "security mindset"
  - Discussions of how movies get security right or wrong
  - Discussions of news articles about security (or not about security, but that miss important security-related things)
  - Discussions about security flaws you observe in the real world

#### Announcements

- We will use Ed for **announcements** 
  - It will send an email to you for announcements

# **Final Project**

- No midterm or final exam!
- Final project will require you to find and fix vulnerabilities in a medium (~1200 lines) piece of software.
  - Lab 3 will be warmup for the final project
- You will also need to explain your decisions and evaluation of the vulnerabilities
  - This will be either scheduled with TAs or a video (TBD)

# Prerequisites (CSE 484)

- Required: Data Abstractions (CSE 332)
- Required: Hardware/Software Interface (CSE 351)
- Assume: Working knowledge of C and assembly
  - One of the labs will involve writing buffer overflow attacks in C
  - You must have detailed understanding of x86 architecture, stack layout, calling conventions, etc.
- Assume: Working knowledge of software engineering tools for Unix environments (gdb, etc)
- Assume: Working knowledge of Java and JavaScript
- Assume: Ability to learn new programming languages / skills easily



# Prerequisites (CSE 484)

- Useful (not required): Computer Networks; Operating Systems
  - Will help provide deeper understanding of security mechanisms and where they fit in the big picture
- Useful (not required): Complexity Theory; Discrete Math; Algorithms
  - Will help with the more theoretical aspects of this course.

#### Prerequisites (CSE 484)

- Most of all: Eagerness to learn!
  - This is a 400 level course.
  - We expect you to push yourself to learn as much as possible.
  - We expect you to be a strong, independent learner capable of learning new concepts from the lectures, the readings, and on your own.

#### Another Example



CSE 484 / CSE M 584 - Spring 2023

# To Do

- Homework #1
  - Now: Start forming groups (e.g., use discussion board) and thinking about technologies you'd like to review.

#### Questions?

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