

Announcements

- Project Proposal Presentations: Sept 13th and 15th
- Project Updates: Oct 18th and 20th
- Final Presentations and Demos: TBD (Plan for about last 2 weeks of semester)

Comic thanks to Cartoon stock

Assignment #1: Due on 6th Sept, Midnight

CS172683





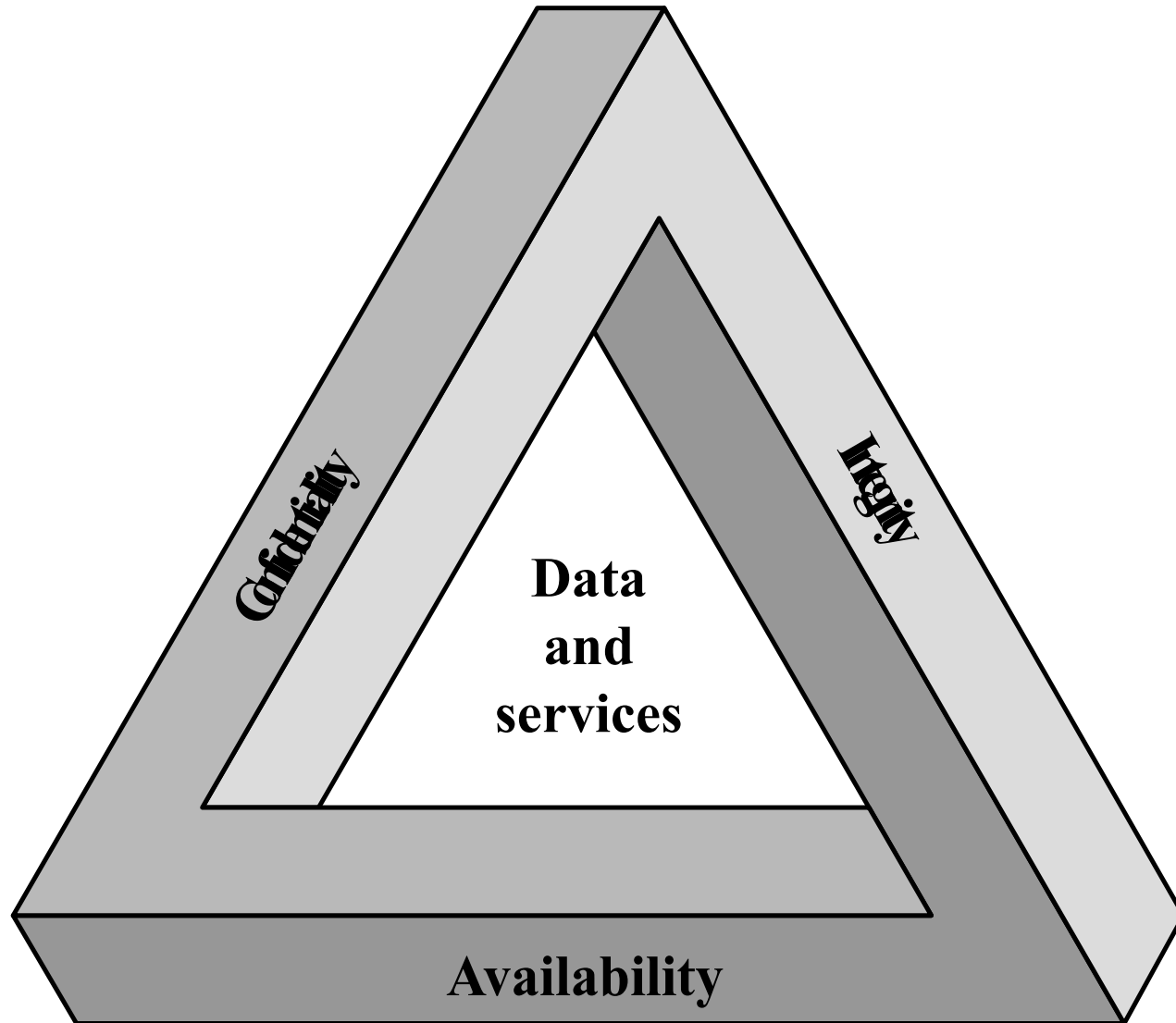
Chapter 1

Overview

The NIST Computer Security Handbook defines the term Computer Security as:

