Secure Systems Engineering

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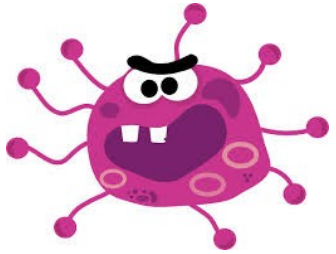
Secure Systems

- Computer systems can be considered a closed box.
- Information in the box is safe as long as nothing enters or leaves the box.

Systems Still Secure

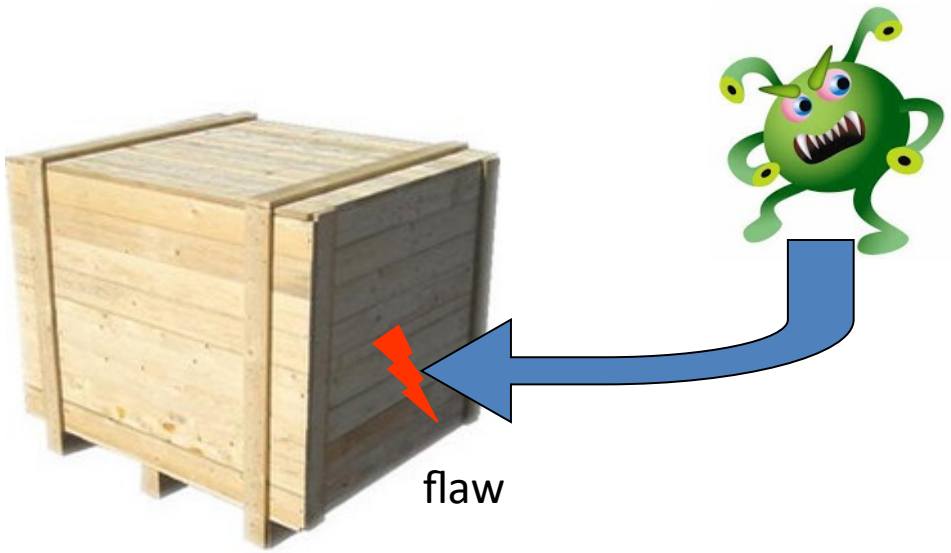
- Even with viruses, worms, and spyware around information is still safe as long as they do not enter the system



Vulnerability

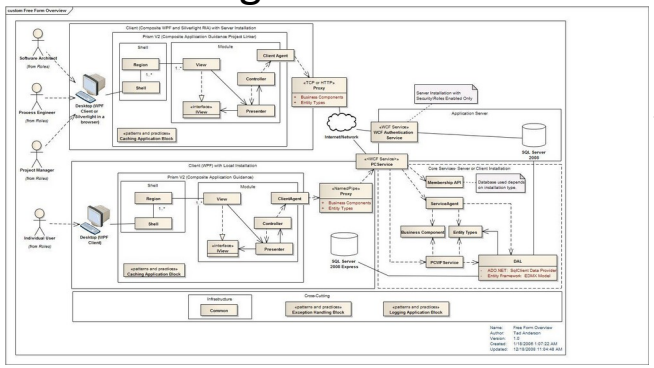
- A flaw that an attacker can use to gain access into the system



Flaws that would allow an attacker access a system

The attacker just needs oneflaw!!!

Design Flaws



Hardware Flaws

flaw

Bugs in the Program

The Human factor

Program Flaws

- In application software
  - SQL Injection
- In system software
  - Buffers overflows and overreads
  - Heap: double free, use after free
  - Integer overflows
  - Format string
- Side Channels Attacks
  - Cache timing attacks
  - Power Analysis Attacks
  - Fault Injection Attacks

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Approach 1: Design flawless systems

eg. SeL4

(Not easy to develop these systems in a large scale)

Static analysis /
Formal Proof Assistant
eg. COQ

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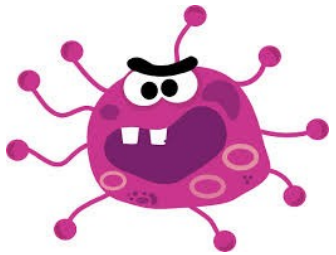
Approach 2: Isolate systems : sandbox environments, virtual machines, trusted execution environments (trusted computing)

