CSCI 476: Computer Security

Security + Threat Modeling

Reese Pearsall

Spring 2023

*all images are stolen from the internet

Announcements

Lab 9 due Sunday **4/30**

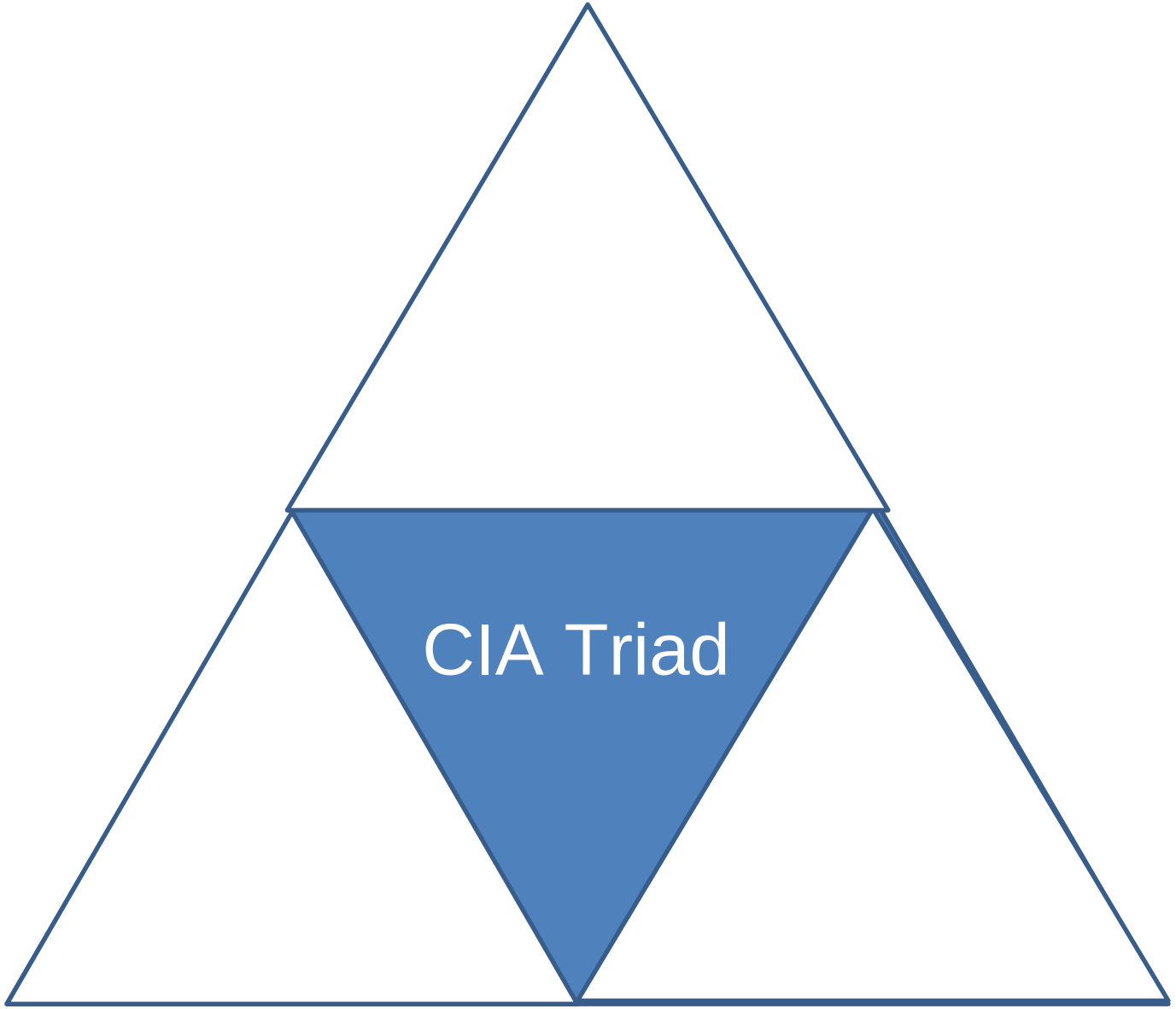
Fill out the course evaluation (Lab 10)
→ If 85%+ of the class fills out the course evaluation, then everyone will get 1% added to their final grade

Final Lab will be posted soon

Next 3 lectures after this will be guest speakers, you can earn extra credit for the final lab

Security Basics

The **CIA Triad** is a widely accepted model for evaluating the security of a system. Consists of three important principles



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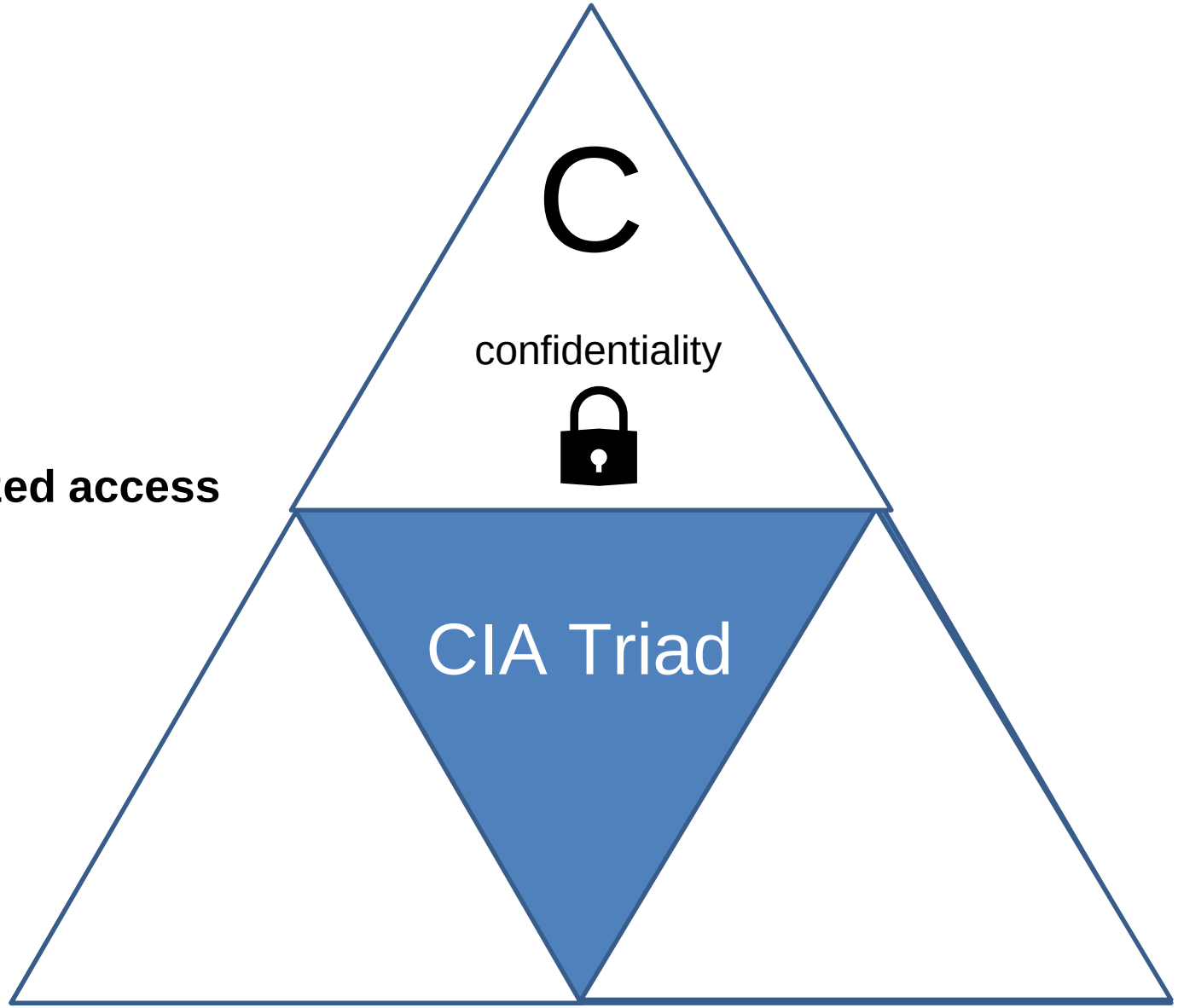

