University of Colorado **Boulder**

CSCI 3403 INTRO TO CYBERSECURITY

Lecture: 1-2

Topic: Fundamentals

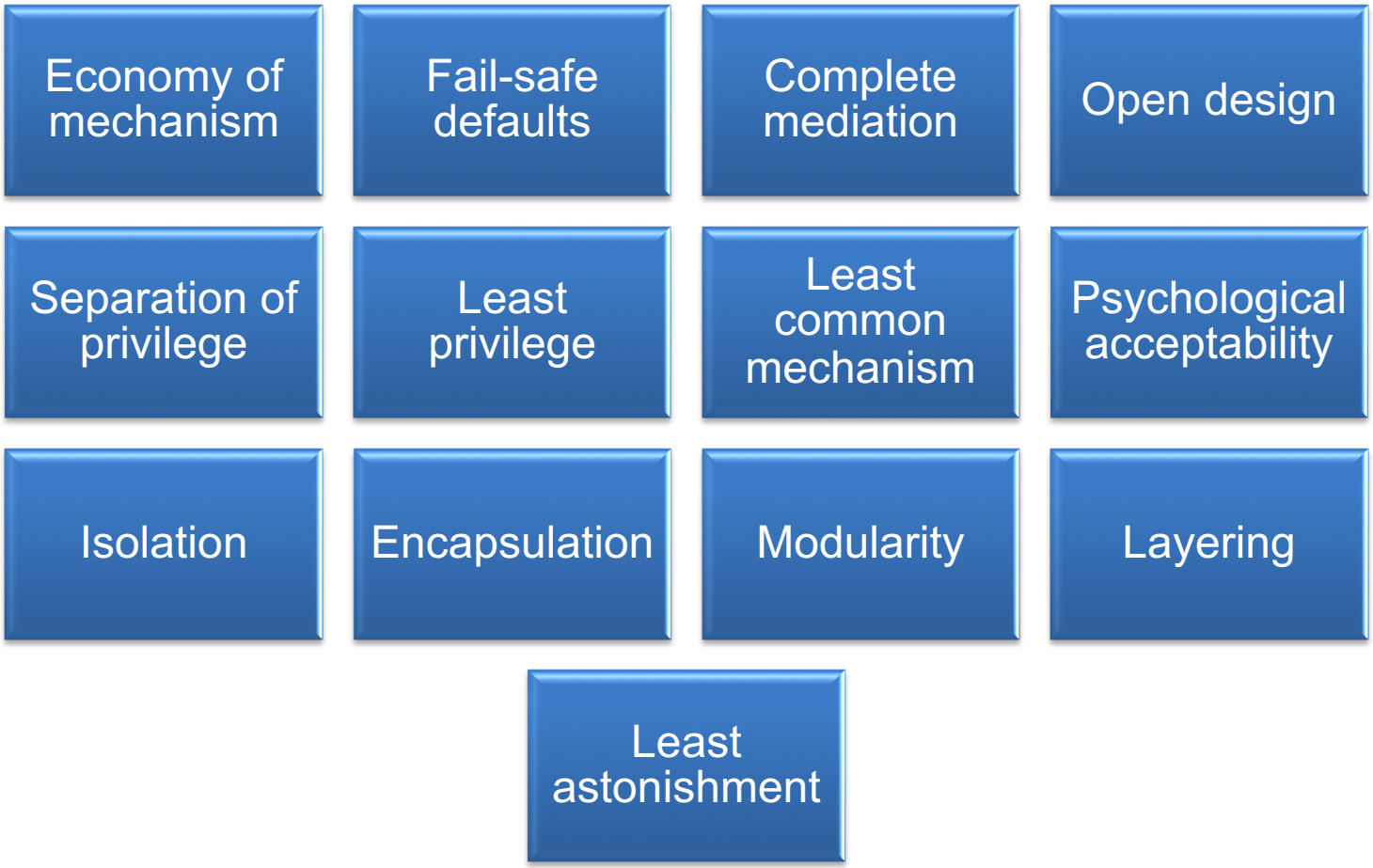
Presenter: Matt Niemiec

Announcements

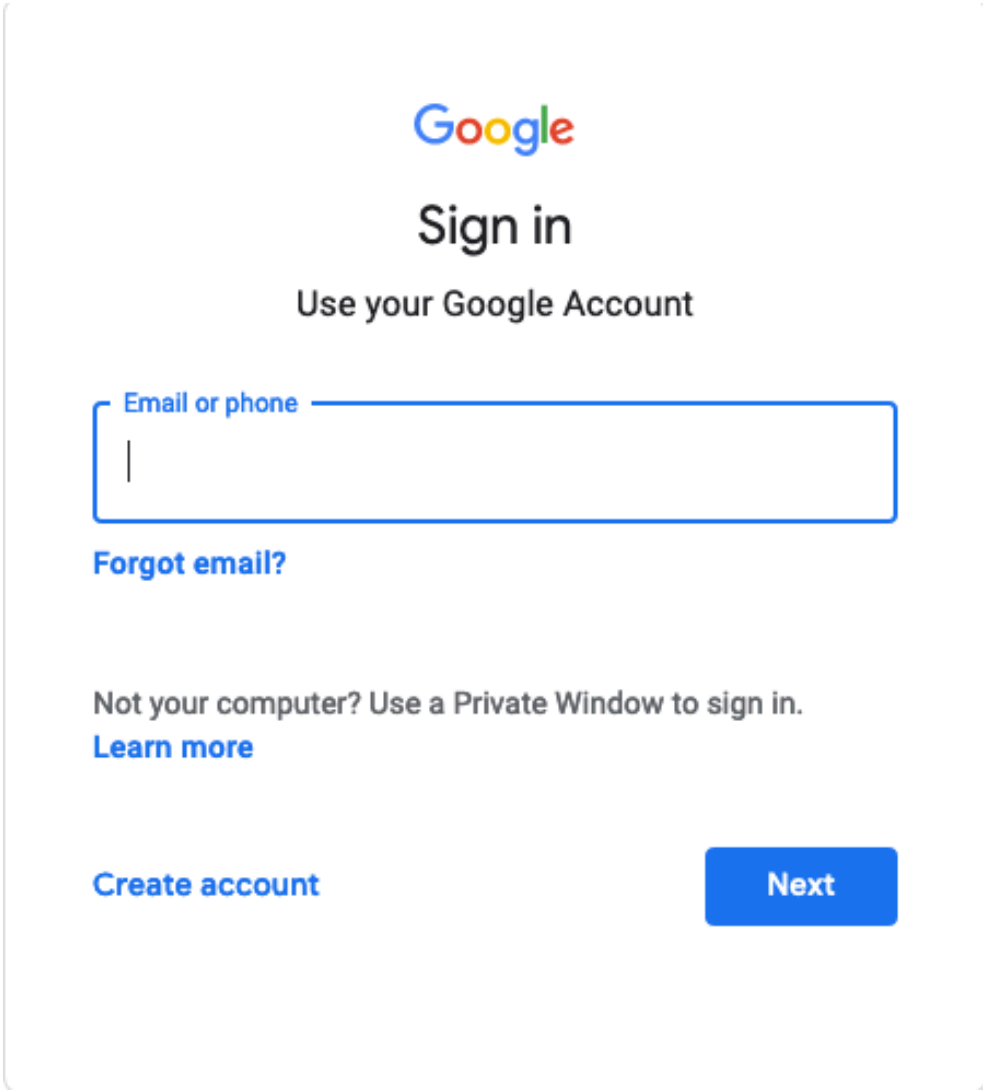
- We have a course email now: cyber@colorado.edu
  - Use for requests, accommodations, etc.
- TAs office hours are on Moodle, not Piazza
- Lecture capture now exists
- HW 1 and Project 1 will be up tomorrow

Design Principles

Book's Principles



Example


Google
Sign in
Use your Google Account
Email or phone
Forgot email?
Not your computer? Use a Private Window to sign in.
Learn more
Create account
Next

Fail-Safe Defaults

- Permission should be given with explicit permission
- All systems fail
  - What will yours do when it does?
  - What are different ways it could fail?
- Fail-safe defaults in web login?

