# NISTIR 8011
# Volume 3

# Automation Support for Security Control Assessments

## *Software Asset Management*

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National Institute of Standards and Technology
U.S. Department of Commerce

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## Abstract

The NISTIR 8011 volumes focus on each individual information security capability, adding tangible detail to the more general overview given in NISTIR 8011 Volume 1, and providing a template for transition to a detailed, NIST standards-compliant automated assessment. This document, Volume 3 of NISTIR 8011, addresses the Software Asset Management (SWAM) information security capability. The focus of the SWAM capability is to manage risk created by unmanaged software on a network. Unmanaged software is a target that attackers can use as a platform from which to attack components on the network.

## Keywords

actual state; assessment; assessment boundary; assessment method; authorization boundary; automated assessment; automation; capability; continuous diagnostics and mitigation; dashboard; defect; defect check; desired state specification; software asset management; information security continuous monitoring; firmware; ISCM dashboard, inventory management; malware; malicious code; mobile code; mitigation; ongoing assessment; root cause analysis; security automation; security capability; security control; security control assessment; security control item; software executable; SWID tag; software injection; software product; software whitelisting.

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# Executive Summary

The National Institute of Standards and Technology (NIST) and the Department of Homeland Security (DHS) have collaborated on the development of a process that automates the test assessment method described in NIST Special Publication (SP) 800-53A for the security controls catalogued in SP 800-53. The process is consistent with the Risk Management Framework as described in SP 800-37 and the Information Security Continuous Monitoring (ISCM) guidance in SP 800-137. The multi-volume NIST Interagency Report 8011 (NISTIR 8011) has been developed to provide information on automation support for ongoing assessments. NISTIR 8011 describes how ISCM facilitates automated ongoing assessment to provide near-real-time security-related information to organizational officials on the security posture of individual systems and the organization as a whole.

NISTIR 8011 Volume 1 includes a description of *ISCM Security Capabilities*—groups of security controls working together to achieve a common purpose. The subsequent NISTIR 8011 volumes are capability-specific volumes. Each volume focuses on one specific ISCM information security capability in order to (a) add tangible detail to the more general overview given in NISTIR 8011 Volume 1; and (b) provide a template for the transition to detailed, standards-compliant automated assessments.

This document, Volume 3 of NISTIR 8011, addresses the information security capability known as Software Asset Management (SWAM). The focus of the SWAM capability is to manage risk created by unmanaged or unauthorized software executables that are on a network. When software executables are unmanaged or unauthorized, they are vulnerable because the software executables tend to be forgotten or unidentified. Moreover, when vulnerabilities are discovered on such software, responsibility to respond to the consequent risk is not assigned. As a result, unmanaged and unauthorized devices are targets that attackers can use as a persistent platform from which to attack components on the network.

A well-designed SWAM program helps to

- prevent compromised software from being installed or staying deployed on the network;
- prevent exploits or events from gaining a foothold;
- prevent persistence of exploits or events; and
- restore required and authorized software as needed after removal or alteration.

Assessment helps verify that software asset management is working.

This volume outlines detailed step-by-step processes to adapt or customize the template presented here to meet the needs of a specific assessment target network and apply the results to the assessment of all authorization boundaries on that network. A process is also provided to implement the assessment (diagnosis) and response. Automated testing related to the controls for SWAM, as outlined herein, is consistent with other NIST guidance.

It has not been obvious to security professionals how to automate testing of other than technical controls. This volume documents a detailed assessment plan to assess the effectiveness of controls related to authorizing and assigning software to be managed. Included are specific tests that form the basis for such a plan, how the tests apply to specific controls, and the kinds of resources needed to operate and use the assessment to mitigate defects found. For SWAM, it can be shown that the assessment of 92.7 percent[1] of determination statements for controls in the SP 800-53 Low-Medium-High baselines can be fully or partially automated.

The methods outlined here are designed to provide objective, timely, and complete identification of security defects related to SWAM at a lower cost than manual assessment methods. Using this defect information can drive the most efficient and effective remediation of the worst security defects found.

This volume assumes the reader is familiar with the concepts and ideas presented in the Overview (NISTIR 8011, Volume 1). Terms used herein are also defined in the Volume 1 glossary.

