CSE 484 / CSE M 584:
Computer Security and Privacy

Winter 2023

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Hello 😊

- Instructor: Yoshi Kohno (he/him)
- Staff:
  - Aroosh Kumar
  - Wenqing Lan
  - Kelvin Ng
  - Kentrell Owens
  - Noah Ponto
  - John Taggart
  - William Travis
  - Shaoqi Wang
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 questions and should not be shared outside the class
  – Access the recordings via Canvas

• Largely the same curriculum as usual
  – Labs and homeworks and final project; no exams
  – We will adapt throughout the quarter as needed

• If you are struggling with anything, let us know!

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Course Resource Cheat Sheet

- **In Person:** Lectures, sections, office hours (planned)
- **Zoom:** Limited office hours (planned)
- **Canvas:** Links to recordings, assignment submissions, grades
- **Course website:** Schedule, assignment details, readings, policies
- **Ed:** Discussion board
- **Course mailing list:** Announcements (though most go to Ed)
- **Email:** Reach course staff privately (generally best: cse484-tas@cs – this email goes to all course staff)
What Does “Security” Mean to You?
What are topics you are excited about?

• It is also okay if you don’t know what topics you are interested in yet!
• The course’s final project will give you the opportunity to explore something not covered in class in depth.
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
  – They might sometimes (but not always) be at odds
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
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/section discussions and activities
  – Participation in Ed discussion board (e.g., thoughts and questions about news stories, technologies)
A Word on Groupwork

• Strongly encouraged, in some cases required
  – Beneficial to practice working in groups
    • Especially if you don’t like it 😊
  – Attack-based labs require some creativity, where group interactions can help generate ideas
  – Homeworks and security mindset: also benefits from discussion and group interactions

• (Please follow all the usual in-person contact guidelines 😊)
What This Course is Not About

• **Not** 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!

• **Not** about all of the latest and greatest attacks
  – Read news, ask questions, discuss on Ed

• **Not** a course on ethical, legal, or economic issues
  – We will touch on these issues, but the topic is huge

• **Not** 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
- mobile sensing platforms
- medical devices
- cars
- airplanes
Communication

- **yoshi@cs**
  - Use this (or instructor office hours) if something is sensitive, personal, confidential, etc.
  - Please put 484 in the subject line and re-email in case email lost / hit spam folder
- **cse484-tas@cs.washington.edu**
  - Best method 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]
- **Course mailing list: multi_cse484a_wi23@uw.edu**
  - We’ll use this (and often Ed) for announcements
- **We will do our best to be responsive, but please be professional, and plan ahead!**
Course Materials

• Readings:
  – No textbook; I’ll be posting reading materials as we go
  – Some optional, some strongly recommended

• Attend lectures
  – Lectures will not 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: e.g., research, industry, government, legal
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:
  – 2 or 3 labs
    • Plan: First lab out next week (TBD)
  – Topics:
    • Software security (Buffer overflows, …)
    • Web security (XSS attacks, SQL injections, …)
    • Possible third, e.g., on smart homes
  – Submit to Canvas
  – Groups must be configured on Canvas
Homework

• 3 homeworks distributed across quarter
  – http://courses.cs.washington.edu/courses/cse484/23wi/assignments
  – First homework is online

• Do now (no later than January 9): sign ethics form!
Ethics

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

• In order to get a non-zero grade in this course, you must electronically sign the “Security and Privacy Code of Ethics” form by 4:30pm on Monday, January 9.

  (Linked from the course schedule)

We will also repeatedly consider ethics (more generally) as part of our curriculum throughout course (see HW1, for example).
In-Class Participation

• In-class discussions combined with online tools
  – Canvas “quizzes” (see below)
  – (See also online discussion board for “in-class-like” discussions)

• 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

• Please write on the assignment how many late days you are using!
To Do

• Sign ethics form (due January 9)
  – https://forms.gle/R1QM2ZXwU96h8XLTA (link on course web page)

• Homework #1 (due January 20)
  – Start forming groups (e.g., use discussion board) and thinking about technologies you’d like to review.
Mailing List

multi_cse484a_wi23@uw.edu

• Make sure you’re on the mailing list
  – We’ll send a test email this week
  – If you recently enrolled, wait 24 hours
• URL for mailing list on course website
• We will use the mailing list and/or Ed for announcements; please use the Ed Discussion Board for discussions (not the mailing list)
Discussion Board

• We will set up an Ed Discussion Board for this course:
  – https://edstem.org/us/courses/32316/discussion/

• 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 books or 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
Final Project

• No midterm or final exam!
• Instead: **12-15 min video** about a security/privacy topic of your choice
  – Groups of up to 3 people (groups strongly encouraged)
  – Security is a broad field, and this class can’t remotely cover everything – **this is your chance to explore a security or privacy topic in more detail!**
  – Multiple checkpoint deadlines throughout quarter
• Details linked from website’s Assignments page
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.

  – **At the same time: Take care of yourselves and communicate with us!**
Another Example