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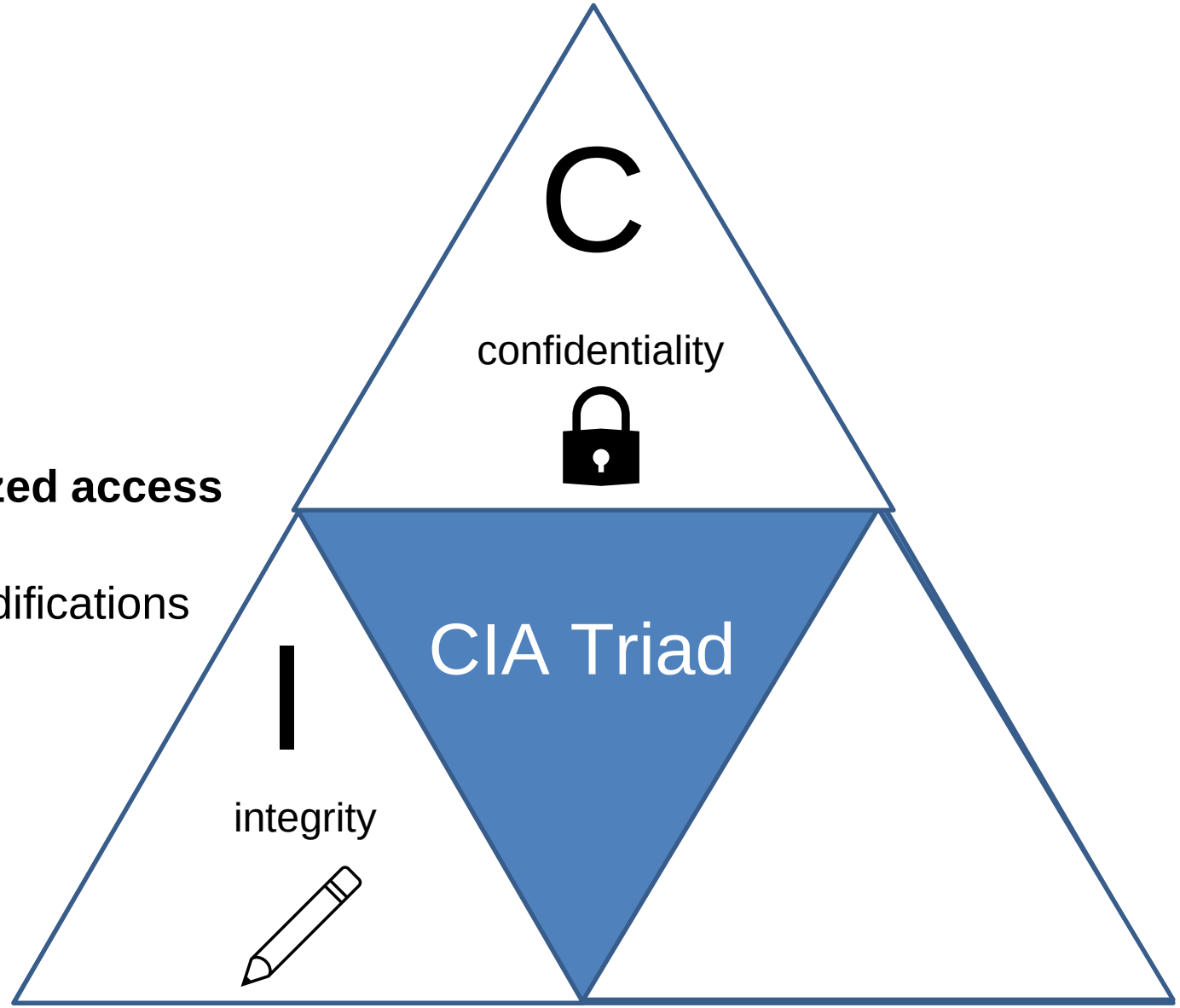

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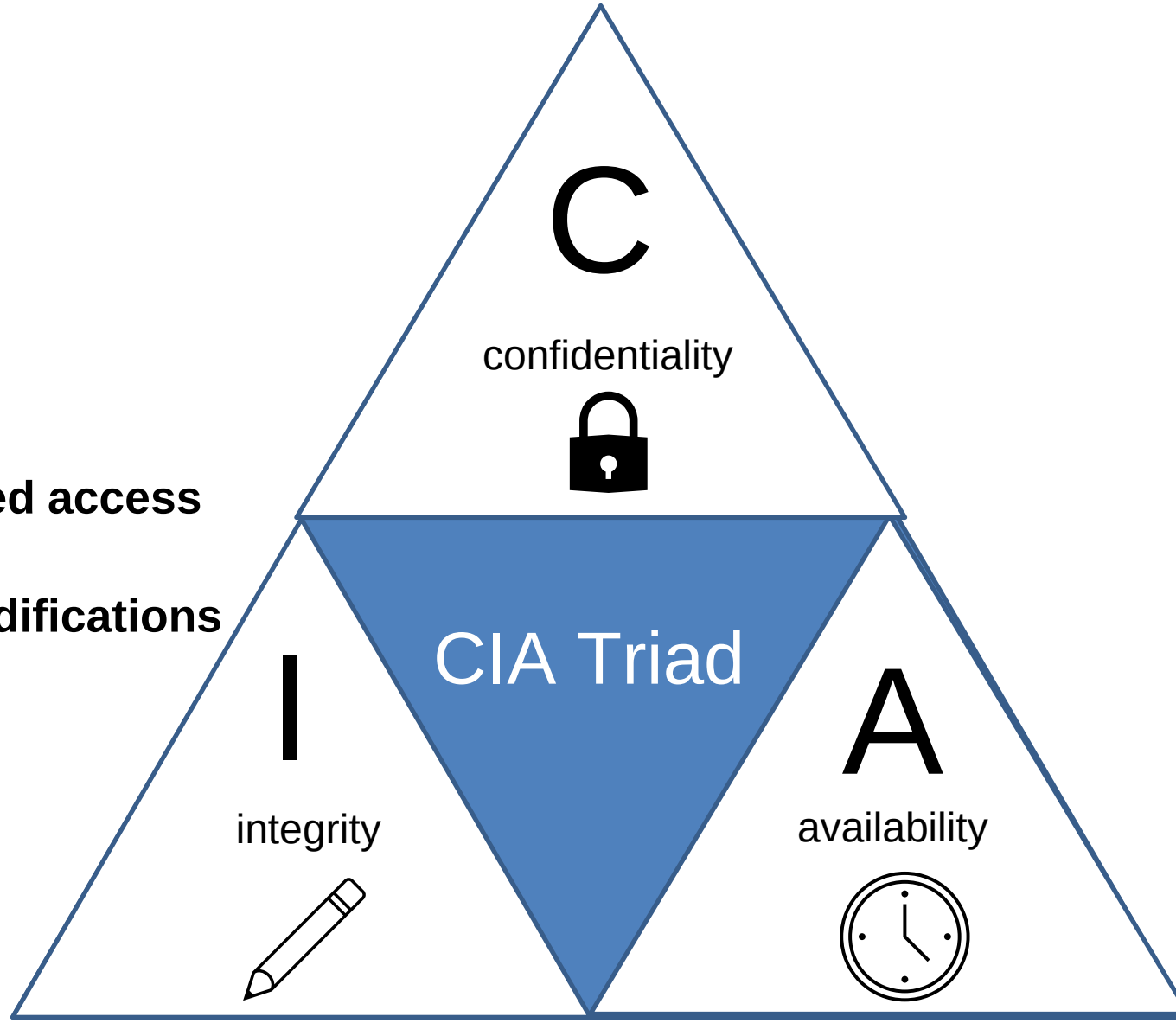
Integrity- protection from **unauthorized modifications**