“The protection afforded to an automated information system in order to attain the applicable objectives of preserving the integrity, availability and confidentiality of information system resources” (includes hardware, software, firmware, information/data, and telecommunications).

The CIA Triad



Key Security Concepts

Confidentiality

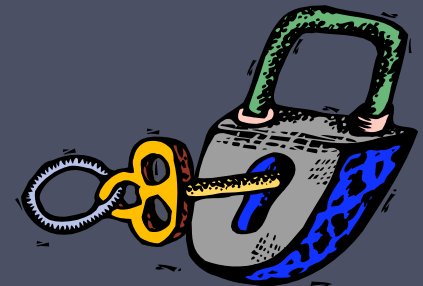
- Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information

Integrity

- Guarding against improper information modification or destruction, including ensuring information nonrepudiation and authenticity

Availability

- Ensuring timely and reliable access to and use of information



Adversary (threat agent)

An entity that attacks, or is a threat to, a system.

Attack

An assault on system security that derives from an intelligent threat; that is, an intelligent act that is a deliberate attempt (especially in the sense of a method or technique) to evade security services and violate the security policy of a system.

Countermeasure

An action, device, procedure, or technique that reduces a threat, a vulnerability, or an attack by eliminating or preventing it, by minimizing the harm it can cause, or by discovering and reporting it so that corrective action can be taken.

Risk

An expectation of loss expressed as the probability that a particular threat will exploit a particular vulnerability with a particular harmful result.

Security Policy

A set of rules and practices that specify or regulate how a system or organization provides security services to protect sensitive and critical system resources.

System Resource (Asset)

Data contained in an information system; or a service provided by a system; or a system capability, such as processing power or communication bandwidth; or an item of system equipment (i.e., a system component--hardware, firmware, software, or documentation); or a facility that houses system operations and equipment.

Threat

A potential for violation of security, which exists when there is a circumstance, capability, action, or event that could breach security and cause harm. That is, a threat is a possible danger that might exploit a vulnerability.

Vulnerability

A flaw or weakness in a system's design, implementation, or operation and management that could be exploited to violate the system's security policy.

