Introduction to Information Security

Objectives

- Understand the definition of information security
- Comprehend the history of computer security and how it evolved into information security
- Understand the key terms and concepts of information security
- Outline the phases of the security systems development life cycle
- Understand the roles of professionals involved in information security within an organization

Introduction

- Information security: a “well-informed sense of assurance that the information risks and controls are in balance.” —Jim Anderson, Inovant (2002)

The History of Information Security

- Began immediately after the first mainframes were developed
- Groups developing code-breaking computations during World War II created the first modern computers
- Physical controls to limit access to sensitive military locations to authorized personnel
- Rudimentary in defending against physical theft, espionage, and sabotage

The 1960s

- Advanced Research Procurement Agency (ARPA) began to examine feasibility of redundant networked communications

- Larry Roberts developed ARPANET from its inception

The 1970s and 80s

- ARPANET grew in popularity as did its potential for misuse
- Fundamental problems with ARPANET security were identified
  - No safety procedures for dial-up connections to ARPANET
  - Non-existent user identification and authorization to system
- Late 1970s: microprocessor expanded computing capabilities and security threats

R-609

- Information security began with Rand Report R-609 (paper that started the study of computer security)
- Scope of computer security grew from physical security to include:
  - Safety of data
  - Limiting unauthorized access to data
  - Involvement of personnel from multiple levels of an organization

The 1990s

- Networks of computers became more common; so too did the need to interconnect networks

- Internet became first manifestation of a global network of networks

- In early Internet deployments, security was treated as a low priority

The Present

- The Internet brings millions of computer networks into communication with each other—many of them unsecured

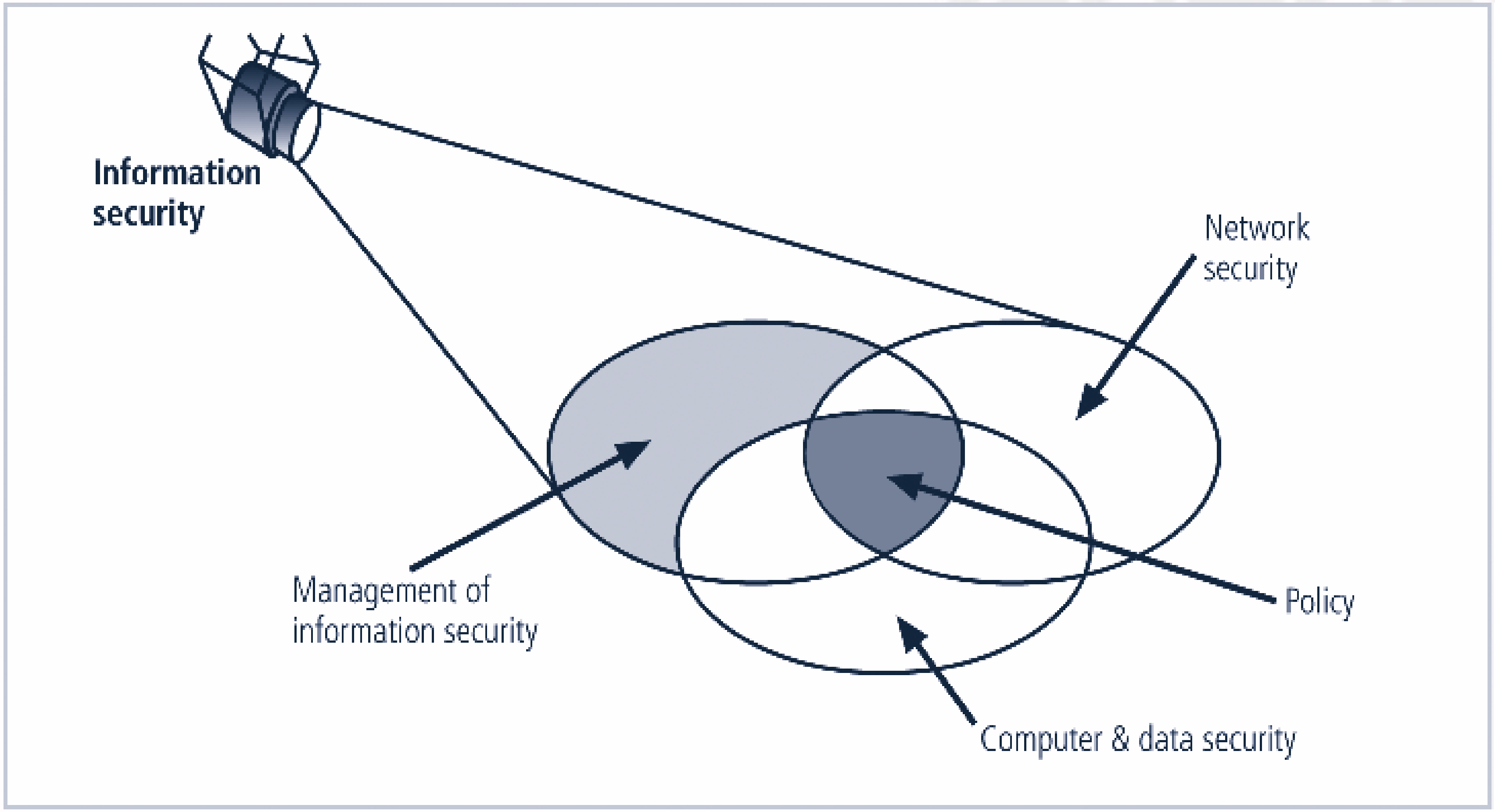
- Ability to secure a computer's data influenced by the security of every computer to which it is connected

