

Comp 790-149: Research Topics in Computer Security

Introduction

August 21, 2023
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Slides adapted from Alex Halderman's EECS 588

Department of Computer Science



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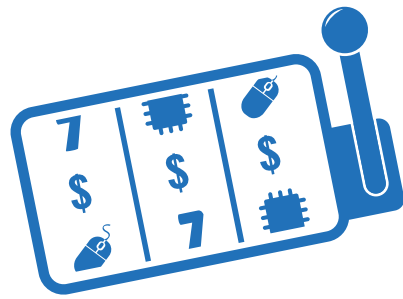
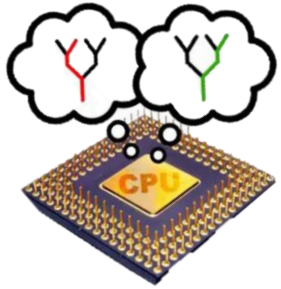
Today's Class

- Introductions
- Course Goals
- What is Security Research?
- Security Mindset
- Course Structure

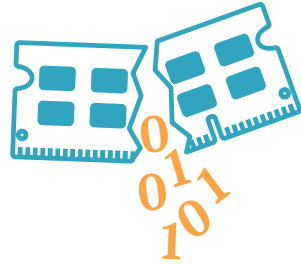


Who am I?

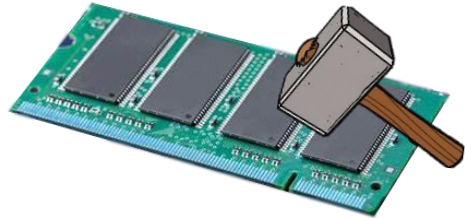
- Andrew Kwong
 - Assistant Professor
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CacheOut



RAMBleed



Rowhammer



My Research

- Side-Channels:
 - Memory
 - CPU
 - Applied-crypto

- Will talk more next class!

Course Goals

- Learn how to conduct security research
 - Broad overview of topics in computer security
 - Foundational works (e.g. Test of Time Award winning papers)
 - Recently Influential papers (Best paper awards)
 - Exposure to useful techniques
- Improve research, reading, writing, presentation skills
 - All are important!
- Develop a security mindset

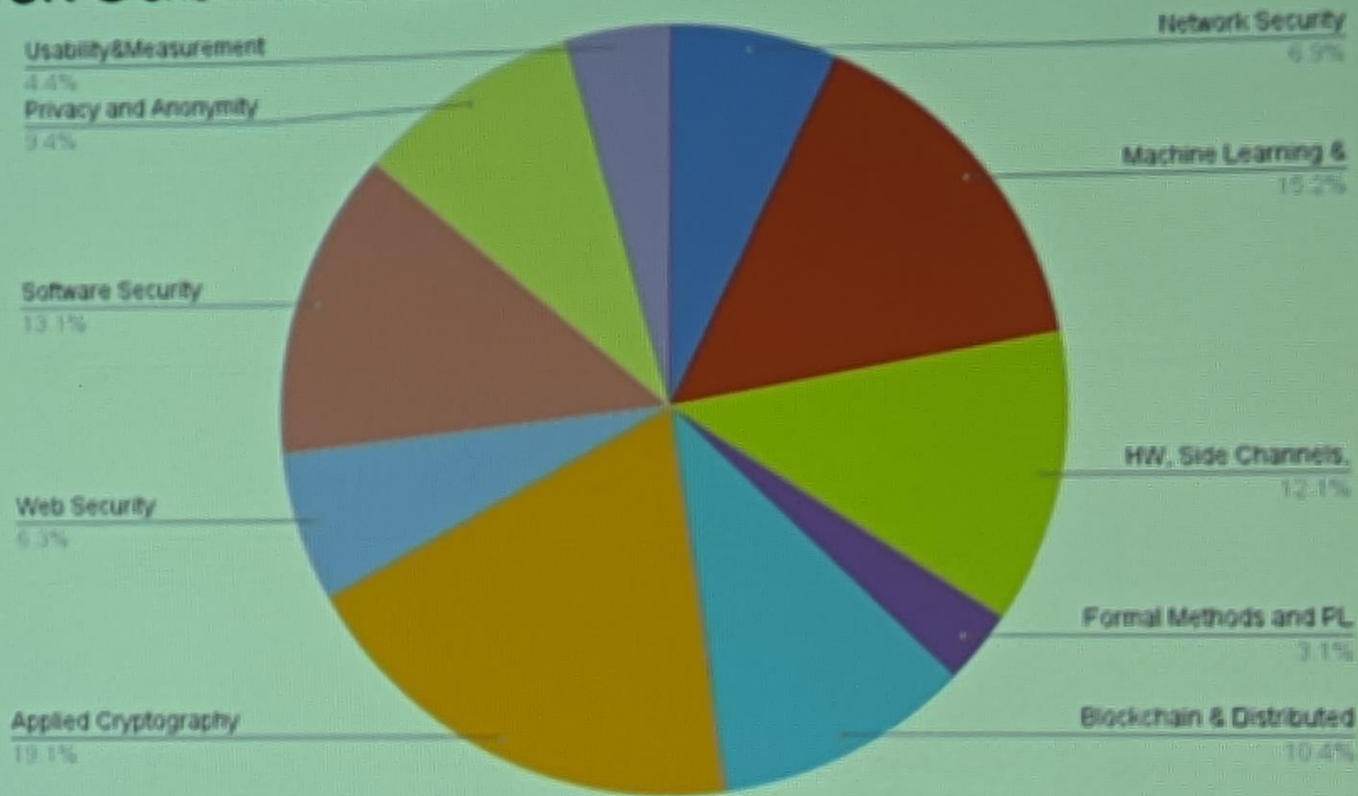
Who are you?