[1] Derived from the Control Allocation Tables (CAT) in this volume. With respect to security controls selected in the SP 800-53 Low-Medium-High baselines that support the SWAM capability, 76 of 82 determination statements (92.7%) can be fully or partially automated.

# 1. Introduction

## 1.1 Purpose and Scope

The purpose of the National Institute of Standards (NIST) Interagency Report (NISTIR) 8011 Volume 3 is to provide an operational approach for automating the assessment of SP 800-53 security controls related to the ISCM-defined security capability of *Software Asset Management* (SWAM) that is consistent with the principles outlined in NISTIR 8011 Volume 1.

The scope is limited to security controls/control items that are implemented to manage software download and installation and/or execution of unauthorized and/or malicious software (malware). In this case, *malware* includes known and unknown malicious code, including software that executes a zero-day attack.

## 1.2 Target Audience

The target audience for this volume, because it is focused on SWAM, is of special relevance to those who authorize, download, install and/or execute software. However, it is still of value to others to help understand the risks software may be imposing on non-software assets.

## 1.3 Organization of this Volume

Section 2 provides an overview of the SWAM capability to clarify both scope and purpose and provides links to additional information specific to the SWAM capability. Section 3 provides detailed information on the SWAM defect checks and how the defect checks automate assessment of the effectiveness of SP 800-53 security controls that support the SWAM capability. Section 3 also provides artifacts that can be used by an organization to produce an automated security control assessment plan for most of the control items supporting Software Asset Management.

## 1.4 Interaction with Other Volumes in this NISTIR

Volume 1 of this NISTIR (Overview) provides a conceptual synopsis of using automation to support security control assessment and provides definitions and background information that facilitates understanding of the information in this and subsequent volumes. This volume assumes that the reader is familiar with the information in Volume 1.

The SWAM capability identifies software that is being placed or executed on hardware in the target network. SWAM supports other ISCM capabilities by providing the full census of software to check for defects such as configuration settings (configuration setting management capability) and patches (vulnerability management capability).

SWAM is in turn supported by other ISCM capabilities such as the Privilege and Account Management capability (PRIV)[2] for implementation. This is discussed further in Section 2.6.1.

The Boundary Management capability (BOUND) is designed to prevent the insertion of malicious code into network devices. For example, SPAM filters attempt to block malicious emails, which frequently contain malware. Network level antivirus scanners have a similar function. Detonation Chambers (See SP 800-53, control SC-44) can be used on software entering the network, to look for actions that might be malicious, by watching behavior of that software in an isolated environment. Detonation chambers can thereby sometimes detect zero-day attacks if equipped to look for patterns of malicious behavior. This is discussed further toward the end of Section 2.3.

It may appear that some software related controls are not included here in error. However, not all software-related controls are covered in SWAM. SWAM focuses on software authorization and configuration management on each device. However, other aspects of software are covered in other ISCM capabilities, for example: Configuration Settings Management (CSM) covers software configurations; Vulnerability Management (VULN) covers vulnerability (CVE and CWE) management; and BOUND covers movement of unauthorized software into the network through telecommunications, etc.

# 2. Software Asset Management (SWAM) Capability Definition, Overview, and Scope

Software Asset Management recognizes that target network devices with unauthorized software[3] are likely to be vulnerable. External and internal attackers search for and exploit such software, either for what the software itself can offer, or as a platform from which to persist on the network to attack other assets. By removing unauthorized software and/or assigning such software to a person or team for management and authorization, SWAM helps reduce the probability that attackers find and exploit software.

A key attack vector is to place (or replace) software on a device in order to perform malicious activities. Such software, called malware, can support exfiltration of data (compromising confidentiality), changing data (compromising integrity), disruption of operations (compromising availability) and/or establishment of remote command and control over the device to more flexibly perform such malicious activity at the will of the attacker. Removing unauthorized software from devices, or blocking its execution, can reduce the success rate of malware attacks. Attacks can come from previously unknown software (aka zero-day attacks) which may be reduced by software whitelisting.[4]

[2] See Volume One for a discussion of ISCM capabilities.