Table 1.1

Computer Security Terminology

RFC 4949, *Internet*

Security Glossary,

May 2000



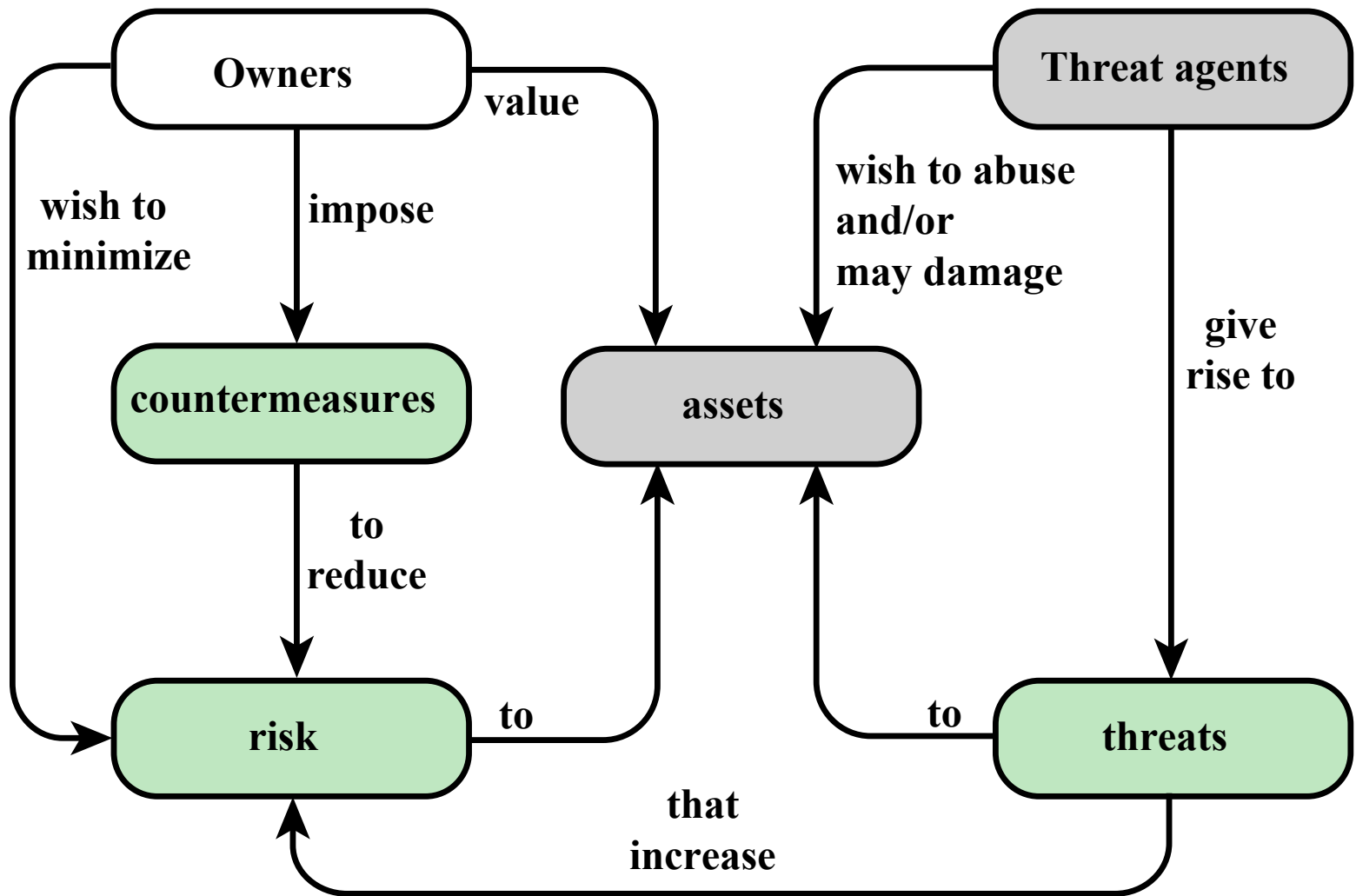
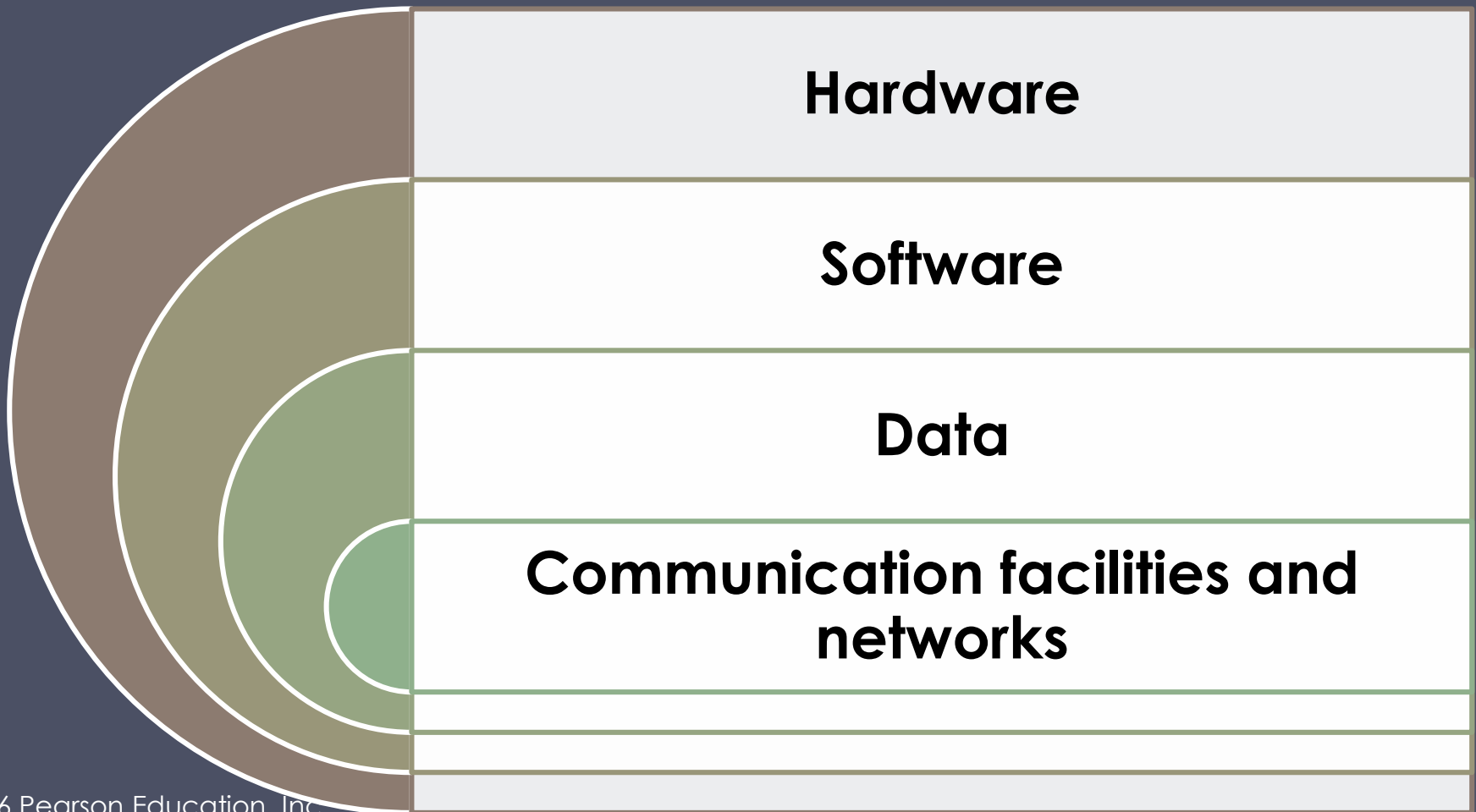