Availability- protection from **interruption**



Common Threats & Attack Vectors

Denial of Service (DoS / DDos)- attack with intent to shut down a machine or network

- Violates the **availability** property

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Information Leakage / Data Corruption- unauthorized or accidental reveal of sensitive information

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Privilege Escalation- gaining illicit permissions beyond what is intended for that user

- Violates the **confidentiality** property
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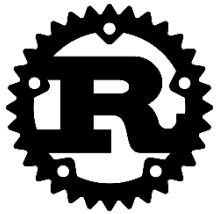
Defense Mechanisms

- Countermeasures (ASLR, SYN Cookies, etc)
- Software testing
- Formal verification
- Refactoring software and safe coding practices

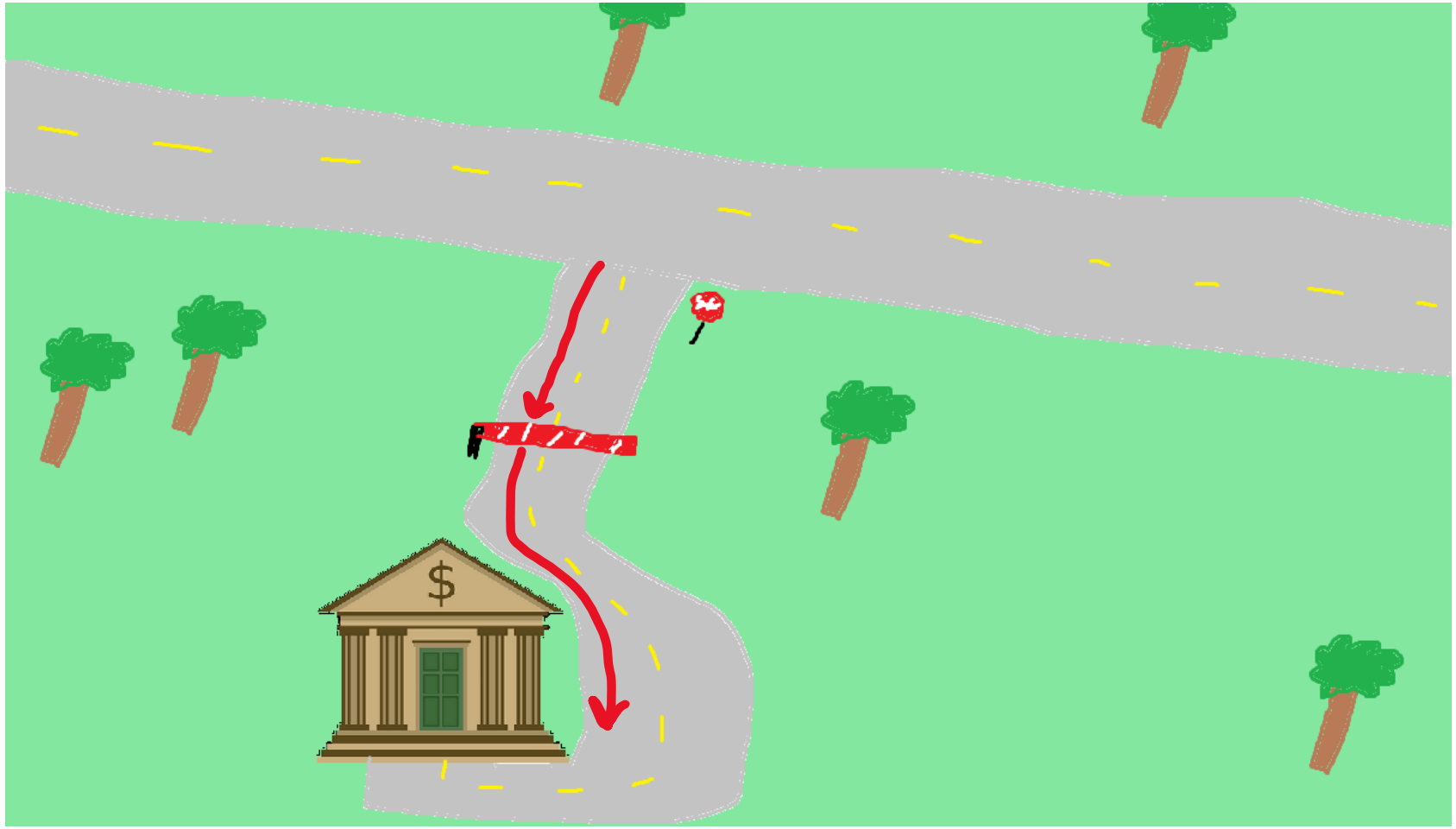