[3] Unauthorized software is software that has not been assessed and authorized to be installed on some or all target network devices as part of an overall information system authorization process or individually if the software was installed after the initial system authorization.

[4] Software whitelisting is defined as allowing software to install, run, etc. by exception (i.e., if it is specified in an authorized software list) as per SP 800-53 CM-7(5).

## 2.1 SWAM Capability Description

The Software Asset Management capability provides an organization visibility into the software operating on its network(s), so it can manage and defend itself in an appropriate manner. It also provides a view of software management responsibility that helps prioritize identified defects and facilitate risk response decisions (e.g., mitigation or acceptance) by the responsible party.

SWAM identifies software that is present on the network (the *actual state*) and compares it with the *desired state* software inventory to determine if the software identified as being installed on target network devices is authorized. The SWAM capability is focused on ensuring that all software authorized to be installed on target network devices is fully identified and that an appropriate installation/execution control policy is applied.

In general, software can be authorized by several means:

1. Software whitelisting (i.e., allow by exception) blocks all software except where explicitly approved in a *software whitelist*.
2. Software blacklisting (i.e., deny by exception) blocks only software specifically prohibited (a *software blacklist*) and allows all other software.

Note that software blacklisting[5] has no impact on zero-day attacks, while software *whitelisting* is likely to have a significant impact. Malware makers can make minor variations to their software that evade blacklisting, thus allowing the attack to proceed.

Most software whitelisting products divide software into three categories:

1. Known good software (such as a pre-approved whitelist)
2. Known bad software (such as a pre-approved list of things that are *not* to be approved, similar to a blacklist, but used to restrict the range of what gets whitelisted).
3. Other software, not yet assessed for whitelist eligibility (a *graylist*).

Organizations just beginning to whitelist may have a large quantity of software on the graylist. Some organizations may choose to temporarily allow (whitelist) the graylisted software. Others may block items on the graylist until evaluated and approved. In either case, management of unassessed (graylist) software is an important task.

The ISCM process (as adapted for each agency) provides insight into what percentage of the actual software assets are included in the desired state, and of those, how many have an assigned manager identified.

[5] As this volume is being written, blacklisting is not selected as a viable software authorization strategy for the low, moderate, or high baselines in the draft of NIST 800-53 Revision 5.

## 2.2 SWAM Attack Scenarios and Desired Result

This document (NISTIR 8011) uses an attack step model to summarize the six primary steps of cyber attacks that SP 800-53 controls work together to block or delay (see Figure 1: SWAM Impact on an Attack Step Model). The SWAM security capability is designed to block or delay attacks at the attack steps listed in Table 1: SWAM Impact on an Attack Step Model.