-
- Research Field
 - Hobby/interesting fact
 - Something you want to learn from this course.

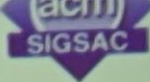
What is Security Research?

- Pwning?
 - Scientific term for writing a binary exploit that gives the attacker root

ack Submissions



ack Acceptance Rates

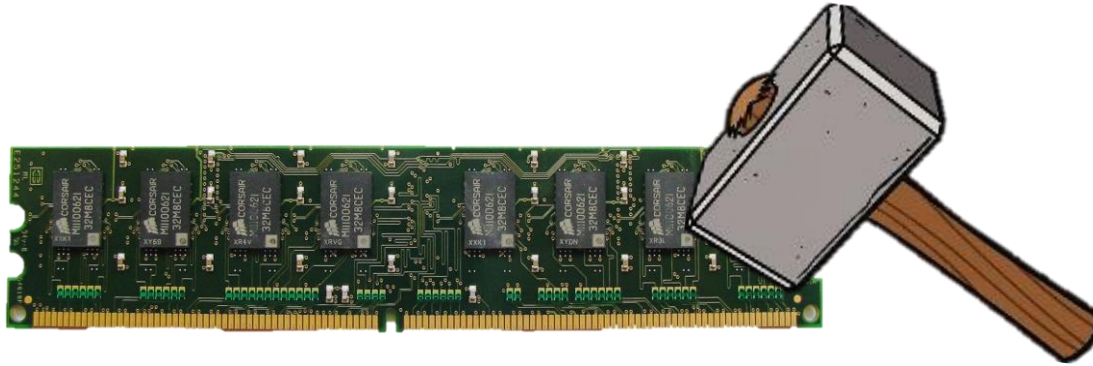


What is Security Research?