Threat Modeling

NEED: a consistent and structured approach for defense and assessing risk

Assessing Risk

We expect users to interact with our system in a certain way



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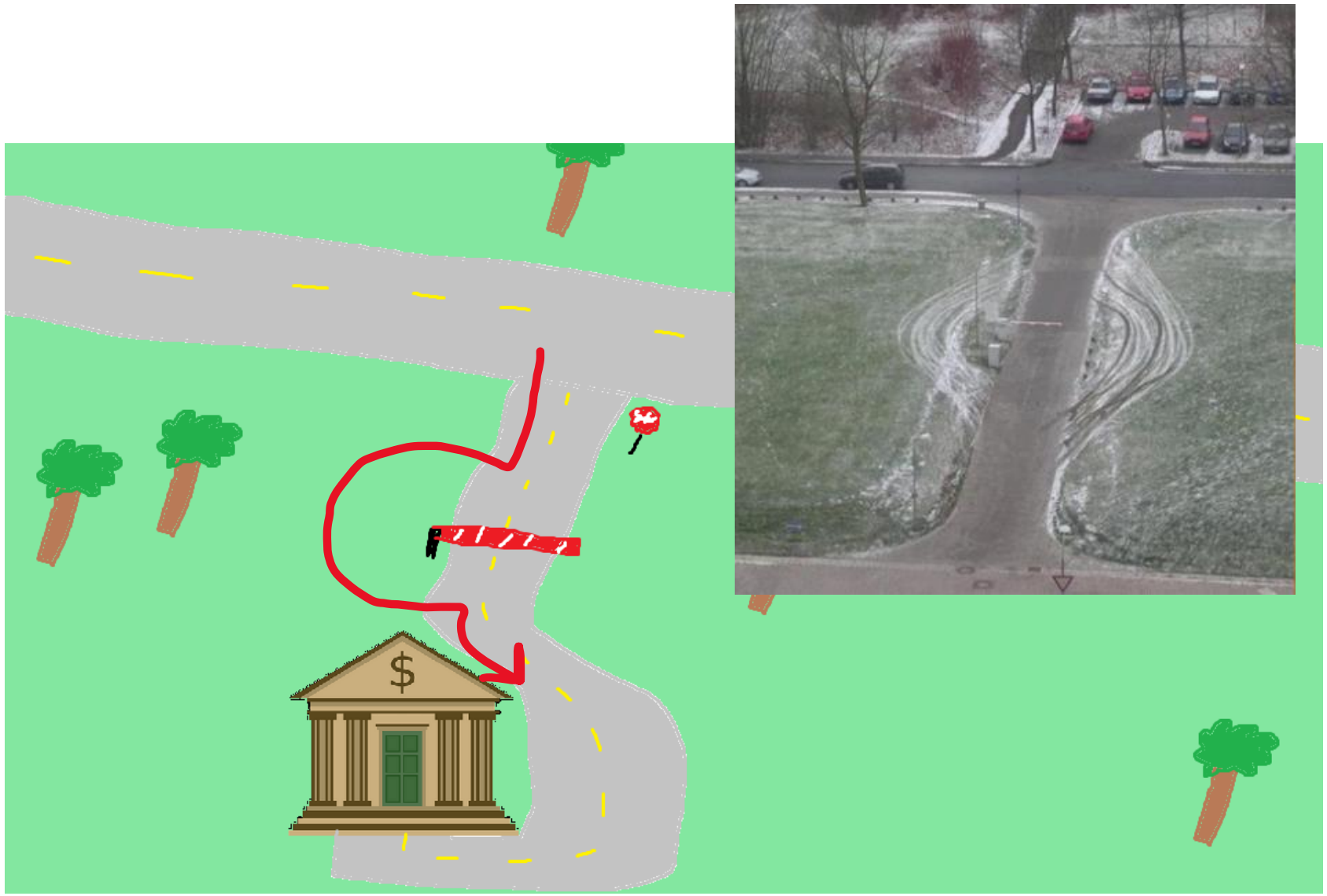

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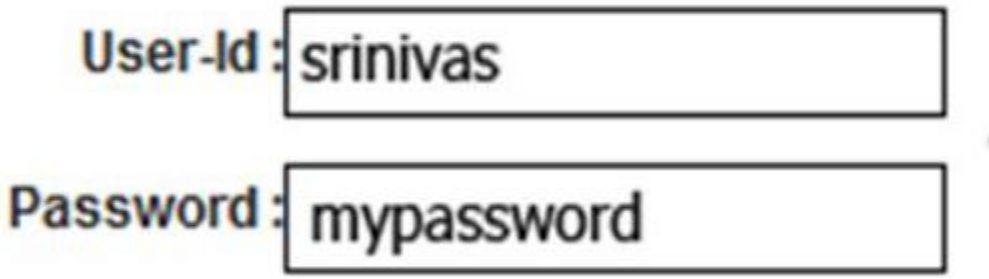

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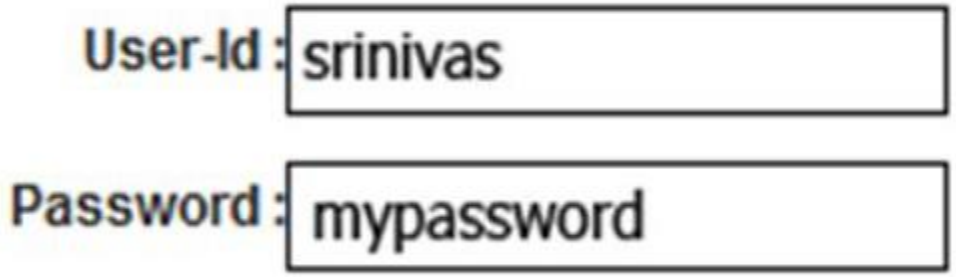

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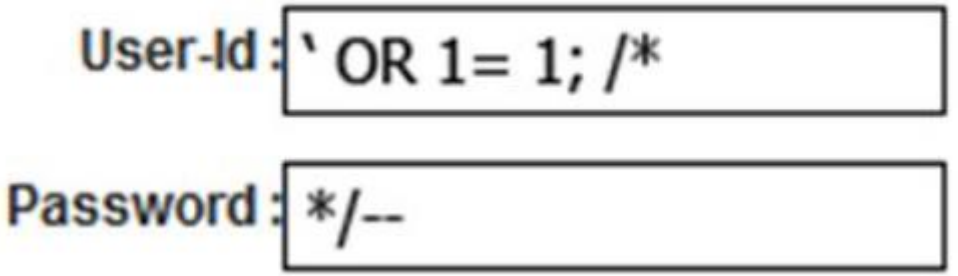

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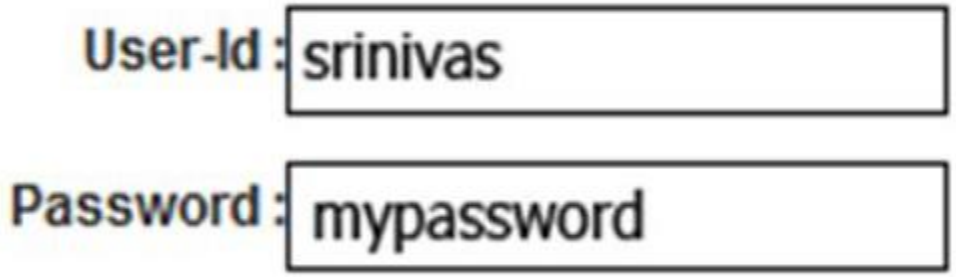

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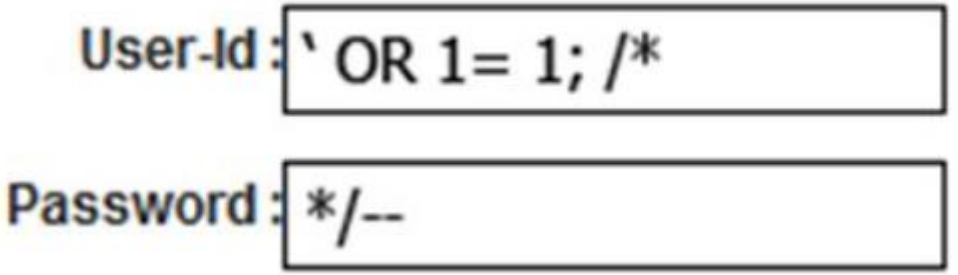


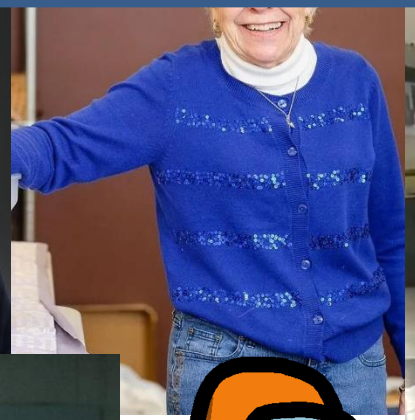
LOGIN SUCCESS

Who do we trust?