What is Security?

- “The quality or state of being secure—to be free from danger”
- A successful organization should have multiple layers of security in place:
  - Physical security
  - Personal security
  - Operations security
  - Communications security
  - Network security
  - Information security

What is Information Security?

- The protection of information and its critical elements, including systems and hardware that use, store, and transmit that information
- Necessary tools: policy, awareness, training, education, technology
- C.I.A. triangle was standard based on confidentiality, integrity, and availability
- C.I.A. triangle now expanded into list of critical characteristics of information

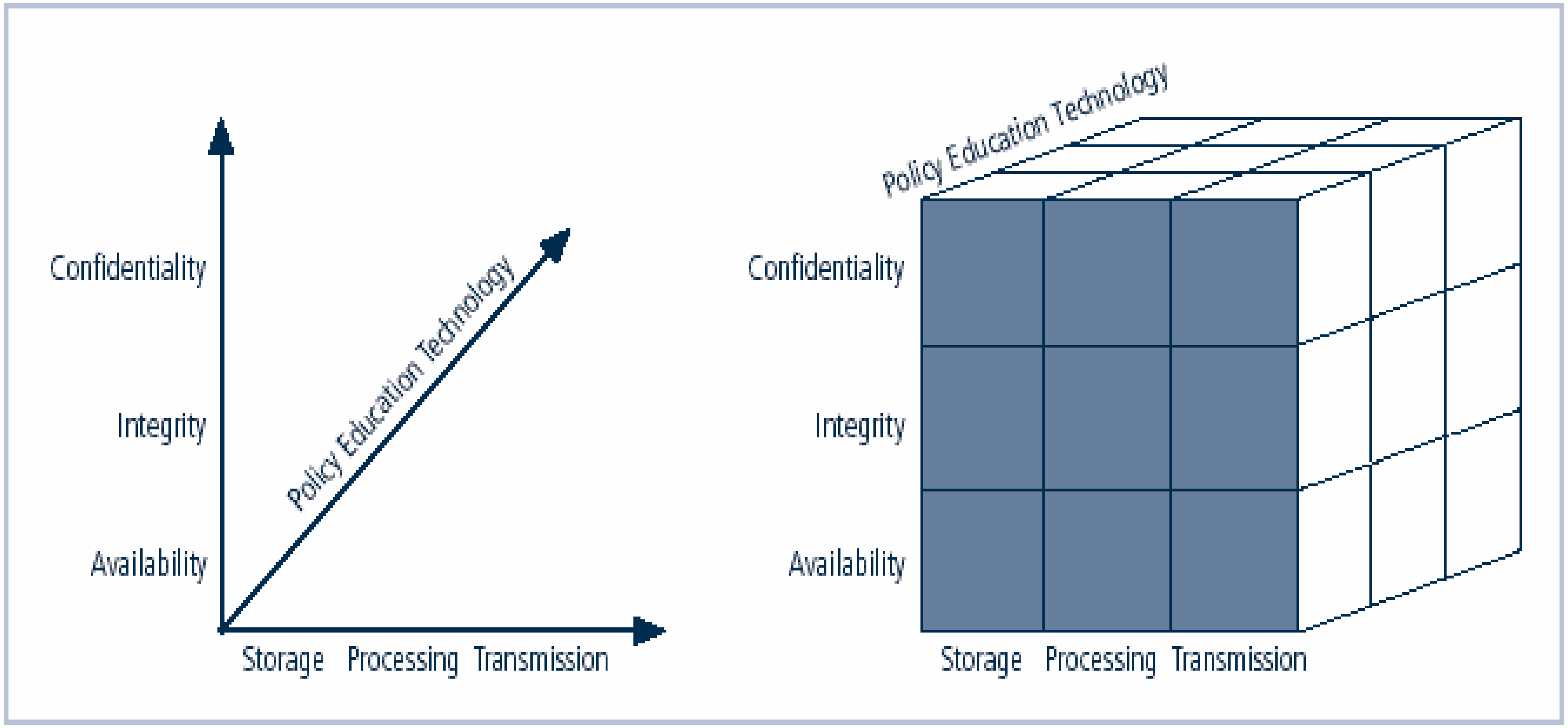


Components of Information Security

Critical Characteristics of Information

- The value of information comes from the characteristics it possesses:
  - Availability
  - Accuracy
  - Authenticity
  - Confidentiality
  - Integrity
  - Utility
  - Possession

National Security Telecommunications and Information Systems Security Committee (NSTISSC) Security Model