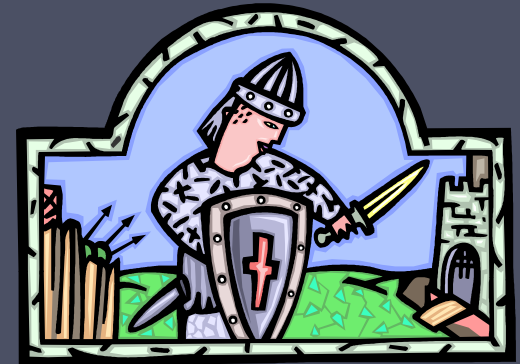
Figure 1.1 Security Concepts and Relationships

Assets of a Computer System

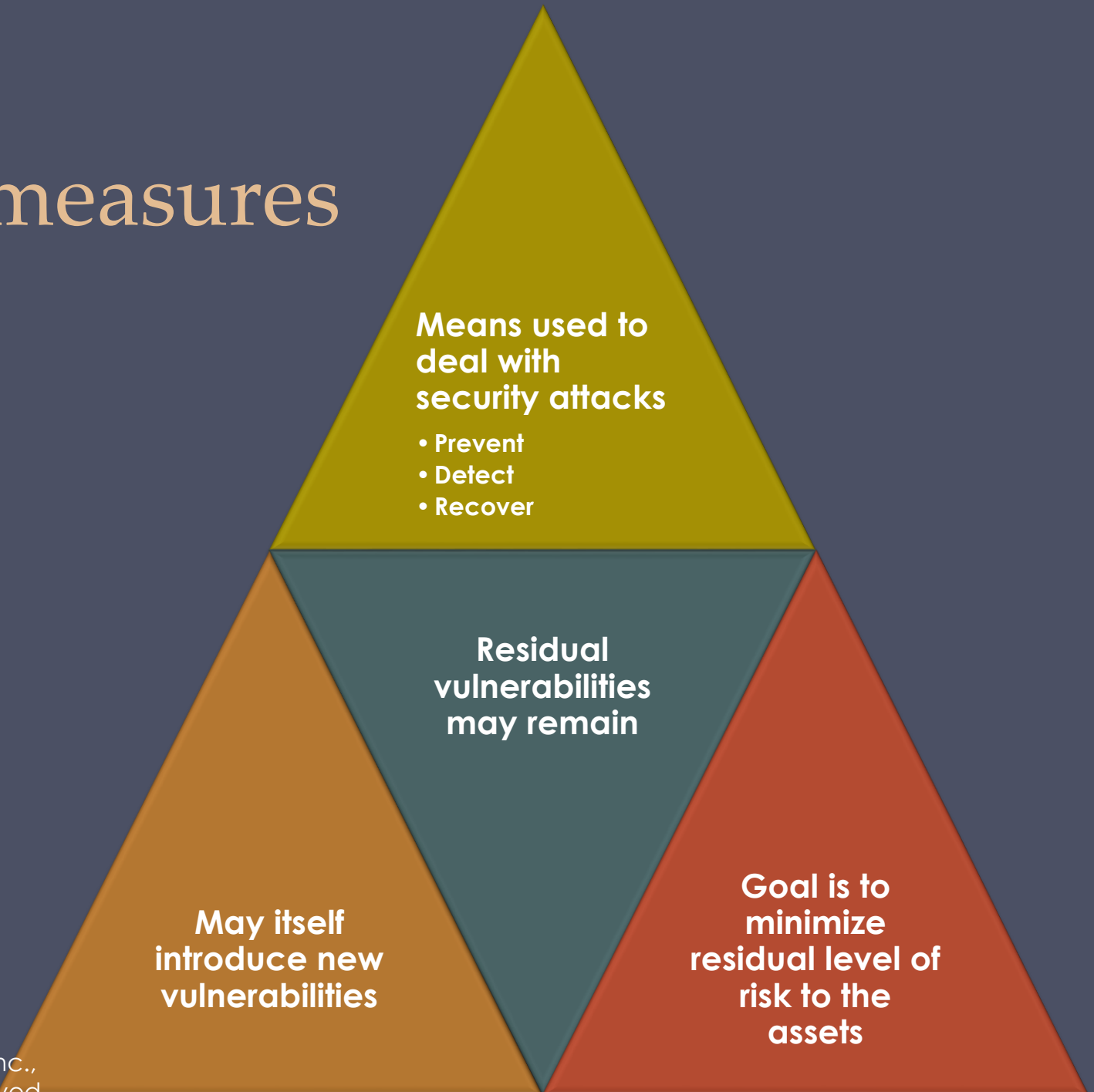


Vulnerabilities, Threats and Attacks

- Categories of vulnerabilities
 - Can be corrupted (loss of integrity)
 - Can become leaky (loss of confidentiality)
 - Can become unavailable or very slow
- Threats
 - Capable of exploiting vulnerabilities
 - Represent potential security harm to an asset
- Attacks (threats carried out)
 - Passive – attempt to learn or make use of information from the system that does not affect system resources
 - Active – attempt to alter system resources or affect their operation
 - Insider – initiated by an entity inside the security parameter
 - Outsider – initiated from outside the perimeter