Least Privilege

- Every process and user shouldn't have more privileges than absolutely necessary
- If you don't need privileges, you shouldn't have them
- sudo chmod –R 777 /
- Uses in our example

Open Design

- One of the most commonly-violated principles
- Keep your algorithms known
  - E.g. encryption, secret bytes transfer
- You CANNOT design better than decades of review
- In our example

Minimize The Attack Surface Area

- Two things are twice as hard to defend as one thing
- Attack surfaces: hardware, software, data, networks
- Don’t forget about old surfaces
  - Equifax
- Apply to our example?

Defense In Depth

- Don’t rely on just one defense mechanism
- Redundancy is better
  - Redundant servers, authenticators, data
- In our example

Keep It Simple...

- If it's difficult to reason about, you probably made a mistake
- Assume people will take the time to break your system
- In our example

And Many Others!

- These are just a few
- Avoid getting caught in the details
- Know what each is protecting against

Attack Trees

Attack Surface Categories

Network Attack Surface

- Vulnerabilities over an enterprise network, wide-area network, or the Internet
- Included in this category are network protocol vulnerabilities, such as those used for a denial-of-service attack, disruption of communications links, and various forms of intruder attacks

Software Attack Surface

- Vulnerabilities in application, utility, or operating system code
- Particular focus is Web server software

Human Attack Surface

- Vulnerabilities created by personnel or outsiders, such as social engineering, human error, and trusted insiders

Attack Surfaces

Consist of the reachable and exploitable vulnerabilities in a system

Examples:

Open ports on outward facing Web and other servers, and code listening on those ports	Services available on the inside of a firewall	Code that processes incoming data, email, XML, office documents, and industry-specific custom data exchange formats	Interfaces, SQL, and Web forms	An employee with access to sensitive information vulnerable to a social engineering attack