NSTISSC Security Model

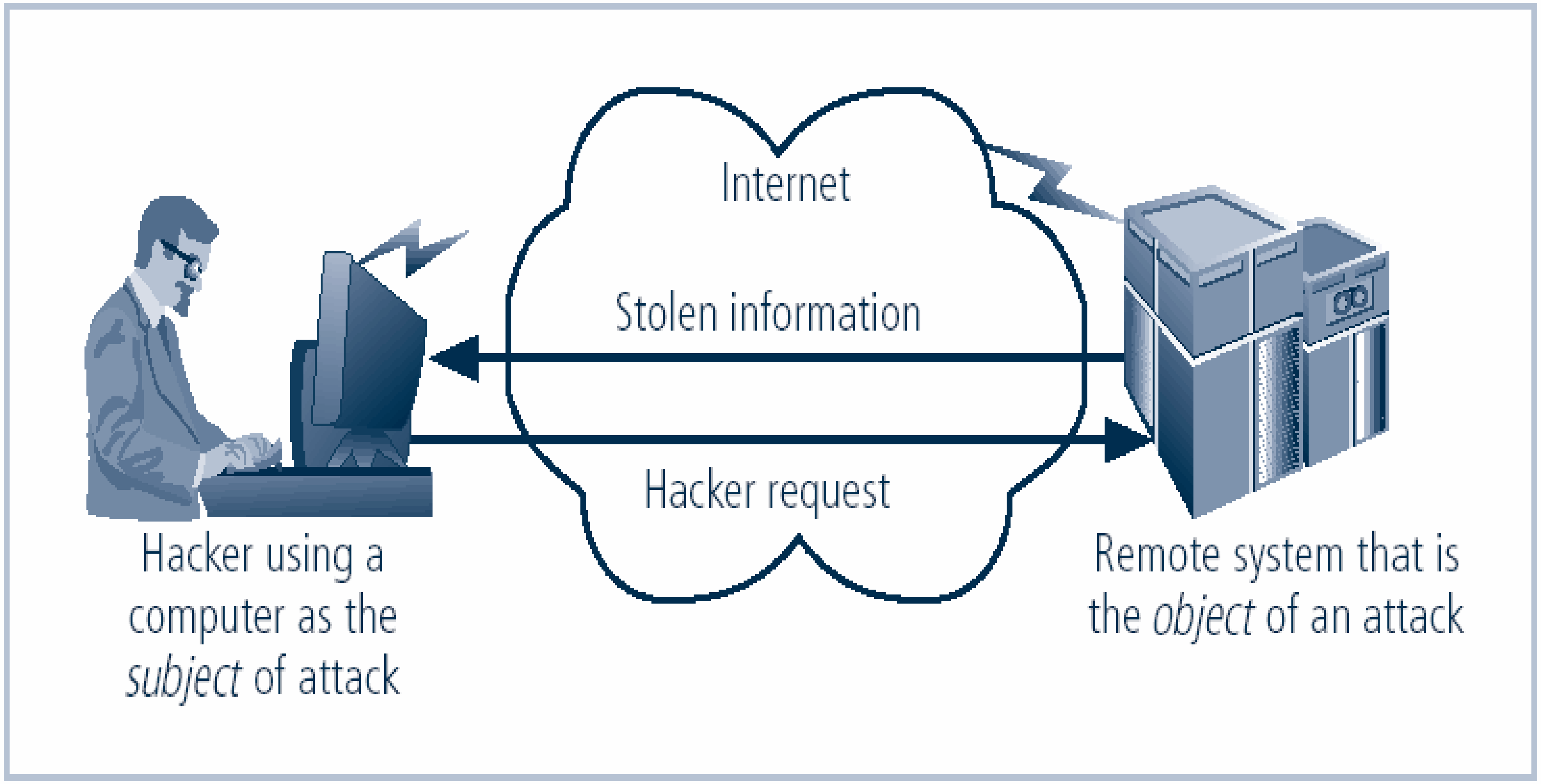
Components of an Information System

- Information System (IS) is entire set of software, hardware, data, people, procedures, and networks necessary to use information as a resource in the organization

Securing Components

- Computer can be subject of an attack and/or the object of an attack
  - When the subject of an attack, computer is used as an active tool to conduct attack
  - When the object of an attack, computer is the entity being attacked

Figure 1-5 – Subject and Object of Attack


Internet
Stolen information
Hacker request
Hacker using a computer as the *subject* of attack
Remote system that is the *object* of an attack