Are they honest? Are they reliable? Are they dependable? What are their intentions?

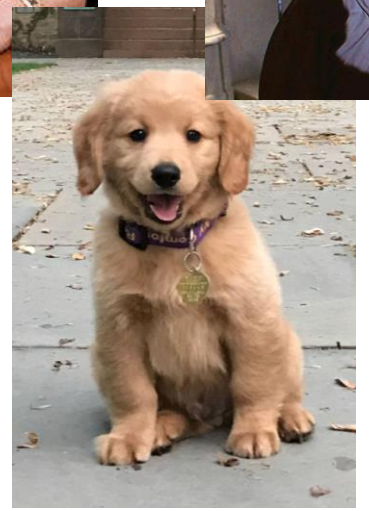
Who do we trust?

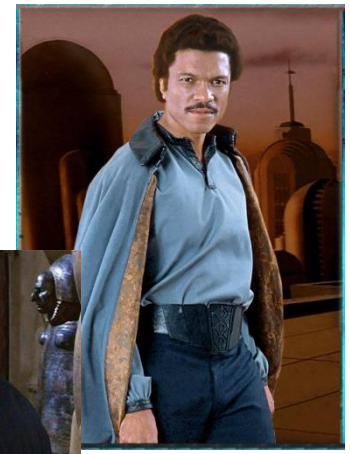
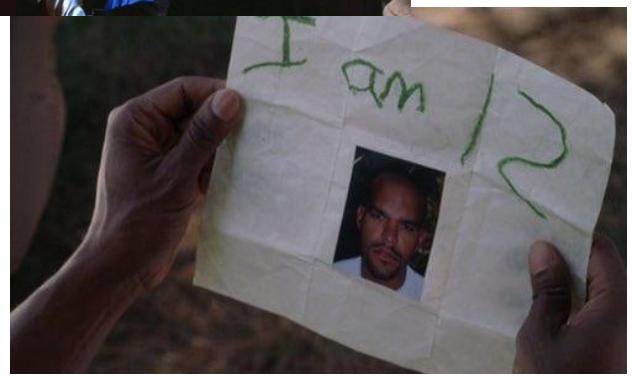
Trust as little as possible







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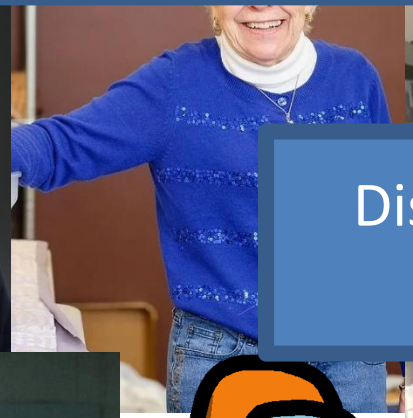
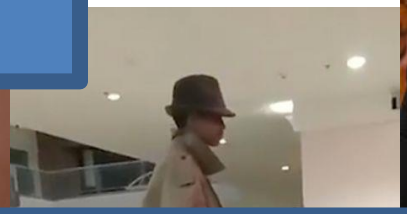
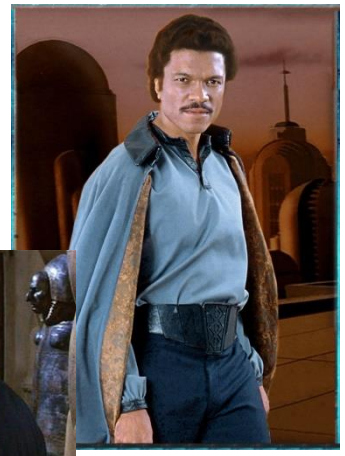
Who do we trust?

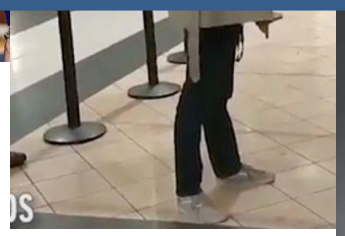
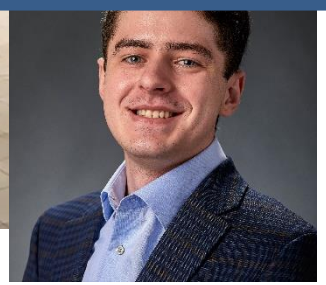
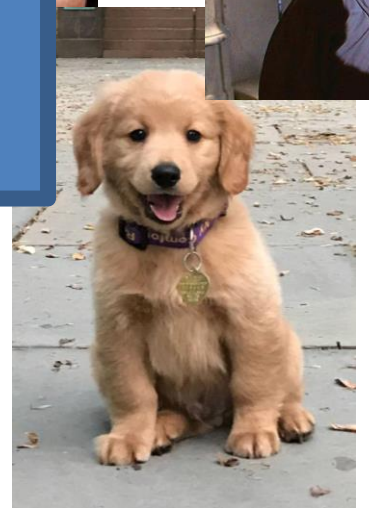
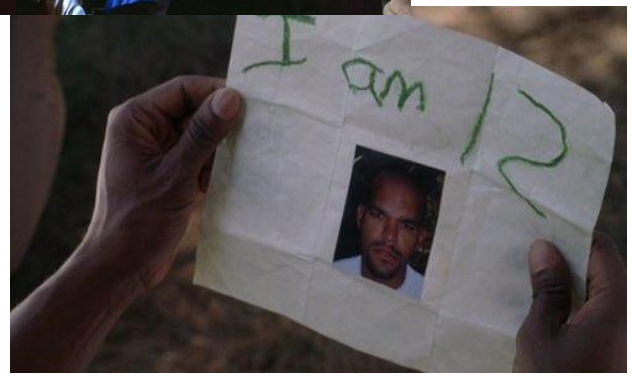
Trust as little as possible

Distrust proportionally to level of risk





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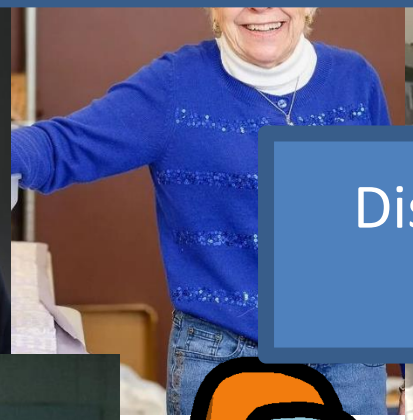
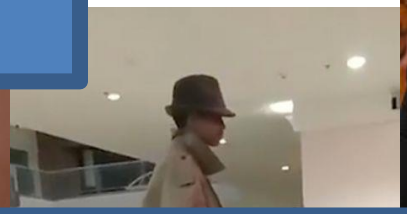
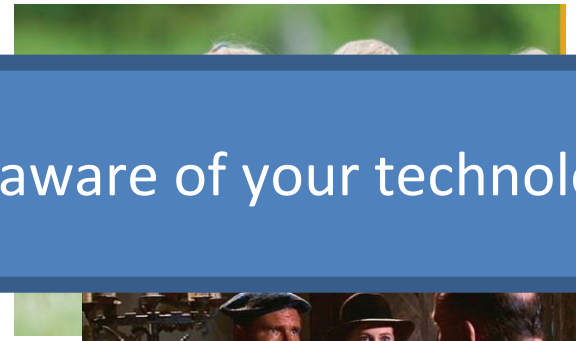
Who do we trust?