Takes care of the human factor as well



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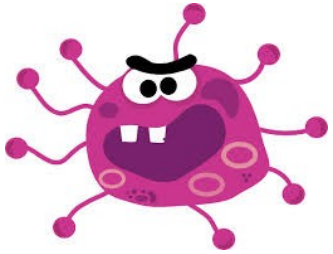
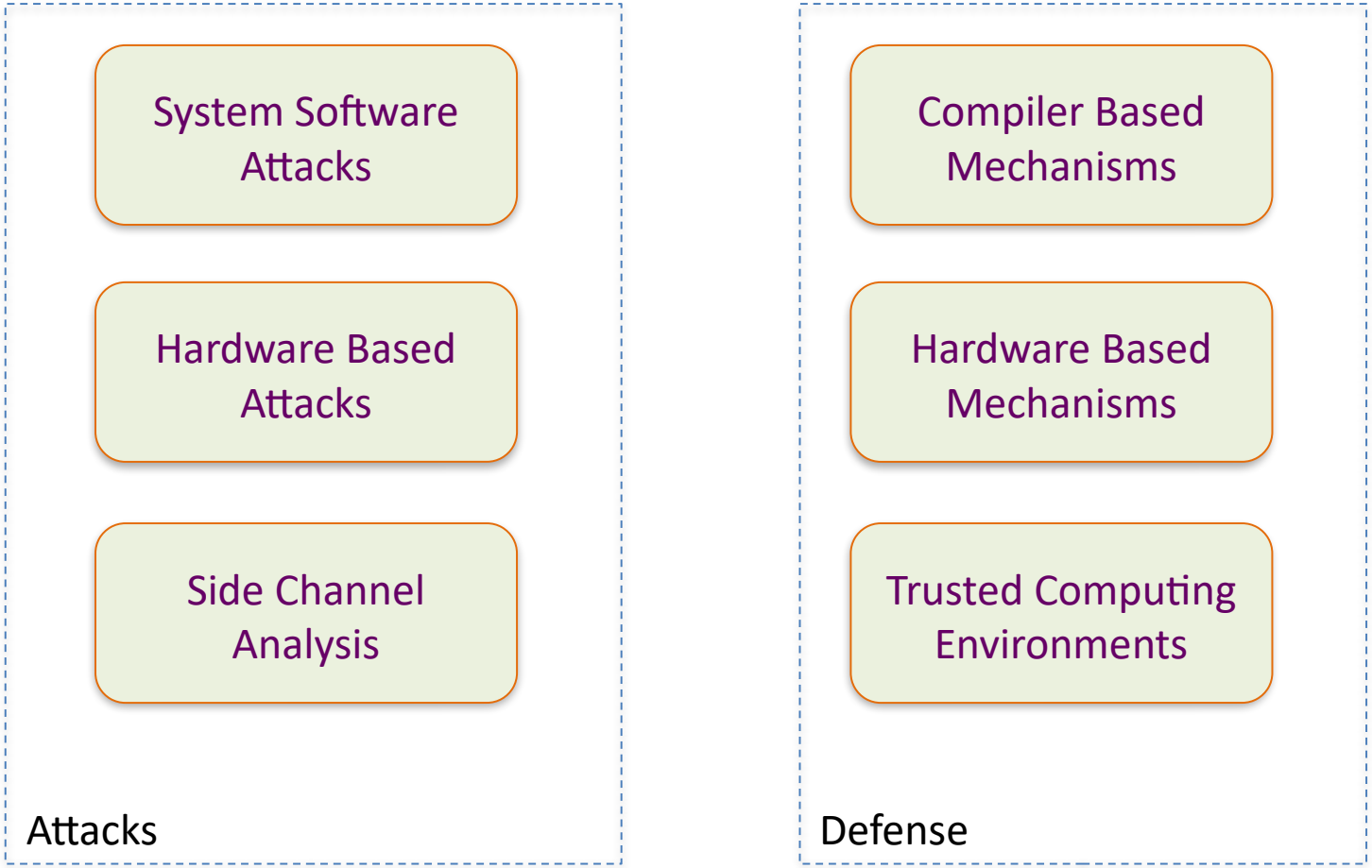
Approach 3: Detect and Mitigate Attacks



Course Structure



What to expect during this course

- Deep study of systems:
  - Software
    - Assembly level
    - Compiler and OS level
  - Hardware
    - Some computer organization features
- Expected Outcomes
  - Understand the internals of malware and other security threats
  - Evaluate security measure applied at the hardware, OS, and compiler
  - Understand trade offs between performance and security

Websites and Communication

- Reference Textbooks

  mostly research papers; will be provided as per topic

- For slides and programming assignments

  https://chetrebeiro@bitbucket.org/casl/sse.git