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# Design Principles

CS498SH

Fall 2006

# Reading Material

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- Chapter 13 Computer Security: Art and Science

# Overview

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- **Simplicity**
  - Less to go wrong
  - Fewer possible inconsistencies
  - Easy to understand
- **Restriction**
  - Minimize access
  - Inhibit communication

# Economy of Mechanism

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- *Keep the design as simple and small as possible*
- Simpler means less can go wrong
  - And when errors occur, they are easier to understand and fix
- Interfaces and interactions

# Fail-Safe Defaults

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- *Base access decisions on permission rather than exclusion*
- Burden of proof is on the principal seeking permission
- If the protection system fails, then legitimate access is denied but illegitimate access is also denied

# Complete Mediation

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- *Every access to every object must be checked for authority*
- Usually done once, on first action
  - UNIX: access checked on open, not checked thereafter
- If permissions change after, may get unauthorized access
- Proposals to gain performance by remembering the result of an authority check should be examined skeptically

# Open Design

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- *The design should not be secret*
- Do not depend on secrecy of design or implementation
  - Popularly misunderstood to mean that source code should be public
  - “Security through obscurity”
  - Does not apply to information such as passwords or cryptographic keys

# Separation of Privilege

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- *Where feasible, a protection mechanism that requires two keys to unlock it is more robust and flexible than one that allows access to the presenter of only a single key.*
- Require multiple conditions to grant privilege
  - Separation of duty
  - Defense in depth

# Least Privilege

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- *Every program and every user of the system should operate using the least set of privileges necessary to complete the job*
- A subject should be given only those privileges necessary to complete its task
  - Function, not identity, controls
  - Rights added as needed, discarded after use
  - Minimal protection domain

# Least Common Mechanism

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- *Minimize the amount of mechanism common to more than one user and depended on by all users*
- Mechanisms should not be shared
  - Information can flow along shared channels
  - Covert channels
- Isolation
  - Virtual machines
  - Sandboxes

# Psychological Acceptability

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- *It is essential that the human interface be designed for ease of use so that users routinely and automatically accept the protection mechanisms correctly*
- Security mechanisms should not add to difficulty of accessing resource
  - Hide complexity introduced by security mechanisms
  - Ease of installation, configuration, use
  - Human factors critical here

# Examine Scenarios

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- Paper overhead

# Key Points

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- Principles of secure design underlie all security-related mechanisms
- Require:
  - Good understanding of goal of mechanism and environment in which it is to be used
  - Careful analysis and design
  - Careful implementation