3 CATEGORIZATION OF INFORMATION AND INFORMATION SYSTEMS

This publication establishes security categories for both information[1] and information systems. The security categories are based on the potential impact on an organization should certain events occur which jeopardize the information and information systems needed by the organization to accomplish its assigned mission, protect its assets, fulfill its legal responsibilities, maintain its day-to-day functions, and protect individuals. Security categories are to be used in conjunction with vulnerability and threat information in assessing the risk to an organization.

[1] Information is categorized according to its *information type*. An information type is a specific category of information (e.g., privacy, medical, proprietary, financial, investigative, contractor sensitive, security management) defined by an organization or, in some instances, by a specific law, Executive Order, directive, policy, or regulation.

Security Objectives

The FISMA defines three security objectives for information and information systems:

CONFIDENTIALITY

"Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information…" [44 U.S.C., Sec. 3542]

A loss of *confidentiality* is the unauthorized disclosure of information.

INTEGRITY

"Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity…" [44 U.S.C., Sec. 3542]

A loss of *integrity* is the unauthorized modification or destruction of information.

AVAILABILITY

"Ensuring timely and reliable access to and use of information…" [44 U.S.C., SEC. 3542]

A loss of *availability* is the disruption of access to or use of information or an information system.

Potential Impact on Organizations and Individuals

FIPS Publication 199 defines three levels of *potential impact* on organizations or individuals should there be a breach of security (i.e., a loss of confidentiality, integrity, or availability). The application of these definitions must take place within the context of each organization and the overall national interest.

The *potential impact* is **LOW** if—

– The loss of confidentiality, integrity, or availability could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.[2]

AMPLIFICATION: 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.

The *potential impact* is **MODERATE** if—

– The loss of confidentiality, integrity, or availability could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.

AMPLIFICATION: A serious adverse effect means that, for example, the loss of confidentiality, integrity, or availability 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.

[2] Adverse effects on individuals may include, but are not limited to, loss of the privacy to which individuals are entitled under law.

The *potential impact* is **HIGH** if—

– The loss of confidentiality, integrity, or availability could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.

AMPLIFICATION: A severe or catastrophic adverse effect means that, for example, the loss of confidentiality, integrity, or availability 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.

Security Categorization Applied to Information Types

The security category of an information type can be associated with both user information and system information[3] and can be applicable to information in either electronic or non-electronic form. It can also be used as input in considering the appropriate security category of an information system (see description of security categories for information systems below). Establishing an appropriate security category of an information type essentially requires determining the *potential impact* for each security objective associated with the particular information type.

The generalized format for expressing the security category, SC, of an information type is:

SC information type = {(**confidentiality**, *impact*), (**integrity**, *impact*), (**availability**, *impact*)},

where the acceptable values for potential impact are LOW, MODERATE, HIGH, or NOT APPLICABLE.[4]

EXAMPLE 1: An organization managing *public information* on its web server determines that there is no potential impact from a loss of confidentiality (i.e., confidentiality requirements are not applicable), a moderate potential impact from a loss of integrity, and a moderate potential impact from a loss of availability. The resulting security category, SC, of this information type is expressed as:

SC public information = {(**confidentiality**, NA), (**integrity**, MODERATE), (**availability**, MODERATE)}.

EXAMPLE 2: A law enforcement organization managing extremely sensitive *investigative information* determines that the potential impact from a loss of confidentiality is high, the potential impact from a loss of integrity is moderate, and the potential impact from a loss of availability is moderate. The resulting security category, SC, of this information type is expressed as:

SC investigative information = {(**confidentiality**, HIGH), (**integrity**, MODERATE), (**availability**, MODERATE)}.

EXAMPLE 3: A financial organization managing routine *administrative information* (not privacy-related information) determines that the potential impact from a loss of confidentiality is low, the potential impact from a loss of integrity is low, and the potential impact from a loss of availability is low. The resulting security category, SC, of this information type is expressed as:

SC administrative information = {(**confidentiality**, LOW), (**integrity**, LOW), (**availability**, LOW)}.

[3] System information (e.g., network routing tables, password files, and cryptographic key management information) must be protected at a level commensurate with the most critical or sensitive user information being processed, stored, or transmitted by the information system to ensure confidentiality, integrity, and availability.

[4] The potential impact value of *not applicable* only applies to the security objective of confidentiality.

