SE 4C03 Winter 2001

01. Information Security

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The Information Age

- Information drives commerce and culture
- Made possible by modern computation and communication technology
- Key infrastructure: **Internet**

A New Landscape

- World Wide Web
  - The Web is becoming a universal library
  - Nearly all **new** public information will be on the Web
- Commerce
  - Information is a major commodity
  - Information systems are a major tool of commerce
- Property
  - Much property is now digital
  - Who owns this property?
- Privacy
  - Privacy is threatened by the new technology
  - Encryption may enable privacy to be preserved

A New Landscape (cont.)

- Risks
  - Much of the economy depends on computer networks and software
  - Many systems of our economy are tied together
- Crime
  - Crime can be perpetrated electronically from a distance
  - National borders are no longer a major obstacle to crime
- Warfare
  - The next war may involve attacks on information systems instead of on military resources
  - Small countries and groups can attack large countries

Information Security

- Concerned with the protection of:
  - Electronically stored and manipulated information
  - The systems used to store and manipulate information
- Growing, dynamic field
  - Has major importance in the information age
  - **Network security** is an important subfield
- Closely related to the problem of software reliability
  - Information systems and security mechanisms are heavily based on software
  - Software is difficult to develop and maintain and very often unreliable

Why is Information Security Unique?

- Concerned with **misuse** instead of **proper use**
- Hard to engineer
  - Involves most components of an information system
  - Information security requirements clash with many other system requirements
  - Cuts across component boundaries and levels of abstraction
- A system is only as secure as its weakest component

What Needs to be Protected?

- Data
  - Privacy
  - Integrity
  - Availability
- Information systems
  - System privacy
  - System integrity
  - Availability of services
  - System resources (disk storage, CPU cycles, etc.)
  - Auditing
- Your personal and organization's reputation

Where do the Threats Come From?

- Software and configuration mistakes
- Hardware failures
- Operational mistakes
- Mobile code and viruses
- Insiders
- Hackers
- Information terrorists
- Natural disasters

What is a Security Policy?

- States what services and behavior are allowed and disallowed
- Prioritizes what is allowed and disallowed
- Specifies how violations will be dealt with
- Should be a written document available to all members of the organization

What is a Security Posture?

- The protective measures that are in place
- Should enforce the chosen security policy
- Includes both:
  - **Security strategies** (e.g., host protection, firewall, access control based on trust, monitor and react)
  - **Security mechanisms** (e.g., password protection, encryption, firewall devices)

Steps for Developing a Security Policy

1. Determine what are the operational and legal requirements of the information system
2. Decide what resources need to be protected
3. Determine what are the threats to these resources
4. Decide what entities will be trusted and to what degree

Note: The information used to develop a security policy should usually not be part of the security policy

Steps for Developing a Security Posture

1. Formulate a security policy
2. Determine what security resources are available
   (a) Financial resources
   (b) Hardware and software
   (c) Personnel
   (d) Outside expertise
3. Design and implement a security posture that satisfies the security policy using the resources above

General Principles

1. Have a **security policy** for the site or organization.
2. Keep the security policy and posture **simple**.
3. Prevent the information and security systems from being **probed**.
4. Give each subject the **least privilege** that is needed for it to perform its task.
5. Employ a **layered and diversified defense**.

General Principles (cont.)

6. Employ **choke points** to narrow the means and place of attack.
7. Make the information and security systems as **failsafe** as possible.
8. Require that all the information systems and all the personnel using them **participate** in the the security strategy.
9. **Monitor** the information and security systems.
10. **Secure the security systems**.

Multilevel Security

- Each subject and object is assigned a security level
- The security levels form a lattice
- **Bell-LaPadula security model**:
  - A subject may not read objects higher than its assigned security level
  - A subject may not write objects lower than its assigned security level
- Information transmitted via **covert channels** is a concern
- The U.S. Department of Defense has spent many millions on this idea