Countermeasures



Threat Consequence	Threat Action (Attack)
Unauthorized Disclosure A circumstance or event whereby an entity gains access to data for which the entity is not authorized.	Exposure: Sensitive data are directly released to an unauthorized entity. Interception: An unauthorized entity directly accesses sensitive data traveling between authorized sources and destinations. Inference: A threat action whereby an unauthorized entity indirectly accesses sensitive data (but not necessarily the data contained in the communication) by reasoning from characteristics or byproducts of communications. Intrusion: An unauthorized entity gains access to sensitive data by circumventing a system's security protections.
Deception A circumstance or event that may result in an authorized entity receiving false data and believing it to be true.	Masquerade: An unauthorized entity gains access to a system or performs a malicious act by posing as an authorized entity. Falsification: False data deceive an authorized entity. Repudiation: An entity deceives another by falsely denying responsibility for an act.
Disruption A circumstance or event that interrupts or prevents the correct operation of system services and functions.	Incapacitation: Prevents or interrupts system operation by disabling a system component. Corruption: Undesirably alters system operation by adversely modifying system functions or data. Obstruction: A threat action that interrupts delivery of system services by hindering system operation.
Usurpation A circumstance or event that results in control of system services or functions by an unauthorized entity.	Misappropriation: An entity assumes unauthorized logical or physical control of a system resource. Misuse: Causes a system component to perform a function or service that is detrimental to system security.

Table 1.2

Threat
Consequences,
and the
Types of
Threat Actions
That Cause
Each
Consequence

Based on
RFC 4949

Table 1.3

Computer and Network Assets, with Examples of Threats

	Availability	Confidentiality	Integrity
Hardware	Equipment is stolen or disabled, thus denying service.	An unencrypted CD-ROM or DVD is stolen.	
Software	Programs are deleted, denying access to users.	An unauthorized copy of software is made.	A working program is modified, either to cause it to fail during execution or to cause it to do some unintended task.
Data	Files are deleted, denying access to users.	An unauthorized read of data is performed. An analysis of statistical data reveals underlying data.	Existing files are modified or new files are fabricated.
Communication Lines and Networks	Messages are destroyed or deleted. Communication lines or networks are rendered unavailable.	Messages are read. The traffic pattern of messages is observed.	Messages are modified, delayed, reordered, or duplicated. False messages are fabricated.



Passive and Active Attacks

Passive Attack

- Attempts to learn or make use of information from the system but does not affect system resources
- Eavesdropping on, or monitoring of, transmissions
- Goal of attacker is to obtain information that is being transmitted
- Two types:
 - Release of message contents
 - Traffic analysis

Active Attack

- Attempts to alter system resources or affect their operation
- Involve some modification of the data stream or the creation of a false stream
- Four examples:
 - Replay
 - Masquerade
 - Modification of messages
 - Denial of service

Fundamental Security Design Principles

- Economy of mechanism
- Fail-safe defaults
- Open design
- Separation of privilege
- Least privilege
- Psychological acceptability
- Isolation
- Encapsulation
- Layering

Attack Surfaces

Sum-total of all the points of access that an unauthorized person could use to enter the system

Examples:

Services available on the inside of a firewall

Code that processes incoming data, email, XML, office documents, and industry-specific custom data exchange formats

Interfaces, SQL, and Web forms

An employee with access to sensitive information vulnerable to a social engineering attack