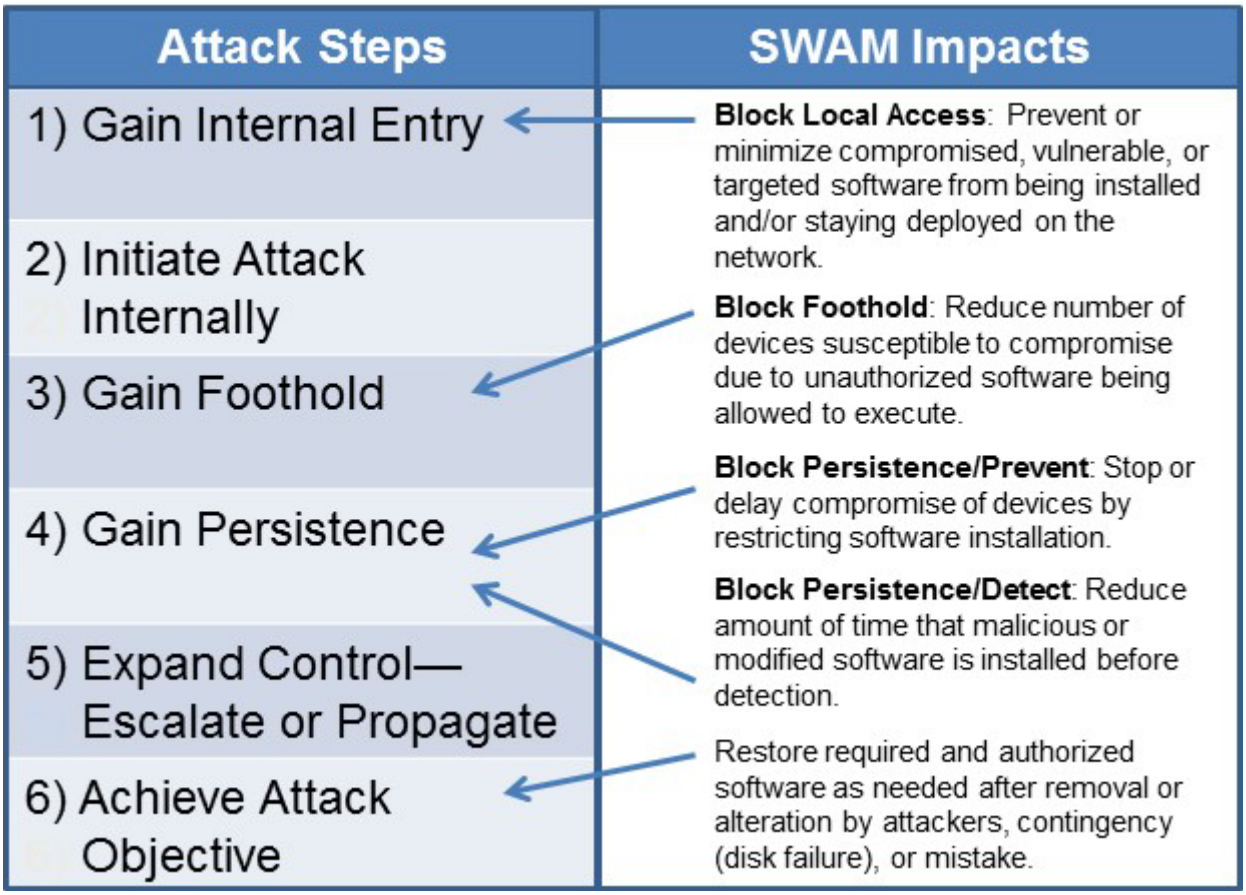


**Figure 1: SWAM Impact on an Attack Step Model**

**Note**

The attack steps shown in Figure 1: SWAM Impact on an Attack Step Model, apply only to adversarial attacks. (See NISTIR 8011, Volume 1, Section 3.2.)

344 **Table 1: SWAM Impact on an Attack Step Model**

| Attack Step Name | Attack Step Purpose | Examples |
|---|---|---|
| 1) Gain Internal Entry | The attacker is outside the target boundaries and seeks entry.<br>Examples include: spear phishing email sent; DDoS attack against .gov initiated; unauthorized person attempts to gain physical access to restricted facility. | **Block Local Access**: Prevent or minimize compromised, vulnerable, or targeted software from entering or being stored on the network or devices in a way that would allow installation or execution. |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | **Block Foothold**: Reduce number of devices susceptible to compromise due to unauthorized software being allowed to execute. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence.<br>Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | **Block Persistence/Prevent**: Stop or delay compromise of devices by restricting software installation.<br>**Block Persistence/Detect**: Reduce amount of time that malicious or compromised software is installed or remains active before detection and removal. |
| 6) Achieve Attack Objective | The attacker achieves an objective. Loss of confidentiality, integrity, or availability of data or system capability.<br>Examples include: Exfiltration of files; modification of database entries; deletion of file or application; denial of service; disclosure of PII. | **Restore required and authorized software** as needed, after being removed or altered by attackers, contingency (disk failure), or by mistake. |

345

346 **Other examples of traceability among requirement levels**. While Table 1 shows SWAM
347 impacts on example attack steps, it is frequently useful to observe traceability among other sets
348 of requirements. To examine such traceability, see Table 2: Traceability among Requirement
349 Levels. To reveal traceability from one requirement type to another, look up the cell in the
350 matching row and column of interest and click on the link.

