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Information Security: Goals and Enabling Technologies

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Enabling Technical Concepts and Mechanisms

Enabling technical concepts

- Cryptography
- Access control
- Security protocols
- Secure software
- Trust

The Cast of Characters

- Alice and Bob are "honest" players.

- Malory is a generic "intruder".

Bob's Online Bank

- Bob opens Bob's Online Bank (BOB)
- What are Bob's security concerns?
- If Alice is a customer of BOB, what are her security concerns?
- How are Alice and Bob concerns similar? How are they different?
- How does Malory view the situation?

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Confidentiality

- **Confidentiality:** prevent unauthorized disclosure of information
- BOB must prevent Malory from learning Alice's account balance

Integrity

- **Integrity:** prevent unauthorized writing of information
- Malory must not be able to change Alice's account balance
- Alice must not be able to improperly change her own account balance

Availability

- **Availability:** Data is available in a timely manner when needed
- BOB's information must be available when needed
- Alice must be able to make transactions
  - If not, she'll take her business elsewhere

Enabling Technology: cryptography

- How does Bob 's computer know that "Alice" is really Alice and not Malory?
- Alice's password must be verified
  - This requires some clever **cryptography**
- What are security concerns of passwords?
- Are there alternatives to passwords?

Enabling Technology: Protocols

- When Alice logs on, how does BOB know that "Alice" is really Alice?
- Unlike standalone computer case, network security issues arise
- What are network security concerns?
- **Protocols** are critically important and crypto plays an essential role defining these protocols

Enabling Technology: Authentication

Protocols are based on:

- Something you **know** (a PIN, or password).
- Something you **have**:
  - secureID card or other token, generating a one-time password.
  - a key imbedded in a `secure area' on host machine, in browser software, etc.
  - a smartcard (which may have keys imbedded and can perform cryptographic operations on behalf of a user).
- Something identifies **where** you are.
  - IP address
  - GPS
- Something you **are** (a biometric).
  - fingerprints,
  - retinal characteristics

Enabling Technology: *Authorization*

- Once Alice is *authenticated* by BOB, then BOB must restrict actions of Alice
  - Alice can't view Charlie's account info
  - Alice can't install new software, etc.
- Enforcing these restrictions is known as *authorization*
- **Access control** includes both authentication and authorization

Enabling Technology: secure software

- Cryptography, protocols, and access control are implemented in **software**
- What are security issues of software?
  - Most software is complex and buggy
  - Software flaws lead to security flaws
  - How to reduce flaws in software development?

Enabling Technology: Anti-Virus

- Some software is intentionally evil
  - Malware: computer viruses, worms, etc.
- What can Alice and Bob do to protect themselves from malware?
- What can Malory do to make malware more "effective"?

Enabling Technology: Trust?

- Operating systems enforce security
  - For example, authorization
- OS: large and complex software
  - Win XP has 40,000,000 lines of code!
  - Subject to bugs and flaws like any other software
  - Many security issues specific to OSs
- Can you **trust**:
  - An operating system? Hardware chips?
  - How about insiders, administrators or cloud operators?

Enabling Technology: Trust?

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Malware inserted on PC production lines, says study

Cybercriminals have opened a new front in their battle to infect computers with malware - PC production lines.

Several new computers have been found carrying malware installed in the factory, suggests a Microsoft study.

One virus called Nitol found by Microsoft steals personal details to help criminals plunder online bank accounts.

Microsoft discovered four factory fresh PCs that were pre-infected with malware

Microsoft won permission from a US court to tackle the network of hijacked PCs made from Nitol-infected computers.

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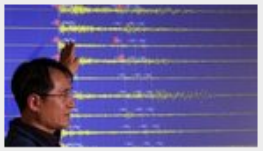

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Think Like Malory

- Good guys must think like bad guys!
- A police detective
  - Must study and understand criminals
- In information security
  - We want to understand Malory's motives
  - We must know Malory's methods
- "It's about time somebody wrote a book to teach the good guys what the bad guys already know." — Bruce Schneier

Key questions

- Which information assets are we trying to protect?
- What are they worth to the business?
- What's the impact if we lost Confidentiality, Integrity or Availability of these?
- How do we mitigate the risk? – which controls
- What's the cost?

Security Journey

- An ongoing dynamic journey – never done must constantly tune program
- Must protect against current known threats as well as preparing for threats not yet.
- Security program must encompass defense in depth
- The cost of protection must align with value of asset
- Tension between security and usability

Investigations

- For each attack case study outlined in the lecture, investigate the following characteristics:
  - Which security goal was violated?
  - Source
  - Target
  - Means
  - Sophistication
  - Impact
- Comment on how the attack could have been avoided?

Questions???