Security Categorization Applied to Information Systems

Determining the security category of an information system requires slightly more analysis and must consider the security categories of all information types resident on the information system. For an information system, the potential impact values assigned to the respective security objectives (confidentiality, integrity, availability) shall be the highest values (i.e., high water mark) from among those security categories that have been determined for each type of information resident on the information system.[5]

The generalized format for expressing the security category, SC, of an information system is:

SC information system = {(**confidentiality**, *impact*), (**integrity**, *impact*), (**availability**, *impact*)},

where the acceptable values for potential impact are LOW, MODERATE, or HIGH.

Note that the value of *not applicable* cannot be assigned to any security objective in the context of establishing a security category for an information system. This is in recognition that there is a low minimum potential impact (i.e., low water mark) on the loss of confidentiality, integrity, and availability for an information system due to the fundamental requirement to protect the system-level processing functions and information critical to the operation of the information system.

EXAMPLE 4: An information system used for large acquisitions in a contracting organization contains both sensitive, pre-solicitation phase contract information and routine administrative information. The management within the contracting organization determines that: (i) for the sensitive contract information, the potential impact from a loss of confidentiality is moderate, the potential impact from a loss of integrity is moderate, and the potential impact from a loss of availability is low; and (ii) for the routine administrative information (non-privacy-related information), the potential impact from a loss of confidentiality is low, the potential impact from a loss of integrity is low, and the potential impact from a loss of availability is low. The resulting security categories, SC, of these information types are expressed as:

SC contract information = {(**confidentiality**, MODERATE), (**integrity**, MODERATE), (**availability**, LOW)},

and

SC administrative information = {(**confidentiality**, LOW), (**integrity**, LOW), (**availability**, LOW)}.

The resulting security category of the information system is expressed as:

SC acquisition system = {(**confidentiality**, MODERATE), (**integrity**, MODERATE), (**availability**, LOW)},

representing the high water mark or maximum potential impact values for each security objective from the information types resident on the acquisition system.

[5] It is recognized that information systems are composed of both programs and information. Programs in execution within an information system (i.e., system processes) facilitate the processing, storage, and transmission of information and are necessary for the organization to conduct its essential mission-related functions and operations. These system processing functions also require protection and could be subject to security categorization as well. However, in the interest of simplification, it is assumed that the security categorization of all information types associated with the information system provide an appropriate *worst case* potential impact for the overall information system—thereby obviating the need to consider the system processes in the security categorization of the information system.

EXAMPLE 5: 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. The management at the power plant determines that: (i) for the sensor data being acquired by the SCADA system, there is no potential impact from a loss of confidentiality, a high potential impact from a loss of integrity, and a high potential impact from a loss of availability; and (ii) for the administrative information being processed by the system, there is a low potential impact from a loss of confidentiality, a low potential impact from a loss of integrity, and a low potential impact from a loss of availability. The resulting security categories, SC, of these information types are expressed as:

SC sensor data = {(**confidentiality**, NA), (**integrity**, HIGH), (**availability**, HIGH)},

and

SC administrative information = {(**confidentiality**, LOW), (**integrity**, LOW), (**availability**, LOW)}.

The resulting security category of the information system is initially expressed as:

SC SCADA system = {(**confidentiality**, LOW), (**integrity**, HIGH), (**availability**, HIGH)},

representing the high water mark or maximum potential impact values for each security objective from the information types resident on the SCADA system. The management at the power plant chooses to increase the potential impact from a loss of confidentiality from low to moderate reflecting a more realistic view of the potential impact on the information system should there be a security breach due to the unauthorized disclosure of system-level information or processing functions. The final security category of the information system is expressed as:

SC SCADA system = {(**confidentiality**, MODERATE), (**integrity**, HIGH), (**availability**, HIGH)}.

Table 1 summarizes the potential impact definitions for each security objective—confidentiality, integrity, and availability.

	POTENTIAL IMPACT		
Security Objective	**LOW**	**MODERATE**	**HIGH**
Confidentiality Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information. [44 U.S.C., SEC. 3542]	The unauthorized disclosure of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized disclosure of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized disclosure of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.
Integrity Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity. [44 U.S.C., SEC. 3542]	The unauthorized modification or destruction of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized modification or destruction of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The unauthorized modification or destruction of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.
Availability Ensuring timely and reliable access to and use of information. [44 U.S.C., SEC. 3542]	The disruption of access to or use of information or an information system could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.	The disruption of access to or use of information or an information system could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.	The disruption of access to or use of information or an information system could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.

TABLE 1: POTENTIAL IMPACT DEFINITIONS FOR SECURITY OBJECTIVES