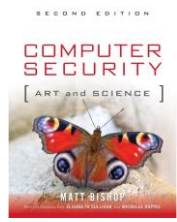
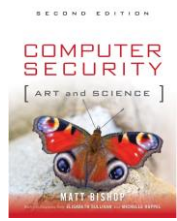


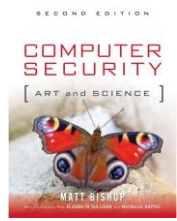
Design Principles

Chapter 14



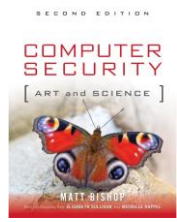
Overview

- Simplicity, restriction
- Principles
  - Least Privilege
  - Fail-Safe Defaults
  - Economy of Mechanism
  - Complete Mediation
  - Open Design
  - Separation of Privilege
  - Least Common Mechanism
  - Least Astonishment



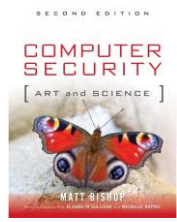
Overview

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



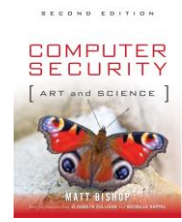
Chapter 14: Design Principles

- Overview
- Principles
  - Least Privilege
  - Fail-Safe Defaults
  - Economy of Mechanism
  - Complete Mediation
  - Open Design
  - Separation of Privilege
  - Least Common Mechanism
  - Least Astonishment



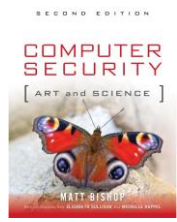
Least Privilege

- 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



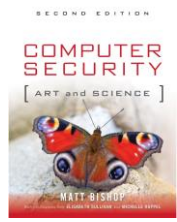
Related: Least Authority

- Principle of Least Authority (POLA)
  - Often considered the same as Principle of Least Privilege
  - Some make distinction:
    - *Permissions* control what subject can do to an object directly
    - *Authority* controls what influence a subject has over an object (directly or indirectly, through other subjects)



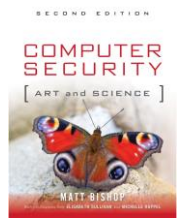
Fail-Safe Defaults

- Default action is to deny access
- If action fails, system as secure as when action began



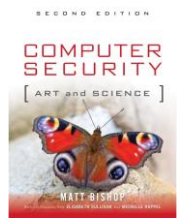
Economy of Mechanism

- Keep it as simple as possible
  - KISS Principle
- Simpler means less can go wrong
  - And when errors occur, they are easier to understand and fix
- Interfaces and interactions



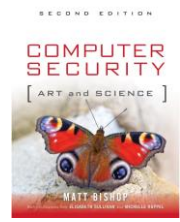
Complete Mediation

- Check every access
- Usually done once, on first action
  - UNIX: access checked on open, not checked thereafter
- If permissions change after, may get unauthorized access



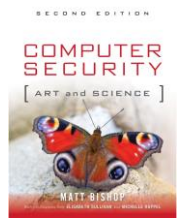
Open Design

- Security should 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



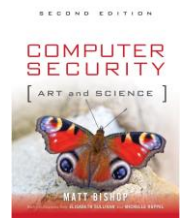
Separation of Privilege

- Require multiple conditions to grant privilege
  - Separation of duty
  - Defense in depth



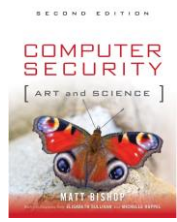
Least Common Mechanism

- Mechanisms should not be shared
  - Information can flow along shared channels
  - Covert channels
- Isolation
  - Virtual machines
  - Sandboxes



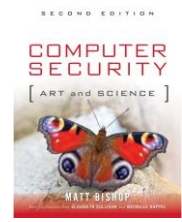
Least Astonishment

- Security mechanisms should be designed so users understand why the mechanism works the way it does, and using mechanism is simple
  - Hide complexity introduced by security mechanisms
  - Ease of installation, configuration, use
  - Human factors critical here



Related: Psychological Acceptability

- Security mechanisms should not add to difficulty of accessing resource
  - Idealistic, as most mechanisms add *some* difficulty
    - Even if only remembering a password
  - Principle of Least Astonishment accepts this
    - Asks whether the difficulty is unexpected or too much for relevant population of users



Key Points

- 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