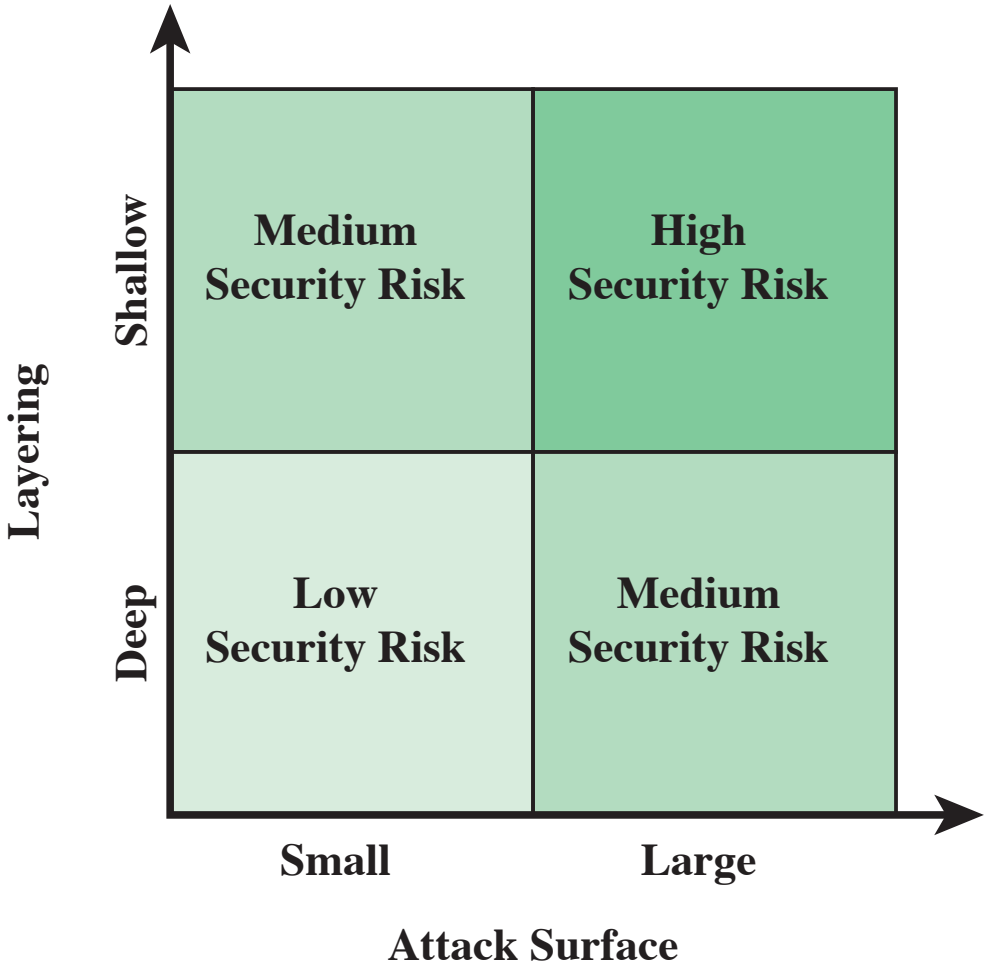


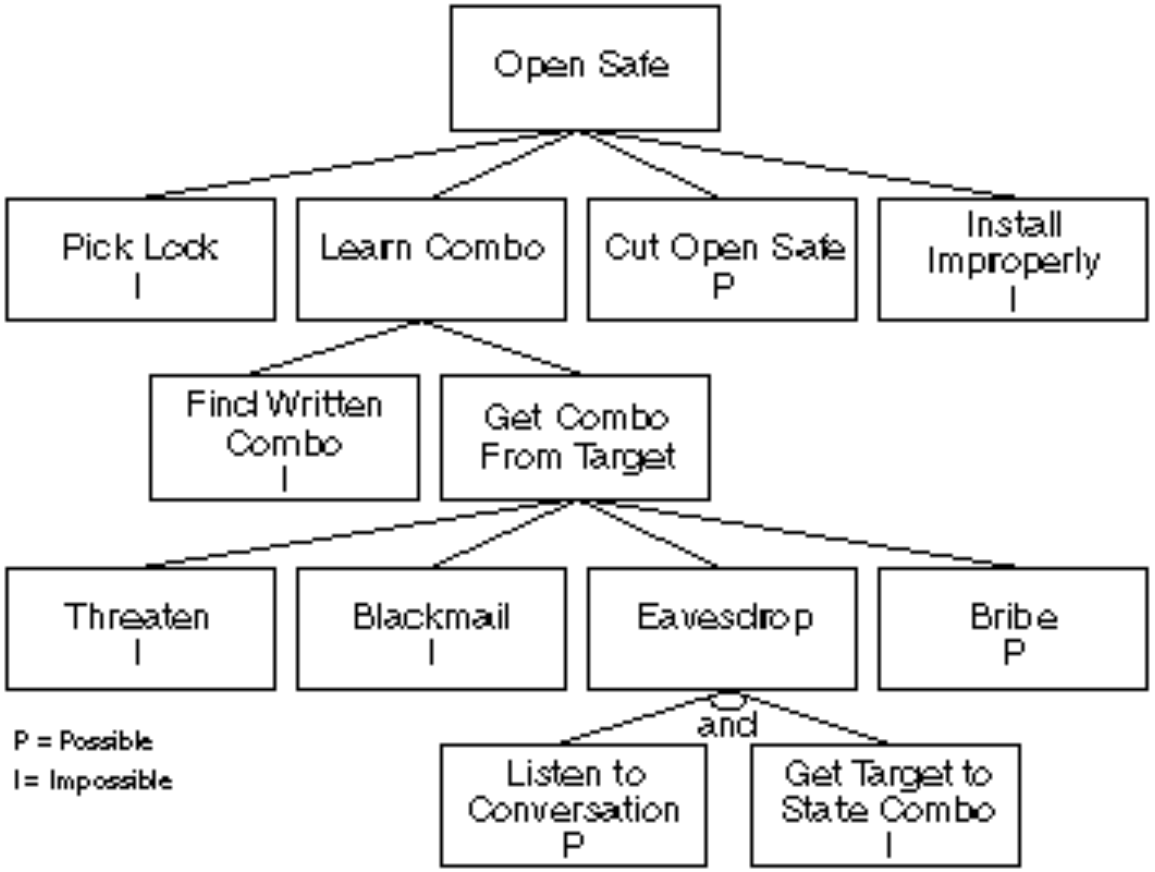
Figure 1.4 Defense in Depth and Attack Surface