**Table 2: Traceability among Requirement Levels**

| | Example Attack Steps | Capability | Sub-Capability/ Defect Check | Control Items |
|---|---|---|---|---|
| **Example Attack Steps** | | Figure 1<br>Table 1 | Table 6 | Appendix A |
| **Capability** | Figure 1<br>Table 1 | | Table 6 | Section 3.3[a] |
| **Sub-Capability/ Defect Check** | Table 6 | Table 6 | | Section 3.2[b] |
| **Control Items** | Appendix A | Section 3.3[a] | Section 3.2[b] | |

[a] Each level-four section (e.g., 3.3.1.1) is a control item that supports this capability.
[b] Refer to the table under the heading *Supporting Control Items* within each defect check.

## 2.3 Assessment Objects Protected and Assessed by SWAM

As noted in Section 1.1, the assessment objects directly managed and assessed by the SWAM capability are software executables and software products. However, the following clarification is relevant:

**Software (code)**, as used here, includes a range of assets that might not always be thought of as software. Such software assets include:

- Installed software executables and products listed in the operating system software database (e.g., Windows registry, Linux package manager);
- Software executables and products residing on a hard drive, but not listed in the operating system database;
- Mobile code;[6]
- Firmware, if it can be modified[7] (usually includes the BIOS); and
- Code in memory (which could be modified in place).

Note: *Software* includes all software on the system. The term *software* is not limited to business software, but also includes, for example, operating system software and security software (e.g., firewalls, white-listing software, vulnerability scanners, etc.). Moreover, the parameters that determine how the non-business software operates are also under configuration management. See Appendix G for how configuration management applies to SWAM related control items.

[6] Mobile code is software programs or parts of programs obtained from remote systems, transmitted across a network, and executed on a local system without explicit installation or execution by the recipient.
[7] Modifiable firmware is treated as software.

Each of the above types of software may require different controls to effectively prevent the execution of malicious software.

**Software Executables** are files which can be stored on a device's mass storage, loaded into memory, and executed. [See Figure 4].

Software executables can be authoritatively identified by a message digest[8] computed from the executable file. If an adversary tampers with the executable, the tampering can be objectively and accurately confirmed by viewing the resulting change to the message digest (cryptographic hash value or digital fingerprint).

**Figure 2: Definition and Discussion of *Software Executables* for SWAM**

**Software Products** are collections of software executables (generally sold as a unit) that work together to provide user functionality.

Examples of software products are operating systems (e.g., Apple IOS 11), office products (e.g., Microsoft Office), utilities (e.g., a DBMS such as Oracle), or drivers that come with devices such as printers, scanners, monitors, etc.

A software product frequently has multiple versions. This includes not only a major version (such as Oracle 12C), but also specific releases within that version, or minor versions, (such as 12.2) and the specific patches that may be applied to that release.

A unique product has the identical collection of executables with the same digital fingerprints as any other instance of that product. Any change in the executables could be malicious.

**Figure 3: Definition and Discussion of *Software Products* for SWAM**

**Installed software executables** for software products may be shared by several other products. This is notably true for shared library executables. An update to any one of the executables for a product may update the shared library used by other products. Given the definition of a software product above—as a collection of executables with the same digital fingerprints—changing the shared library changes each of the affected products into a different product.

Instances where executables and products are missing from the operating system software database occur because some software products do not require formal installation. They are simply copied to the device's mass storage, and then executed without creating software database entries.

In software approval processes, the focus is on whitelisting/blacklisting of software *products* or software *executables*. Because software products may be difficult to identify, focusing on software executables is often more reliable. Identifying software at the product level (typically done via operating system software database entries) is significantly less reliable than identifying the product with a digital fingerprint for all files contained in the installation. However, it is still hard to identify the product (except probabilistically) because:

[8] A message digest results from applying a cryptographic hash function to an executable or file. The executable or file is the *message*, and the result of the computation is the *digest*. A message digest is also known as a *cryptographic hash value* or *digital fingerprint*.

- The same *product*, even the same product *version*, might contain different files with different digital fingerprints, due to:
  a. Differences in installation media.
  b. Differences in installation options.
  c. Subsequent patching of the product.
  d. Subsequent patching of other products, e.g., that affect a shared DLL.
  e. Attacker action that modifies a product file.
  f. Execution of an uninstalled file, not related to a registered product.
- When products are removed or upgraded, it is possible that not all executables are removed, as installers might not remove them, fearing that particular executables are still needed by other products. Such files would remain subject to exploitation.

