Chapter 1 – Overview - Exercises

Exercise 1:
Consider an automated teller machine (ATM) in which users provide a personal identification number (PIN) and a card for account access. Give examples of confidentiality, integrity, and availability requirements associated with the system and, in each case, indicate the degree of importance of the requirement.

Examples

Confidentiality Student grade information is an asset whose confidentiality is considered to be highly important by students. In the United States, the release of such information is regulated by the Family Educational Rights and Privacy Act (FERPA). Grade information should only be available to students, their parents, and employees that require the information to do their job. Student enrollment information may have a moderate confidentiality rating. While still covered by FERPA, this information is seen by more people on a daily basis, is less likely to be targeted than grade information, and results in less damage if disclosed. Directory information, such as lists of students or faculty or departmental lists, may be assigned a low confidentiality rating or indeed no rating. This information is typically freely available to the public and published on a school's Web site.

Integrity Several aspects of integrity are illustrated by the example of a hospital patient's allergy information stored in a database. The doctor should be able to trust that the information is correct and current. Now suppose that an employee (e.g., a nurse) who is authorized to view and update this information deliberately falsifies the data to cause harm to the hospital. The database needs to be restored to a trusted basis quickly, and it should be possible to trace the error back to the person responsible. Patient allergy information is an example of an asset with a high requirement for integrity. Inaccurate information could result in serious harm or death to a patient and expose the hospital to massive liability.
An example of an asset that may be assigned **a moderate level** of integrity requirement is a Web site that offers a forum to registered users to discuss some specific topic. Either a registered user or a hacker could falsify some entries or deface the Web site. If the forum exists only for the enjoyment of the users, brings in little or no advertising revenue, and is not used for something important such as research, then potential damage is not severe. The Web master may experience some data, financial, and time loss.
An example of a **low integrity requirement** is an anonymous online poll. Many Web sites, such as news organizations, offer these polls to their users with very few safeguards. However, the inaccuracy and unscientific nature of such polls is well understood.

Availability The **more critical** a component or service, the higher is the level of availability required. Consider a system that provides authentication services or critical systems, applications, and devices. An interruption of service results in the inability for customers to access computing resources and staff to access the resources they need to perform critical tasks. The loss of the service translates into a large financial loss in lost employee productivity and potential customer loss.
An example of an asset that would typically be rated as having a **moderate** availability requirement is a public Web site for a university; the Web site provides information for current and prospective students and donors. Such a site is not a critical component of the university's information system, but its unavailability will cause some embarrassment.
An online telephone directory lookup application would be classified as a **low availability** requirement. Although the temporary loss of the application may be an annoyance, there are other ways to access the information, such as a hardcopy directory or the operator.

Exercise 2:
For each of the following assets, assign a low, moderate, or high impact level for the loss of confidentiality, availability, and integrity, respectively. Justify your answers.

a. An organization managing public information on its Web server.
b. A law enforcement organization managing extremely sensitive investigative information.
c. A financial organization managing routine administrative information (not privacy-related information).
d. An information system used for large acquisitions in a contracting organization contains both sensitive, pre-solicitation phase contract information and routine administrative information. Assess the impact for the two data sets separately and the information system as a whole.
e. A power plant contains a SCADA (supervisory control and data acquisition) system controlling the distribution of electric power for a large military installation. The SCADA system contains both real-time sensor data and routine administrative information. Assess the impact for the two data sets separately and the information system as a whole.

Examples

We now provide some examples of applications that illustrate the requirements just enumerated. For these examples, we use three levels of impact on organizations or individuals should there be a breach of security (i.e., a loss of confidentiality, integrity, or availability). These levels are defined in FIPS PUB 199:

• Low: The loss could be expected to have a limited adverse effect on organizational operations, organizational assets, or individuals. A limited adverse effect means that, for example, the loss of confidentiality, integrity, or availability might (i) cause a degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is noticeably reduced; (ii) result in minor damage to organizational assets; (iii) result in minor financial loss; or (iv) result in minor harm to individuals.

• **Moderate:** The loss could be expected to have a serious adverse effect on organizational operations, organizational assets, or individuals. A serious adverse effect means that, for example, the loss might (i) cause a significant degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is significantly reduced; (ii) result in significant damage to organizational assets; (iii) result in significant financial loss; or (iv) result in significant harm to individuals that does not involve loss of life or serious, life-threatening injuries.

• **High:** The loss could be expected to have a severe or catastrophic adverse effect on organizational operations, organizational assets, or individuals. A severe or catastrophic adverse effect means that, for example, the loss might (i) cause a severe degradation in or loss of mission capability to an extent and
duration that the organization is not able to perform one or more of its primary functions; (ii) result in major damage to organizational assets; (iii) result in major financial loss; or (iv) result in severe or catastrophic harm to individuals involving loss of life or serious, life-threatening injuries.

Table 1.4 Relationship Between Security Services and Mechanisms

SERVICE \ MECHANISM	Enciphermen	Digital signature	Access control	Data integrity	Authentication exchange	Traffic padding	Routing control	Notarization
Peer entity authentication	Y	Y			Y			
Data origin authentication	Y	Y						
Access control			Y					
Confidentiality	Y						Y	
Traffic flow confidentiality	Y					Y	Y	
Data integrity	Y	Y		Y				
Nonrepudiation		Y		Y				Y
Availability				Y	Y			

Exercice 3:

Develop an attack tree for gaining access to the contents of a physical safe box.