Trust as little as possible

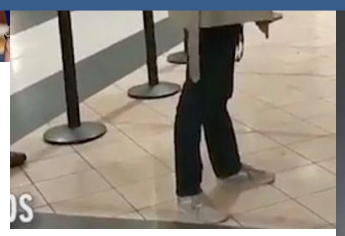
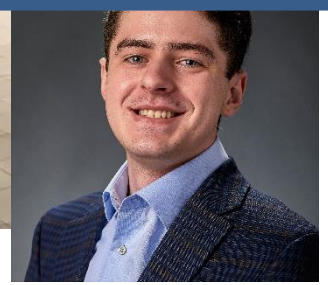
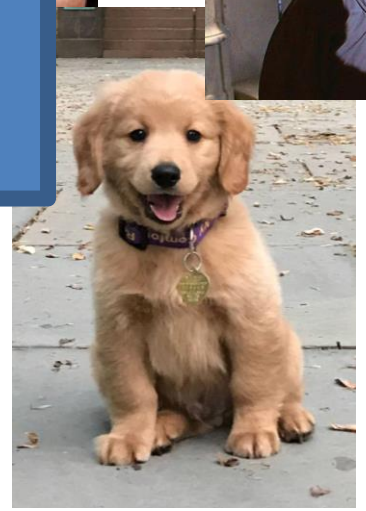
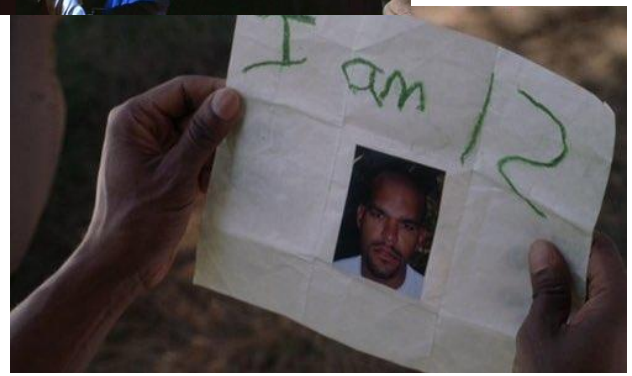
Be aware of your technology

Distrust proportionally to level of risk





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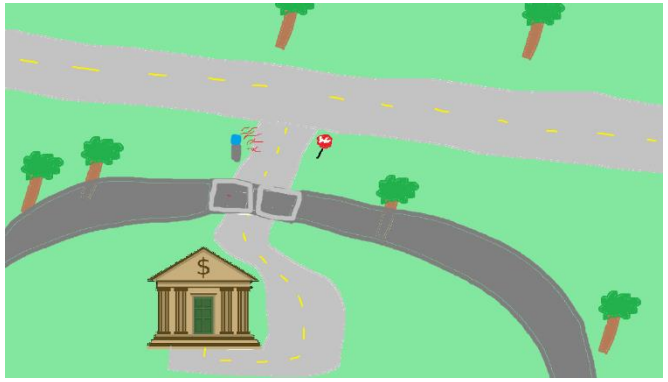

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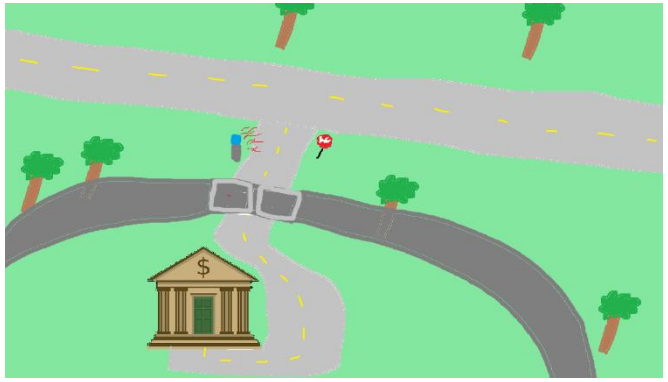
- New **assets**



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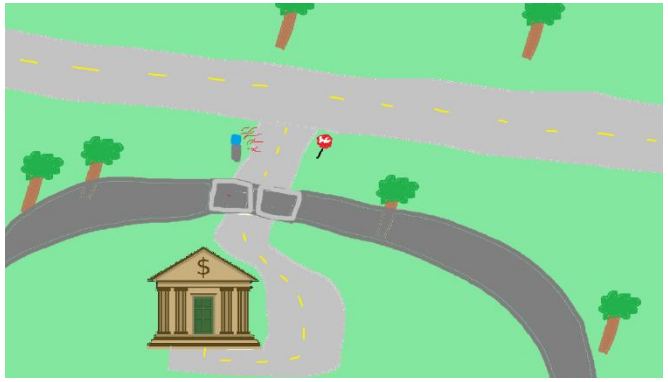

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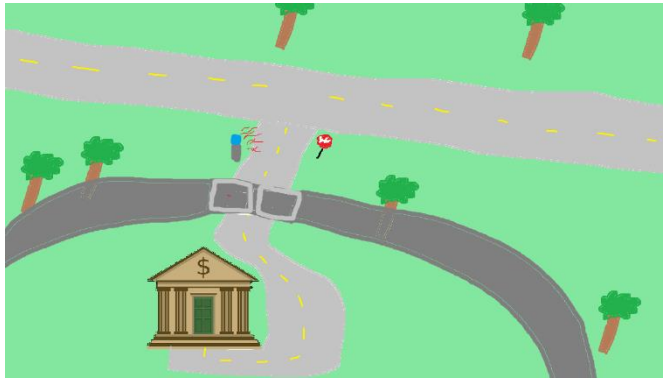

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- New **capabilities**
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Apache LOG4J™

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My goal is to teach you important cybersecurity principles that are universal across any system

Apache LOG4J™

Threat Modeling

You develop a threat model by focusing on five key questions

1. What are you building?
2. What are the assets?
3. What can go wrong? What are the threats?
4. What mechanisms can we implement to prevent things from going wrong?
5. Did you do a decent job of analysis?

