CS 465
Computer Security

Terminology

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Is This System Secure?

Common question, but the wrong question to ask

Security begins by understanding the attackers and the threats

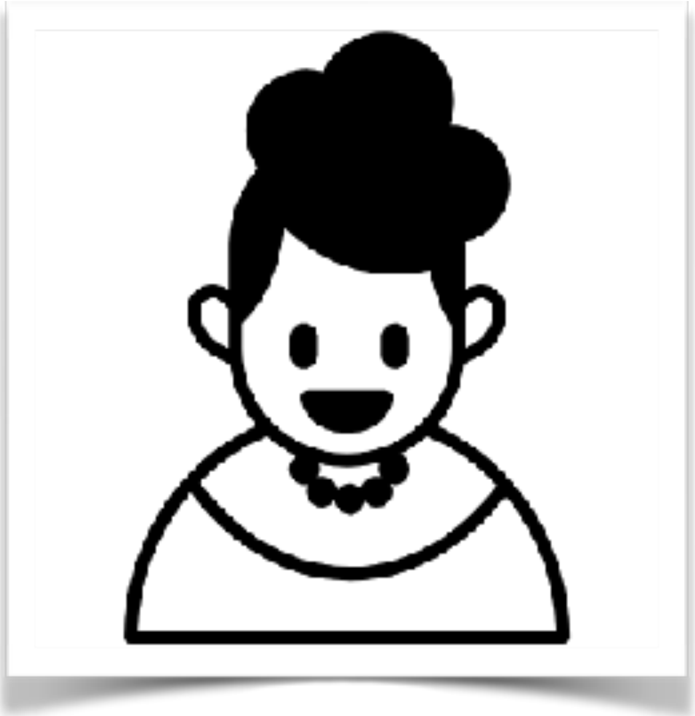
- Secure from whom?
- Secure from what?

Good Guys – Alice and Bob

Traditional names used in the security literature

Alice and Bob attempt to share information

- Exchange secure email or chat messages
- A customer at a website



Bad Guys

Eve

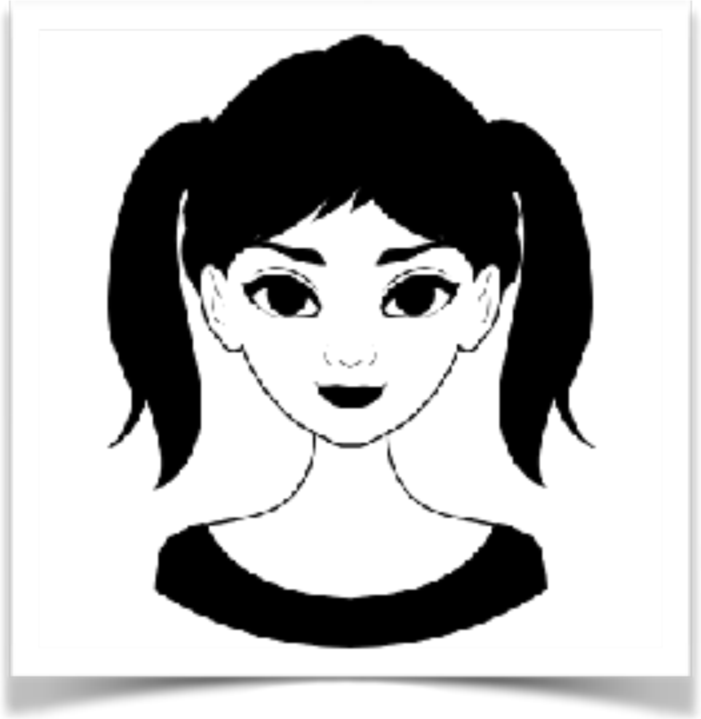
- Eavesdropper – passive attacker

Mallory

- Active attacker

Trudy

- Intruder



What Kinds of Attacks?

- STRIDE Threat Model (Microsoft)
    - **S**poofing user identify
    - **T**ampering
    - **R**epudiation
    - **I**nformation disclosure (privacy breach or data leak)
    - **D**enial of service (DoS)
    - **E**levation of privilege

What Kinds of Defenses?

CIA

Confidentiality

- Prevent unauthorized access to data

Integrity

- Detect unauthorized modification/creation of data

Availability

- Prevent a denial of service attack
- Data is delivered in a reasonable time frame
- System is available when a service is requested

Example: Secure Email

Who are the attackers?

What kind of attacks?

- Confidentiality — eavesdropping, mail server scanning, active attackers (e.g. hacking mail server)
  - End-to-end encryption
- Integrity — changing the content
  - Digital signature
- Availability — DDoS mail server, START/TLS downgrade attack

Threat Model

Decide on the threats that are relevant in a given scenario

Analyze how well the system thwarts those threats

Example

- Email
- Attack
  - Eavesdropping
- Solutions
  - HTTPS
  - End-to-end encryption (S/MIME, PGP)

Access Control

Authentication

- Determining if this is really Alice or Bob

Authorization

- Does the user have authorization to complete a requested action?

Non-repudiation

Prevent the ability to later deny that an action took place

Usually involves cryptographic evidence that will stand up in court

Deniability

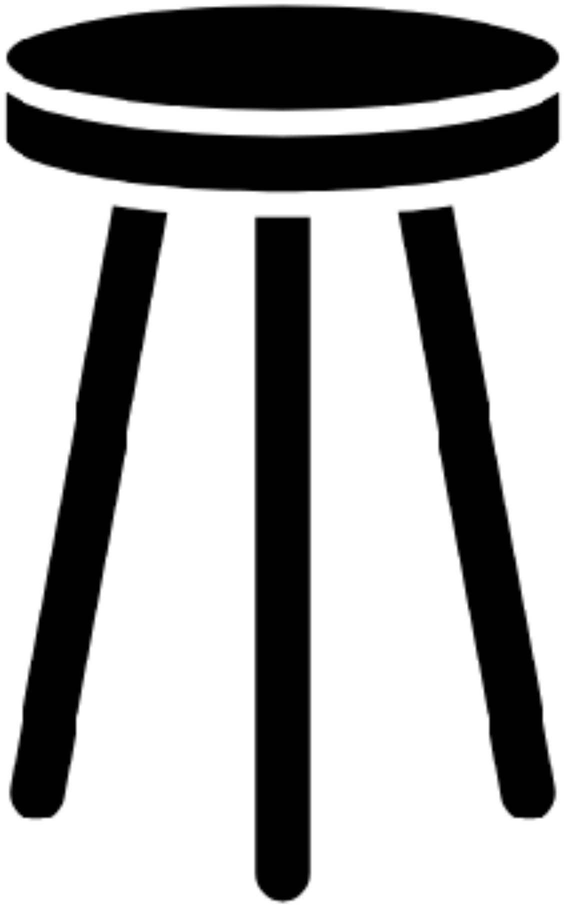
Ability to later deny that an action took place

Three Facets to Security

Prevention

Detection

Reaction



Weakest Link Property

A security system is only as strong as its weakest link

Principle of Least Privilege

A process should have enough permissions to do just what it needs to do and no more

Security Through Obscurity

Reliance on the secrecy of the design or implementation as the main method of providing security for a system or component of a system

Examples

- Key under a rock in the garden
- Obscure URL
- Closed source code with code obfuscation

Related concept: Security Through Minority

- Use an unpopular tool

Attack Trees

An ad-hoc method to reasoning about the threats to a system

Hierarchical tree with the root node as the goal of an attacker

- Child nodes contain all the ways to accomplish the goal of the parent node
- Probability associated with each node