Computer as the Subject and Object of an Attack

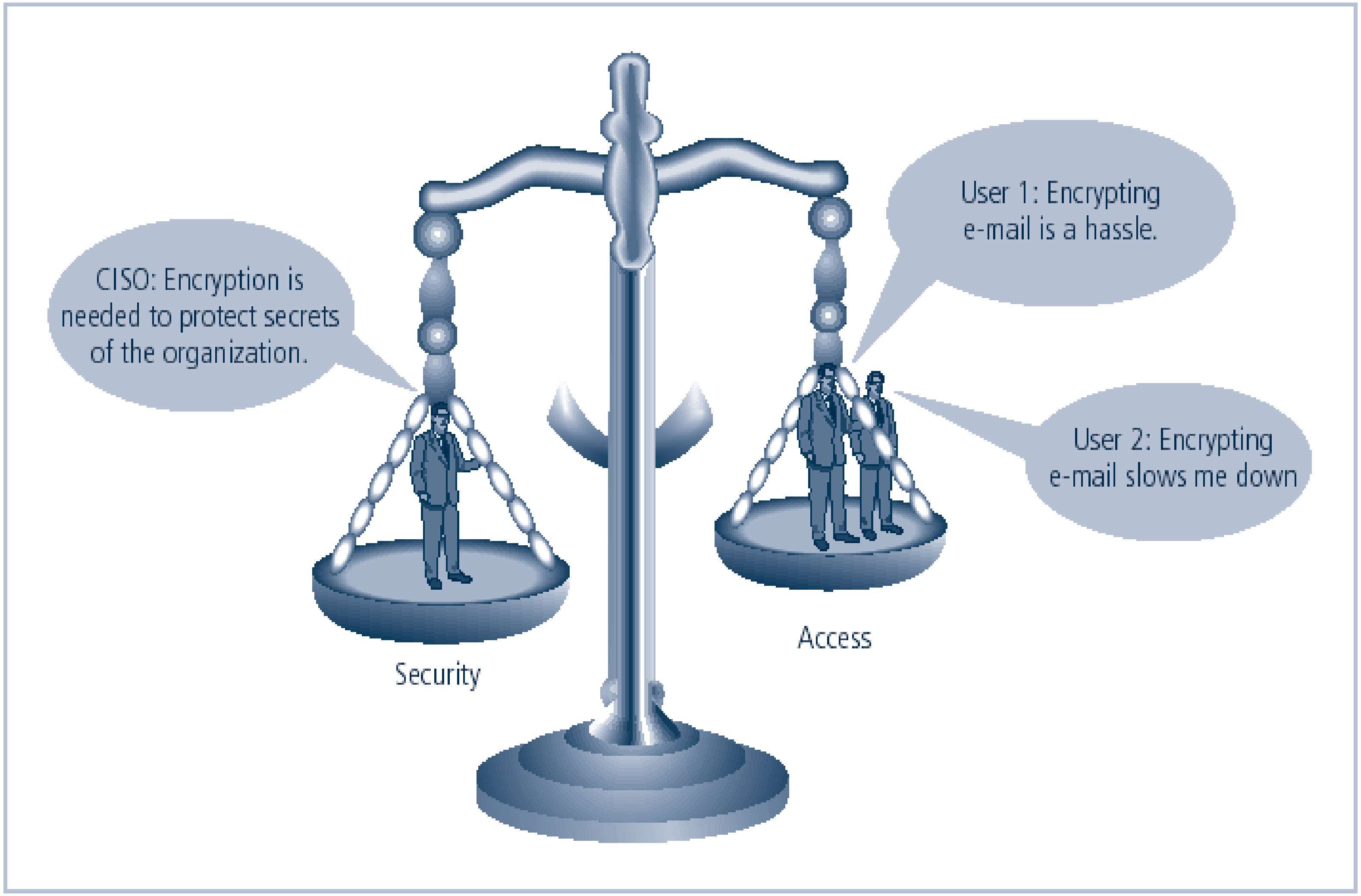
Balancing Information Security and Access

- Impossible to obtain perfect security—it is a process, not an absolute

- Security should be considered balance between protection and availability

- To achieve balance, level of security must allow reasonable access, yet protect against threats