Attack Trees

- Useful for thinking about vulnerabilities
- Demonstrates that nothing is “totally secure”
  - Secure for how long?
  - Secure from whom?
- Practice adversarial thinking

*Material borrowed from: https://www.schneier.com/academic/archives/1999/12/attack_trees.html

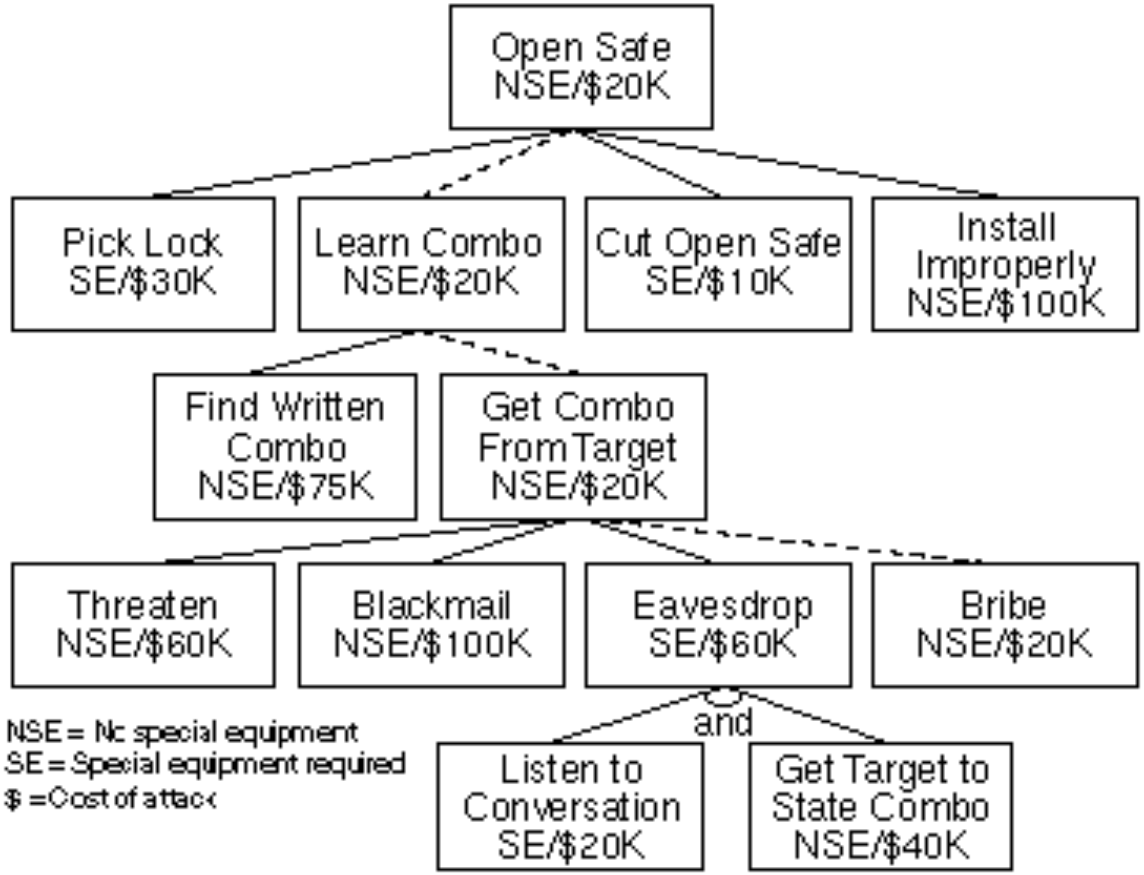
Sample Attack Tree



And vs. Or Nodes

- Do both things need to happen?
- Or just one?
- Helps us understand how difficult attack will be

Pricing Attack Tree



Try Another Example

- Card skimmers
- What's the root node?

Attack Trees Summary

- We want to understand the adversary
- Map out all possible attacks
- See where we're vulnerable

Conclusion

- Defense takes creativity
- We have some common principles to help
- Attack trees help us find where to apply principles