However, an organization that receives a product from a custom development team and/or a COTS supplier can register the contained (trusted) executables, and thereby reliably track whether exactly that specific version and patch level of the software is what has been installed.

Recognizing that software whitelisting at the product level is unreliable, the following four provisions can provide the needed reliability to software whitelisting at the executable level using digital fingerprints:

1. **An *authoritative* directory of trusted executables (trusted repository)**. This is developed by obtaining digital fingerprints from executables obtained as near to the trusted source as possible. The source might be a commercial software provider or an in-house custom software operation. When using open-source code, an authoritative directory might be more difficult to obtain, but can still be addressed by carefully examining the source code for the presence of CWEs and resolving issues found internally before trusting the code.
2. **A means to compute digital fingerprints and register trusted software not included in the vendor's trust repository.**
3. **Executables received as digitally-signed files from trusted sources**. If the code is mobile code, digital signing is an imperative (except perhaps on isolated disposable virtual machines). If mobile code is allowed, the trust can be established dynamically, based on the signature of the trusted source.
4. **Whitelisting software loaded near the *root* of the OS.** This is to block, or seek permission to download/load-in-memory/execute software that is not whitelisted.

Generally, a good software whitelisting product has all of capabilities (1), (2), (3), and (4), and supports automatic trust based on signature and/or identity of those who install the software.

As a result of the definition of software products, the use of shared files, and the ability to load software that is not inventoried in the operating system software database, it is very difficult to know what software products are on a device. Also, controlling software inventory based on software products listed in the operating system software database is highly unreliable, especially when compared to controlling software inventory based on digital fingerprints for executables. However, using software whitelisting with features 1–4, even while ignoring the operating system software database, resolves these issues.

**Mobile code** is distinguished by the fact that rather than being loaded from the device's mass storage, it is loaded at the time of use from the larger network (typically via a website). The code is managed externally, and may change frequently, rendering the device incapable of computing a valid digital fingerprint for the mobile code, and thus requiring other means to validate the code. Requiring the mobile code to be digitally signed by a trusted source is one method employed to validate such code. Another option is to block all mobile code not from a trusted website.

A key alternate method for addressing mobile code is covered in NIST SP 800-53 control SC-44 (Detonation Chamber). Because SC-44 is not covered in the low, moderate, or high baselines, it is not included in this NISTIR. However, detonation chambers are effective in protecting against malicious mobile code, including mobile code downloaded from a web site, as well as mobile code in e-mails and attachments. Malicious mobile code is addressed further in the volume on boundary management.

**Firmware** is often considered to be a hybrid between hardware and software. For the purposes of this NISTIR, firmware is code stored in non-volatile memory that can be updated. The ability to update firmware allows hardware manufacturers great flexibility, reducing the need to replace hardware when issues are found or changes need to be made. Firmware that can be updated is subject to malicious code insertion, and thus needs protection under the SWAM capability. Generally, it is possible to compute a digital fingerprint for firmware. In addition, there are hardware mechanisms to validate firmware, such as the trusted platform module (TPM).

**Code in memory** is harder to protect than other forms of software addressed in this volume. Because changes to code in memory are very hard to detect, such changes can be very stealthy. However, the effects are transient, as the changes only last until other code is loaded into memory. Therefore, controls related to code in memory are assigned to manual assessment.

## *2.4 Example SWAM Data Requirements[9]*

Examples of data requirements for the SWAM actual state are in Table 3. Examples of data requirements for the SWAM desired state are in Table 4.