Threat Modeling

Brainstorming

1. **Free-form brainstorming-** gather around a whiteboard; enumerate threats/possible defenses
2. **Scenario Analysis-** Propose a scenario and ask “what might go wrong?”
3. **Pre-Mortem**- Assuming a failure or compromise, what do you do next?
4. **Movie plotting** – Pick outrageous ideas; what happens next?
5. **Literature review-** study systems that are similar to yours

Threat Modeling Practice

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You are at a bar, and you hand your phone to a cute person …

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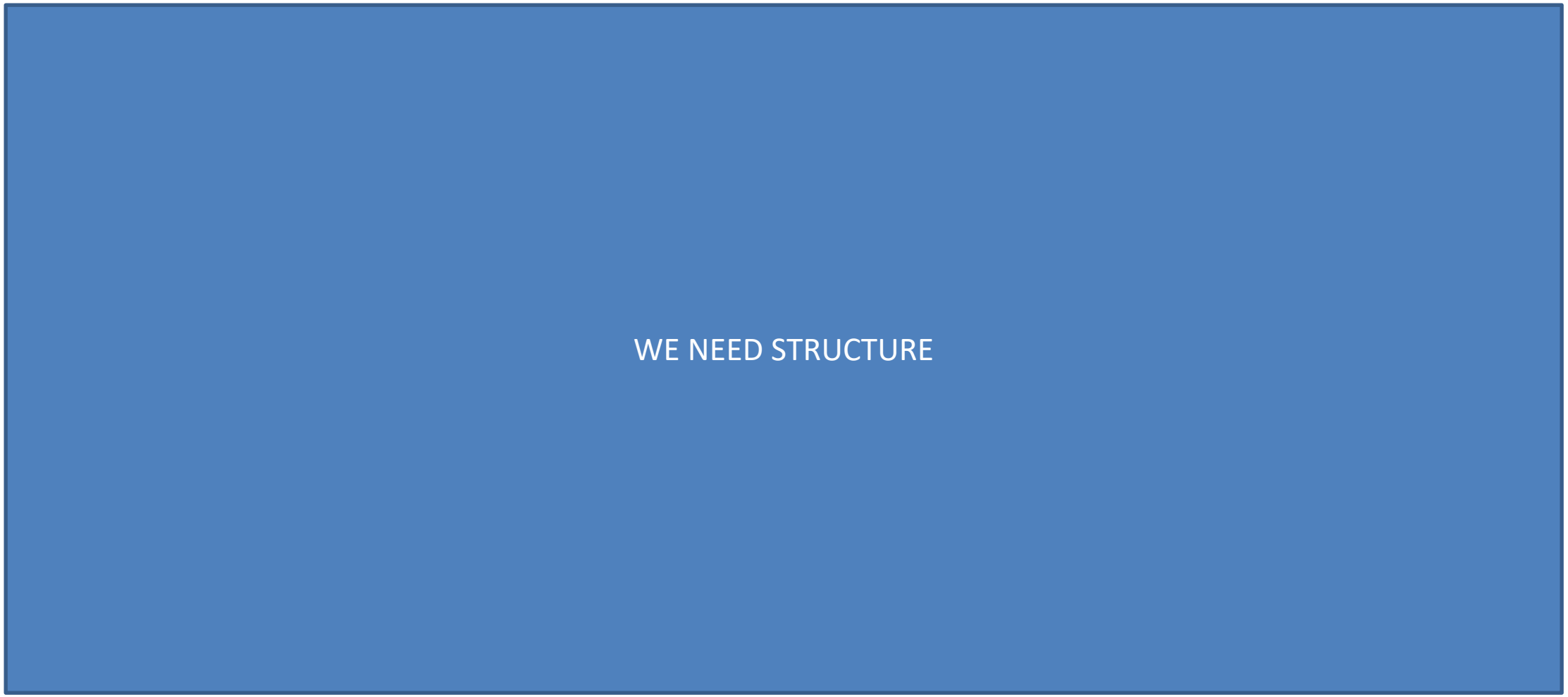
Structured Approaches



- Attack Lists & Libraries (ie. Common and Current vulnerabilities)

There is no “right” choice

Structured Approaches

On the final lab, you will need to use the knowledge you've learned in this class to develop a threat model for some kind of software system

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There is no "right" choice

Structured Approaches

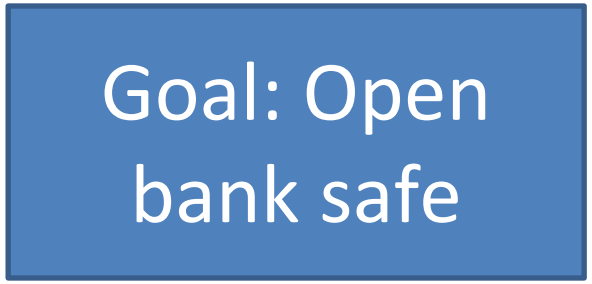
- **Asset-centric**: focus on things of value: things attack want; things you want to protect
- **Attacker-centric**: focus on attackers/archetypes/personas and their capabilities
- **Software-centric**: focus of SW; most SW is backed by structured models (CFG, State diagrams, etc)

Methodologies

- STRIDE
  - **S**poofing, **T**ampering, **R**epudiation, **I**nfo Disclosure, **D**enial of Service, **E**levation of Privilege
    (https://docs.microsoft.com/en-us/azure/security/develop/threat-modeling-tool-threats)
- Attack Trees
- Attack Lists & Libraries (ie. Common and Current vulnerabilities)

There is no “right” choice

Attack Trees



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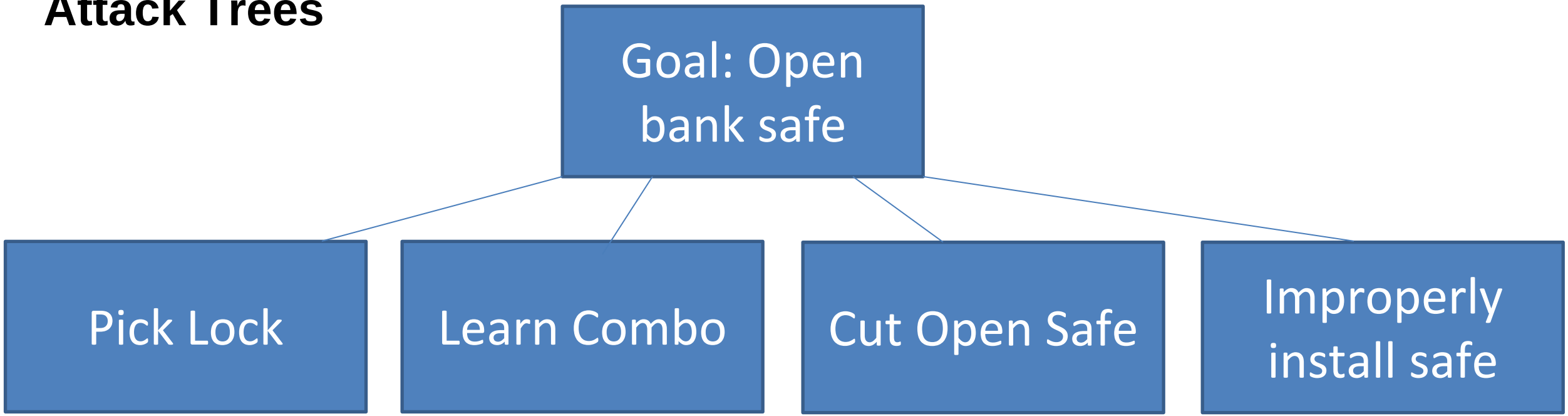

