CSE 484 / CSE M 584: Computer Security and Privacy

Winter 2021

David Kohlbrenner

dkohlbre@cs.washington.edu

Thanks to Franzi Roesner, Dan Boneh, Dieter Gollmann, Dan Halperin, Yoshi Kohno, John Manferdelli, John Mitchell, Vitaly Shmatikov, Bennet Yee, and many others for sample slides and materials ...

Hi!

- Instructor: David Kohlbrenner (he/him)
- TAs:

Wenqing Lan
(she/her)

Keanu Vestil
(he/him)

Khushi Chaudhari
(she/her)

Bowen Xu

Sherry Yang
(she/her)

Tanish Kapur
(he/him)

Online, again

- We're disappointed we can't meet in person!
- I hope you are all doing okay
  - (It's okay if you're not)
- While we've been running classes online for some time, things won't be perfect
- **We are still excited to teach you about computer security and privacy!**
- If something about the course isn't working, let us know! The sooner you do, the better

Online Course Plan

- Lectures and Sections and Office Hours via Zoom
  - Synchronous, but 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
- Largely the same curriculum as usual
  - Labs and homeworks and final project; **no exams**
  - We will adapt throughout the quarter as needed

A Few Words About Zoom Chat

- Please **use it** to ask or answer direct questions
- Please **avoid** tangents or discussions
  - Have more thoughts? Things to share? Awesome! We want to hear them! Please use the discussion board, though.
- **Please be mindful of leaving space for others too**
- Rule of thumb: would you (or would you think someone should) say this out loud to everyone in a physical classroom?

Course Resource Cheat Sheet

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

What Does “Security” Mean to You?

Let’s try a Zoom breakout!

- *What comes to mind when you think of computer security and privacy?*

What are topics you are excited about?

Lets try polleverywhere!

- Pollev.com/dkohlbre

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
- Security deals with intentional failures created by intelligent parties
  - Security is about computing in the presence of an adversary
  - But security, reliability, and usability 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")
  - 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
   - The "Security Mindset" – a "new" way to think about systems
2. **Technical aspects of security**
   - 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
- "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…"

- Why it's important
  - Technology changes, so learning to think like a security person is more important than learning specifics of today
  - Will help you design better systems/solutions
  - Interactions with broader context: law, policy, ethics, etc.