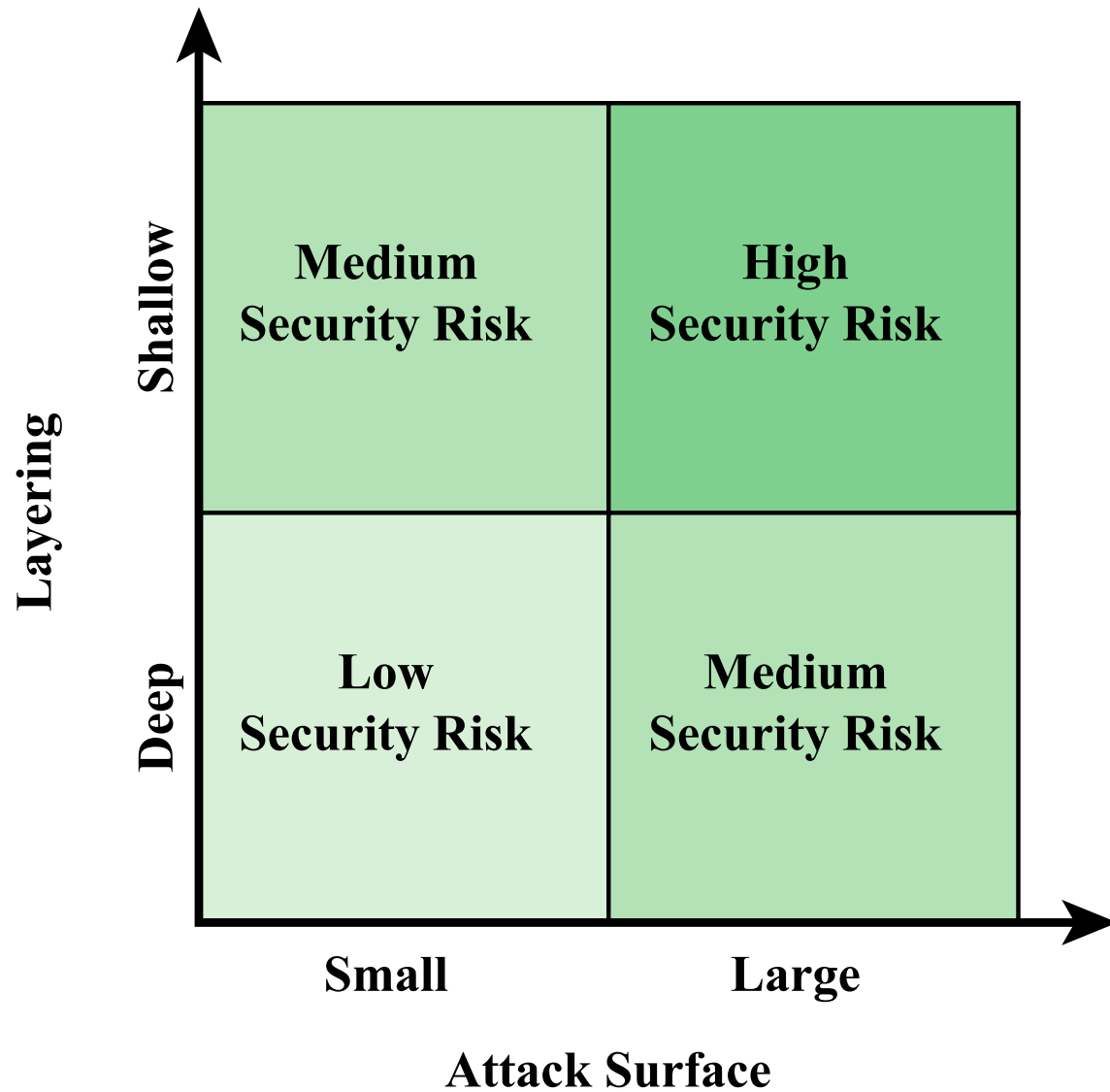
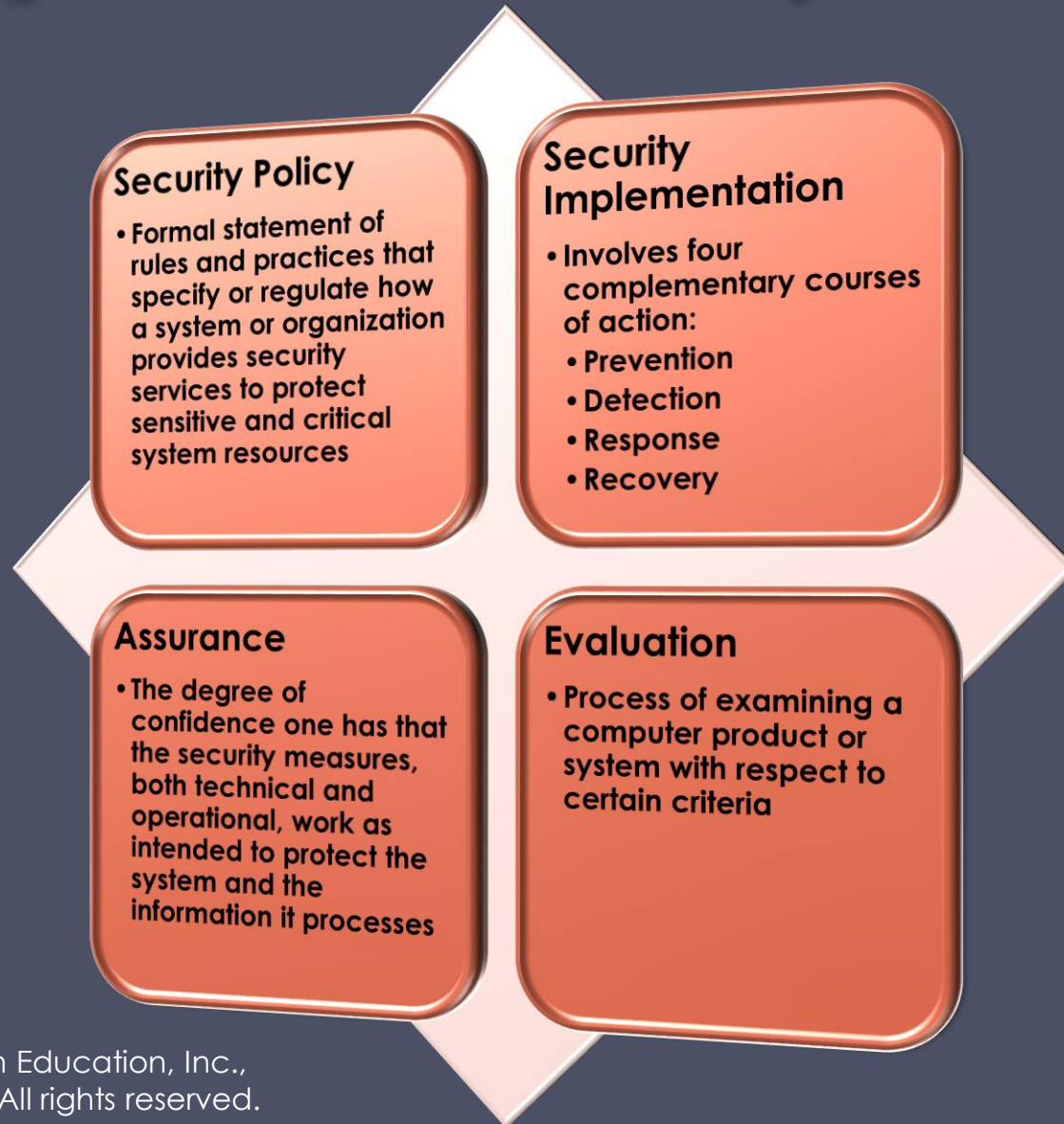


Figure 1.3 Defense in Depth and Attack Surface

Computer Security Strategy



Consider the following general code for allowing access to a resource:

```
DWORD dwRet = IsAccessAllowed(...);  
if (dwRet == ERROR_ACCESS_DENIED) {  
    // Security check failed.  
    // Inform user that access is denied.  
} else {  
    // Security check OK.  
}
```

- a. Explain the security flaw in this program.
- b. Rewrite the code to avoid the flaw

Hint: Consider the design principle of fail-safe defaults.