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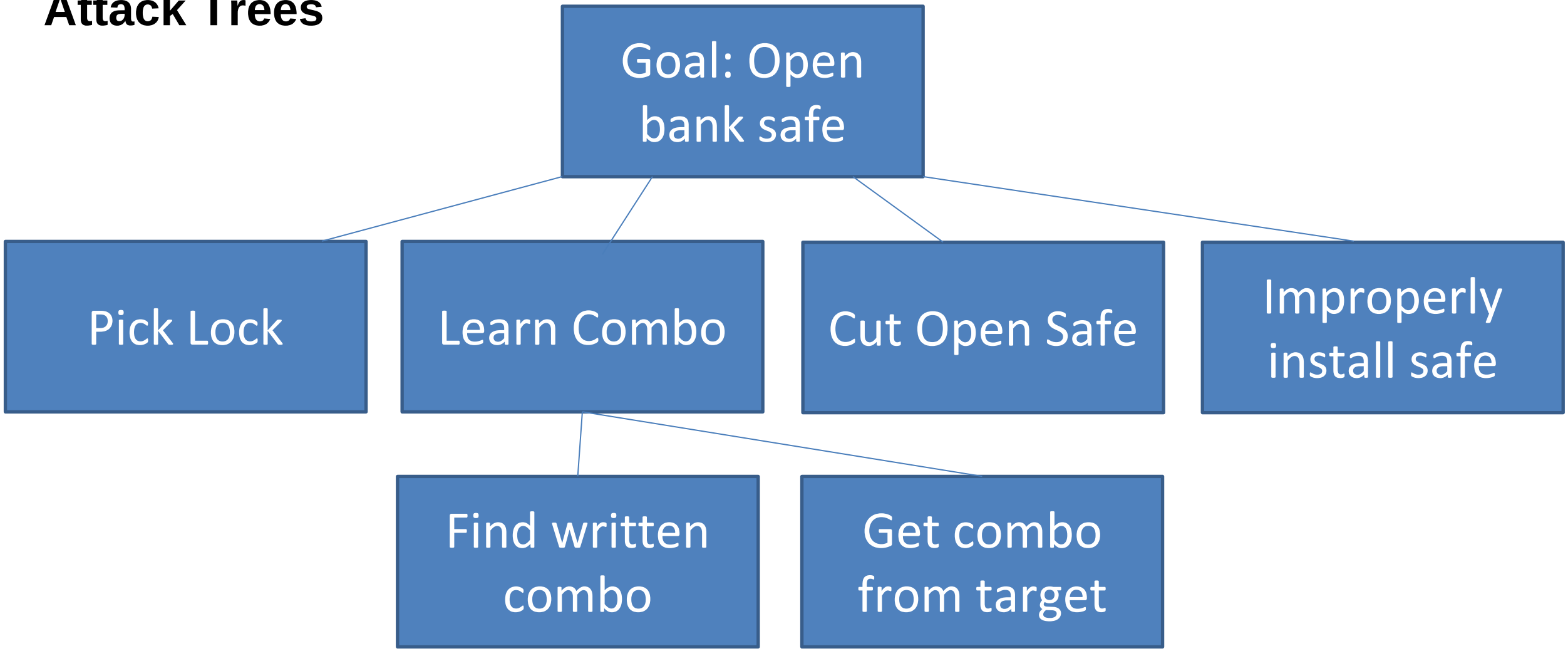
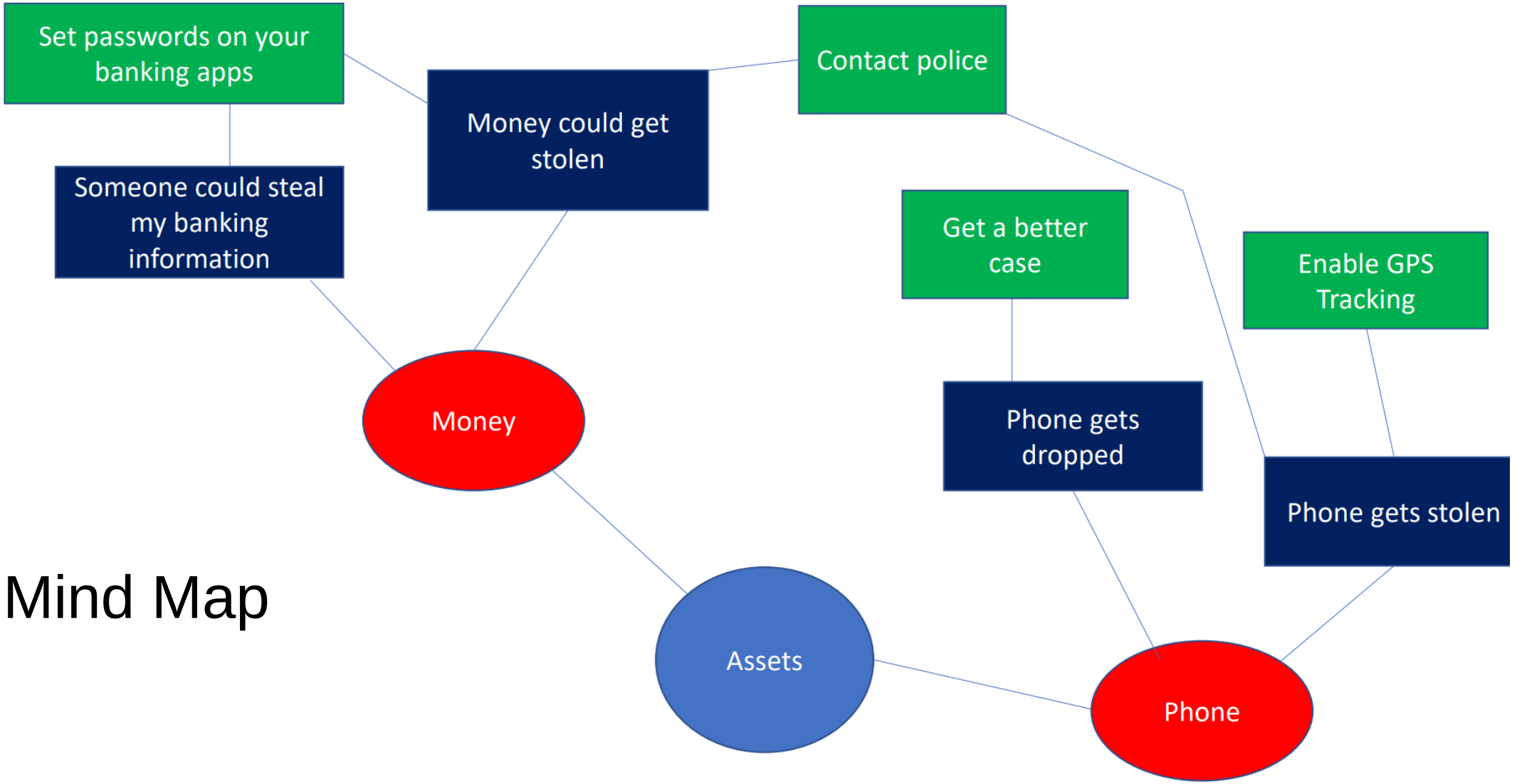


Attack Trees

Mind Map


Set passwords on your banking apps
Someone could steal my banking information
Money could get stolen
Contact police
Get a better case
Enable GPS Tracking
Money
Phone gets dropped
Phone gets stolen
Assets
Phone