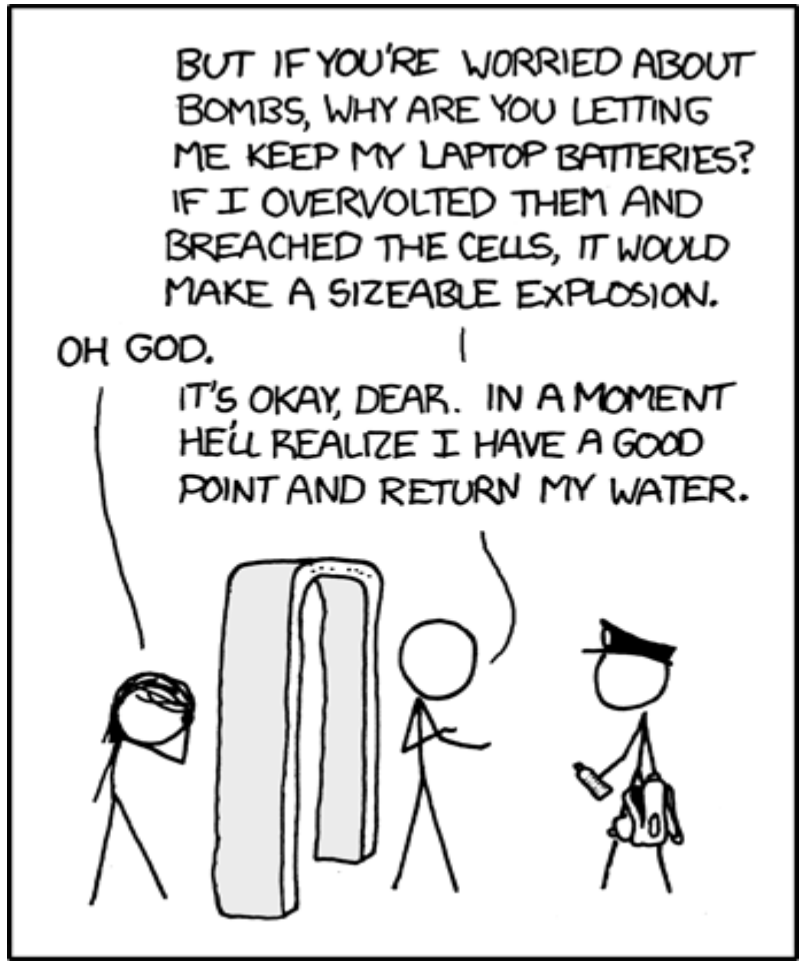
The Security Mindset

Uncle Milton Industries has been selling ant farms to children since 1956. Some years ago, I remember opening one up with a friend. There were no actual ants included in the box. Instead, there was a card that you filled in with your address, and the company would mail you some ants. My friend expressed surprise that you could get ants sent to you in the mail.

I replied: "What's really interesting is that these people will send a tube of live ants to anyone you tell them to."

Bruce Schneier - “The Security Mindset”

The Security Mindset



https://xkcd.com/651/

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 discussions and activities
  - Participation in Ed discussion board (e.g., asking about news stories, technologies)

A Word on Groupwork

- In some quarters, we require it
  - Need to learn how to work in groups
    - Especially if you don't like it ☺
  - Attack-based labs require some creativity, where group interactions can help generate ideas
- This quarter, with time zone and other challenges, we will be flexible as needed
- But, if you can, **we still encourage working in groups.** Social contact is important!
- (Please follow all the usual in-person contact guidelines ☺)

What This Course is Not About

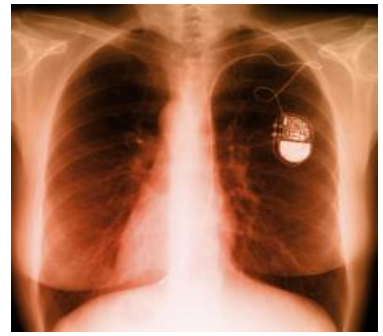
- Not a comprehensive course on computer security
  - Computer security is a broad discipline!
  - Impossible to cover everything in one quarter
  - So be careful in industry or wherever you go!
- Not about all of the latest and greatest attacks
  - Read news, ask questions, discuss on forum
- Not a 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

voting machines

EEG headsets



medical devices

wearables

RFID

mobile sensing platforms

cars

game platforms

airplanes

Communication

- dkohlbre@cs.washington.edu
  - Use this if something is sensitive, confidential, etc.
- cse484-tas@cs.washington.edu
  - Use this to reach all course staff
- Ed Discussion Board
  - Use this if other students in the class would benefit from your question/answers **[common case]**
- Course mailing list: cse484a_wi21@uw.edu
  - We'll use this for announcements
- We will do our best to be responsive, but **please be professional**, and plan ahead!

Course Materials

- Readings:
  - Optional textbook: Daswani, Kern, Kesavan - "Foundations of Security"
  - Additional reading materials linked to from course website (sometimes **strongly recommended**)
- Attend lectures (or watch later)
  - Lectures will not follow the textbook and will cover a significant amount of material that is not in the textbook
  - Lectures will focus on "big-picture" principles and ideas
- Attend sections (or 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 soon, likely next week
  - Topics:
    - Software security (Buffer overflows, …)
    - Web security (XSS attacks, SQL injections, …)
    - Smart homes
  - Submit to Canvas
  - Generally encourage groups

Homework

- 3 homeworks distributed across quarter
  - http://courses.cs.washington.edu/courses/cse484/21wi/assignments
  - First homework out now (due January 13)

- Do now (no later than January 11): 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 11:59pm on Mon, Jan 11.

(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

- Continuing to experiment with online course logistics
  - Zoom breakouts and polls
  - More use of the online discussion board
  - Questions live and via Zoom chat
  - Post-lecture surveys
- **Main component: Lightly graded in-class activities**
  - Usually involve a Zoom breakout
  - Canvas “quiz” submission (intended for use during class, but can be submitted up until start of next lecture)

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

To Do

- Ethics form (due Mon Jan 11– do it now!)
- Homework #1 (due Wed Jan 13)
  - Now: Start forming groups (e.g., use discussion board) and thinking about technologies you'd like to review.

Questions?

dkohlbre@cs.washington.edu

cse484-tas@cs.washington.edu