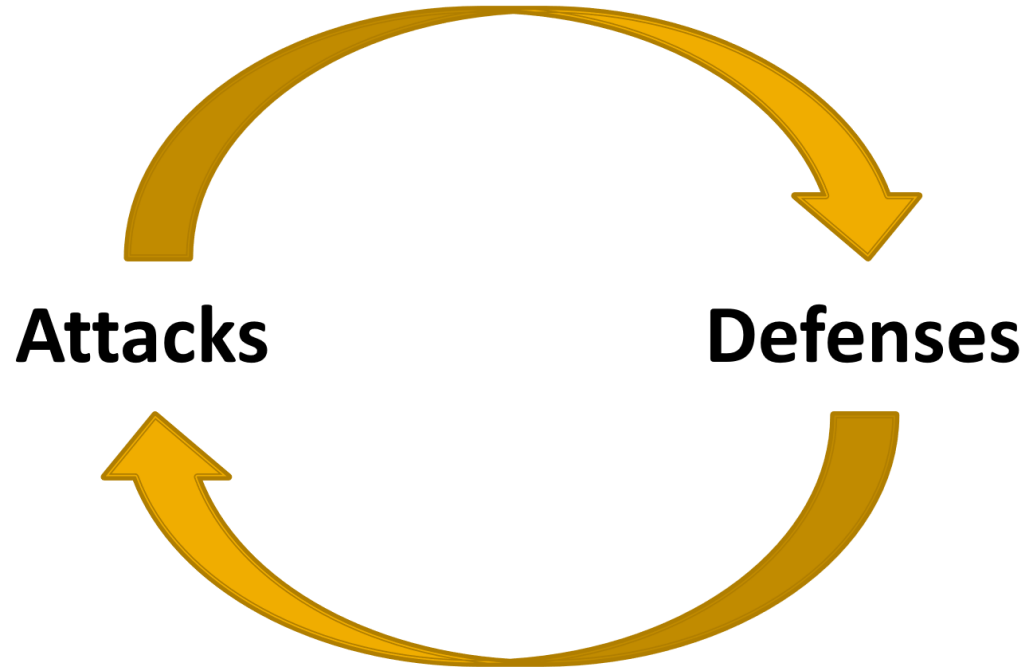
- Pwning?
 - Scientific term for writing a binary exploit that gives the attacker root
- “Computer security studies how systems behave in the presence of an adversary.”
- Adversary:
 - An intelligence that actively tries to cause the system to misbehave.



Adversarial Example



High Level Approach



Attack Research

- Identify vulnerabilities so they can be fixed.
- Create incentives for vendors to be careful.
- Learn about new classes of threats.
 - Determine what we need to defend against.
 - Help designers build stronger systems.
 - Help users more accurately evaluate risk.

More than just finding vulnerabilities!

- Generalizable lesson is learned
 - Used to build more effective defenses

Thinking Like an Attacker

- Look for the weakest links – easiest to attack.
- Identify assumptions that security depends on. Are they false?
- Think outside the box: Not constrained by system designer's worldview.

Practice a Security Mindset:

For every system you interact with, think about what it means for it to be secure, and imagine how it could be exploited.

Exercises

- How to cheat in class?
- How to cheat out of class? (remote proctoring software)

Exercises

- How to steal my password?

Exercises

- How to vote twice?

Exercises

- What are some security systems that you interact with in everyday life?

Thinking Like a Defender

- Security policy
 - What are we trying to protect?
 - What properties are we trying to enforce?
- Threat model
 - Who are the attackers? Capabilities? Motivations?
 - What kind of attack are we trying to prevent?
- Risk assessment
 - What are the weaknesses of the system?
 - What will successful attacks cost us?
 - How likely?
- Countermeasures
 - Costs vs. benefits?
 - Technical vs. nontechnical

Voting Twice

What Not to do

- Common mistake:
 - Looking for evidence that your system is secure
- Security through obscurity
 - Fails historically!
- Kerckhoff's principle
 - Design of a system should not require secrecy

Course Structure

Grading

- Class Participation – 20%
- Paper Presentations – 30%
- Course Project – 50%

Class Participation (20%)

- 2 paper readings each class
- Come prepared to contribute/ask questions
- Full points for speaking up and contributing substantial ideas

Paper Presentations (30%)

- Give conference style talk on assigned papers
- Can make or reuse/augment slides
- Roughly 15 minute presentation
 - High level advertisement for the paper
- Paper list found at <https://andrewkwong.org/readings.html>
- Send me preferences (at least 5) by Friday

Course Project (50%)

- Conduct original research on a topic related to computer security over the course of the semester.
- In class proposal/presentation 2nd week of October
- submit a final report (6-12 pages) at end of the course
- Give a conference style talk on results during the final week of class
- Working in groups is allowed, but a more substantial product is expected when working with more people

Your Assignments

- First paper discussion next Monday
- Rate preferences for paper presentations (Give me your top 5 at the very least)
- Start thinking about your course project
 - Proposals due second week of October



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Content Slide Title 1

Content Slide Subtitle