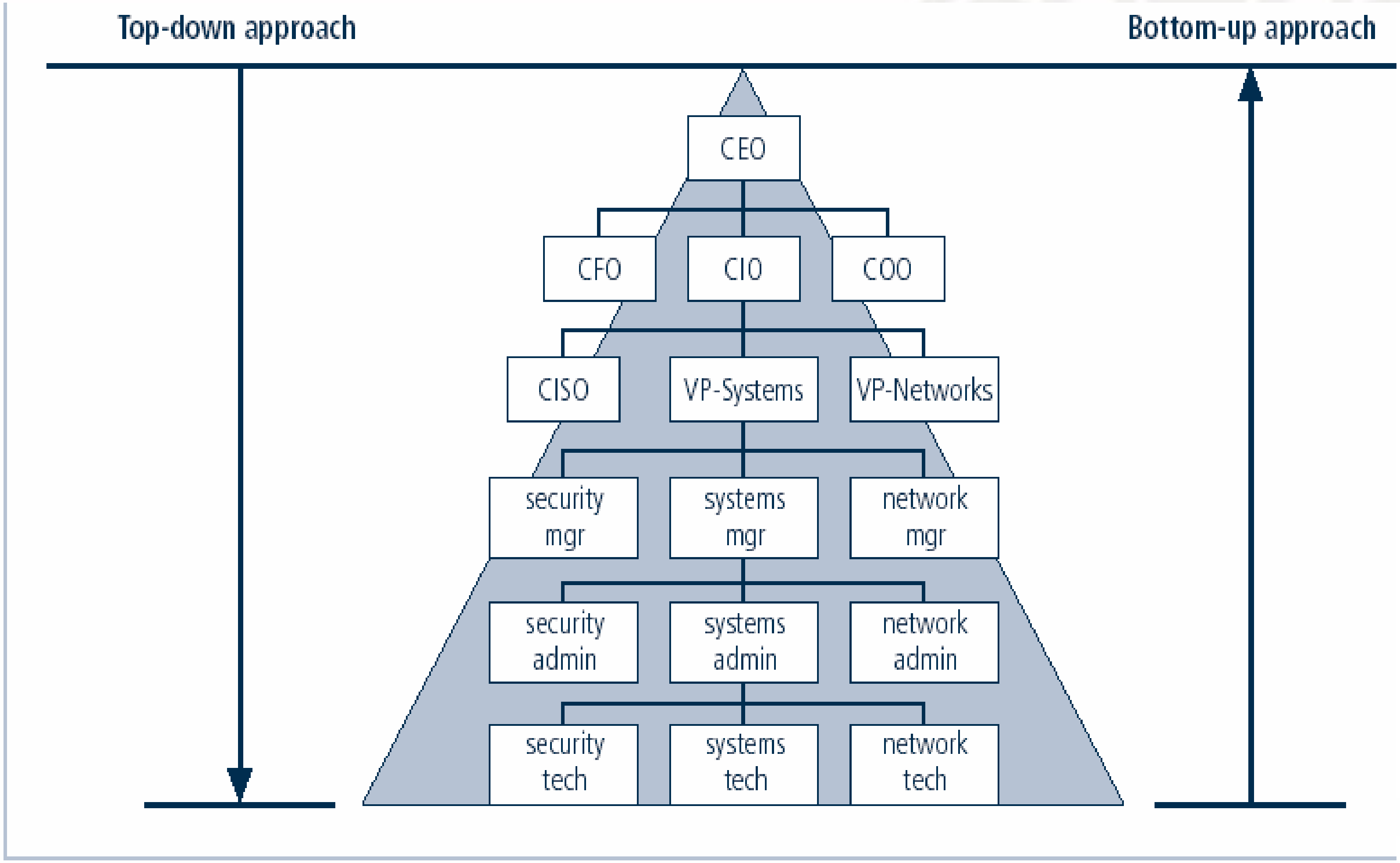
Figure 1-6 – Balancing Security


CISO: Encryption is needed to protect secrets of the organization.
User 1: Encrypting e-mail is a hassle.
User 2: Encrypting e-mail slows me down
Security
Access

Balancing Information Security and Access

Approaches to Information Security Implementation: Bottom-Up Approach

- Grassroots effort: systems administrators attempt to improve security of their systems
- Key advantage: technical expertise of individual administrators
- Seldom works, as it lacks a number of critical features:
  - – Participant support
  - – Organizational staying power



