CSC 405
Computer Security

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Administration

- Class website
  - https://kapravelos.com/teaching/csc405-s22/schedule/
- Piazza
  - https://piazza.com/ncsu/spring2022/csc405
- Mail to instructor (for private matters)
  - akaprav@ncsu.edu
- Recorded classes
  - https://ncsu.hosted.panopto.com/Panopto/Pages/Sessions/List.aspx#folderID=aa29a189-fe0b-4c79-b50e-adff017fca1b

Material

- What material will we be using?
  - Unfortunately, there is no good book on systems security
  - Use the slides that I will post on the web site
  - Related papers/readings and online material (from the syllabus)
- Here are some useful online books that provide additional information:
  - The Shellcoder's Handbook: Discovering and Exploiting Security Holes
  - Hacking, The Art of Exploitation
  - The Tangled Web A Guide to Securing Modern Web Applications

Grading

- What are the requirements to get a grade?

- Homework Assignments - 100% of grade
  - shellcode
  - buffer overflows
  - web security
  - HackPack CTF

Topics

We are going to cover three modules:

Computer Security Basics
Software Security
Web Security

You need to understand

- Networks and Operating Systems
- Basics of systems theory and implementation
  - E.g., file systems, distributed systems, networking, operating systems, …
- You will build stuff. I expect you to:
  - know how to code (in language of your choice*)
  - I will use mix of pseudocode, Python, Assembly, JavaScript, PHP and C
  - be(come) comfortable with Linux/UNIX

Goals

Learn how an attacker takes control of a system

Learn to defend and avoid common exploits

Learn how to architect secure systems

Assignments

- Individual homework assignments
- These are going to be **hard**!
- You are going to implement attacks and defenses
- Discovering a vulnerability is a frustrating, but very rewarding in the end!

- The assignments have a unique nature
  - They require from you some **exploration**
  - They are **VERY** different from any assignments you had so far
  - Most of them will have two parts:
    - **Identify** the vulnerability
    - **Exploit** the vulnerability

Lecture format

- Our lectures are going to be hybrid
  - In-person (COVID permitted)
  - Always recorded and available online to watch if you miss the lecture
  - Sometimes flipped
    - watch the lecture before you come to class
    - we discuss/solve a security challenge during class
- You will have to watch the lectures and study any related material
- We will use piazza to resolve any lecture-related questions -> weekly Q&A!

HackPack CTF

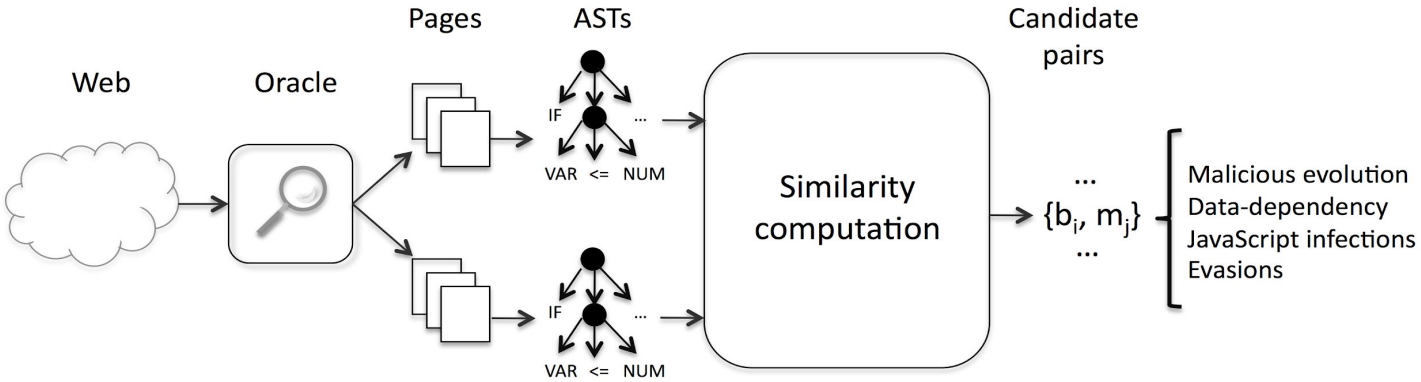
- Capture the Flag security competition
- 24 hours of hacking
- **April 8th at 11:00 am EDT**
- It will count as one homework assignment
  - For the homework-part you will be able to work on the challenges over the weekend
  - Participation is mandatory to the CTF event, if you cannot make it you have to inform me beforehand

Readings

- There is a large amount of readings in this course covering various topics. These readings are intended to:
  - Support the lectures in the course (provide clarity)
  - Augment the lectures and provide a broader exposure to security topics
- **Students are required to go through the readings**
  - Some of the material is really helpful in solving the homework assignments

Cheating policy

- Cheating is not allowed
- We run tools
- If you cheat you will probably get caught and get a failing grade in the course
- All academic dishonesty incidents will be reported



Ethics

With great power comes great responsibility

- Topics will cover technologies whose abuse may infringe on the rights of others
- When in doubt, please contact the instructor for advice. Do not undertake any action which could be perceived as technology misuse anywhere and/or under any circumstances unless you have received explicit written permission from the instructor.

Your Security Zen

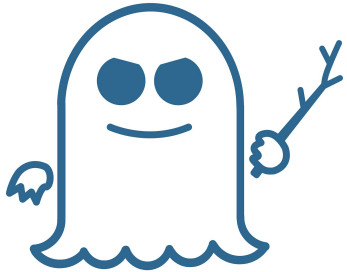
At the end of every lecture we will have a short discussion on a recent security topic

Use piazza or Discord server #random channel if you see in the news interesting security incidents!

Here's one from a previous year

Your Security Zen

Meltdown and Spectre



two major security flaws in the microprocessors inside nearly all of the world's computers (Intel, AMD, ARM)

Spectre: no easy fix, we have to redesign processors

Meltdown: 30% slow down

There are proof of concepts in the wild that can read host kernel memory from inside a KVM guest

Sources: https://googleprojectzero.blogspot.com/2018/01/reading-privileged-memory-with-side.html, https://meltdownattack.com/