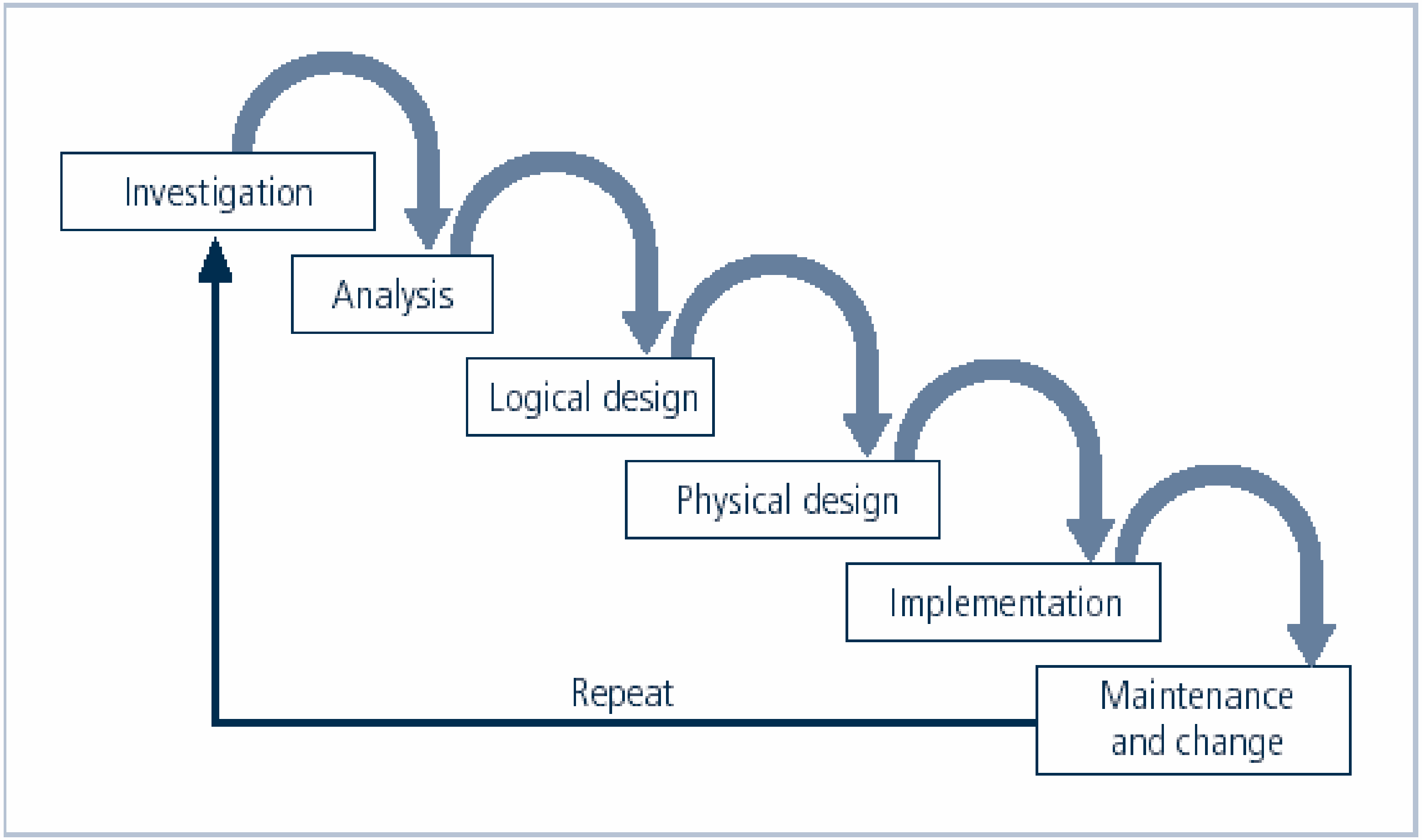
Approaches to Information Security Implementation

Approaches to Information Security Implementation: Top-Down Approach

- Initiated by upper management
  - – Issue policy, procedures and processes
  - – Dictate goals and expected outcomes of project
  - – Determine accountability for each required action
- The most successful also involve formal development strategy referred to as systems development life cycle

The Systems Development Life Cycle

- Systems development life cycle (SDLC) is methodology and design for implementation of information security within an organization
- Methodology is formal approach to problem-solving based on structured sequence of procedures
- Using a methodology
  - ensures a rigorous process
  - avoids missing steps
- Goal is creating a comprehensive security posture/program
- Traditional SDLC consists of six general phases



SDLC Waterfall Methodology

Investigation

- What problem is the system being developed to solve?
- Objectives, constraints and scope of project are specified
- Preliminary cost-benefit analysis is developed
- At the end, feasibility analysis is performed to assesses economic, technical, and behavioral feasibilities of the process

Analysis

- Consists of assessments of the organization, status of current systems, and capability to support proposed systems
- Analysts determine what new system is expected to do and how it will interact with existing systems
- Ends with documentation of findings and update of feasibility analysis

Logical Design

- Main factor is business need; applications capable of providing needed services are selected
- Data support and structures capable of providing the needed inputs are identified
- Technologies to implement physical solution are determined
- Feasibility analysis performed at the end

Physical Design

- Technologies to support the alternatives identified and evaluated in the logical design are selected
- Components evaluated on make-or-buy decision
- Feasibility analysis performed; entire solution presented to end-user representatives for approval

Implementation

- Needed software created; components ordered, received, assembled, and tested

- Users trained and documentation created

- Feasibility analysis prepared; users presented with system for performance review and acceptance test

Maintenance and Change

- Consists of tasks necessary to support and modify system for remainder of its useful life
- Life cycle continues until the process begins again from the investigation phase
- When current system can no longer support the organization’s mission, a new project is implemented

The Security Systems Development Life Cycle

- The same phases used in traditional SDLC may be adapted to support specialized implementation of an IS project

- Identification of specific threats and creating controls to counter them

- SecSDLC is a coherent program rather than a series of random, seemingly unconnected actions

Investigation

- Identifies process, outcomes, goals, and constraints of the project

- Begins with enterprise information security policy

- Organizational feasibility analysis is performed

Analysis

- Documents from investigation phase are studied
- Analyzes existing security policies or programs, along with documented current threats and associated controls
- Includes analysis of relevant legal issues that could impact design of the security solution
- The risk management task begins

Logical Design

- Creates and develops blueprints for information security
- Incident response actions planned:
  - Continuity planning
  - Incident response
  - Disaster recovery
- Feasibility analysis to determine whether project should continue or be outsourced

Physical Design

- Needed security technology is evaluated, alternatives generated, and final design selected

- At end of phase, feasibility study determines readiness of organization for project

Implementation

- Security solutions are acquired, tested, implemented, and tested again

- Personnel issues evaluated; specific training and education programs conducted

- Entire tested package is presented to management for final approval

Maintenance and Change

- Perhaps the most important phase, given the ever-changing threat environment
- Often, reparation and restoration of information is a constant duel with an unseen adversary
- Information security profile of an organization requires constant adaptation as new threats emerge and old threats evolve

Security Professionals and the Organization

- Wide range of professionals required to support a diverse information security program

- Senior management is key component; also, additional administrative support and technical expertise required to implement details of IS program

Senior Management

- Chief Information Officer (CIO)
  - Senior technology officer
  - Primarily responsible for advising senior executives on strategic planning
- Chief Information Security Officer (CISO)
  - Primarily responsible for assessment, management, and implementation of IS in the organization
  - Usually reports directly to the CIO

Information Security Project Team

- A number of individuals who are experienced in one or more facets of technical and non-technical areas:
  - Champion
  - Team leader
  - Security policy developers
  - Risk assessment specialists
  - Security professionals
  - Systems administrators
  - End users

Data Ownership

- Data Owner: responsible for the security and use of a particular set of information

- Data Custodian: responsible for storage, maintenance, and protection of information

- Data Users: end users who work with information to perform their daily jobs supporting the mission of the organization

Communities Of Interest

- Group of individuals united by similar interest/values in an organization
  - Information Security Management and Professionals
  - Information Technology Management and Professionals
  - Organizational Management and Professionals

Key Terms

- Access
- Asset
- Attack
- Control, Safeguard or Countermeasure
- Exploit
- Exposure
- Hacking
- Object
- Risk
- Security Blueprint
- Security Model
- Security Posture or Security Profile
- Subject
- Threats
- Threat Agent
- Vulnerability

Summary

- Information security is a “well-informed sense of assurance that the information risks and controls are in balance.”
- Computer security began immediately after first mainframes were developed
- Successful organizations have multiple layers of security in place: physical, personal, operations, communications, network, and information.

Summary

- Security should be considered a balance between protection and availability
- Information security must be managed similar to any major system implemented in an organization using a methodology like SecSDLC