**Table 3: Example SWAM Actual State Data Requirements**

| Data Item | Justification |
|---|---|
| The software installed on every device. This data must be converted into a format that can be compared with the authorized software inventory. Examples include:<br>• Software Identification (SWID) tag; and<br>• Common Platform Enumeration (CPE). | To identify when unauthorized software is installed on a device |

[9] Specific data required is variable based on organizational platforms, tools, configurations, etc.

| Data Item | Justification |
|---|---|
| Data necessary to determine how long unauthorized software has been present on a device. At a minimum:<br>• Date/time unauthorized software was first discovered; and<br>• Date/time unauthorized software was last seen. | To determine how long unauthorized software has been on a device. |
| Software blacklist[a] used to check device, to include version number or date of last update. [b] | • To determine if device was checked for unauthorized software.<br>• To determine if the known-bad software blacklist is up-to-date per policy. |

[a] Blacklisted software is software that is not authorized to execute on a system; or prohibited Universal Resource Locators or websites.
[b] For blacklists, it is essential to keep the blacklist current, as new "known bad" software items are found. (This is one of the features of blacklisting that makes it less effective.) Whitelists only need to be updated on an event driven basis, e.g., when a version of software is replaced by a new version.

**Table 4: Example SWAM Desired State Data Requirements**

| Data Item | Justification |
|---|---|
| Authorized hardware inventory, to include assigned and authorized device attributes. See NISTIR 8011 Volume 2. | To identify what devices to check against what software defect checks. |
| The associated value for device attributes.[a] | To prioritize defects associated with devices. |
| Sets of attributes designated as mutually exclusive per the organization's policy. | For comparison with the set of assigned device attributes. |
| 1. A listing of all authorized software for the organization to include data necessary to accurately identify the software product and compare to actual state data collected (vendor; product; version/release level/patch level; SWID tag; CPE; etc.).<br>2. Authoritative listing of executable files associated with product. (With digital fingerprint of each file.)<br>3. Software Manager by device and product<br>4. Expiration policy.<br>5. Authorization status (dates initially authorized, last authorized, revoked, etc.) | • To calculate expiration dates for the authorization of software (1, 2, 4, 5).<br>• To enable automated removal of differences that are not defects (All).<br>• To be able to uniquely identify the software (1, 2).<br>• To be able to validate that the software on the device is truly the software authorized (1, 2, 4, 5).<br>• To know who to instruct to fix specific risk conditions found (3).<br>• To assess each software manager's performance in risk management (1, 2, 3, 4, 5). |
| Management responsibility for each software management function for each authorized software product. Local enhancements[b] might include:<br>• Approvers being assigned;<br>• Managers being approved; and<br>• Managers acknowledging receipt. | • To identify management responsibilities for ensuring that licensing, patching, and configuration standards are up-to-date.<br>• To know who to instruct to fix specific risk conditions found.<br>• To assess each such person's performance in risk management.<br>*Note:* If not specified explicitly, management responsibility for each software management |

| Data Item | Justification |
|---|---|
| | function is assumed to lie with the device manager. |
| A set of Software Profiles for the organization to include:<br>• Associated attributes;[c]<br>• Authorized software;<br>• Mandatory software;<br>• Organizationally prohibited software blacklist;<br>• Industry blacklist;[d] and/or<br>• Update frequency for blacklist. | • To compare with the software present on a device to determine defects.<br>• To define authorized and unauthorized software on a per device basis.<br>• To determine when software no longer authorized for the environment is being used for baselines.<br>• To determine if known-bad blacklists are out of date. |
| Sets of device attributes that require a unique software profile when assigned to the same device, to include software profile(s) replaced and software profile(s) used. | To enforce more restrictive policies on devices that are assigned sets of attributes (e.g., database server and database authentication server). |

[a] This value is defined by the organization, based on the value assigned by the organization to assets.
[b] Organizations can define additional data requirements and associated defects for the local environment.
[c] Software profiles have a one-to-many relationship with device attributes. One profile can have more than one device attribute associated with it (e.g., both Internal Web Server and External Web Server can map to the same Web Server software profile), but every device attribute is associated with exactly one software profile.
[d] Known bad blacklists are quite large, very dynamic, and often maintained by an antivirus or antimalware vendor. It is not expected that the organization knows what software is on the list, but that they know what blacklist is to be used and how frequently it is to be updated.

## 2.5 SWAM Concept of Operational Implementation

Figure 4: SWAM Concept of Operations (CONOPS) illustrates how SWAM might be implemented. The CONOPS is central to the automated assessment process.

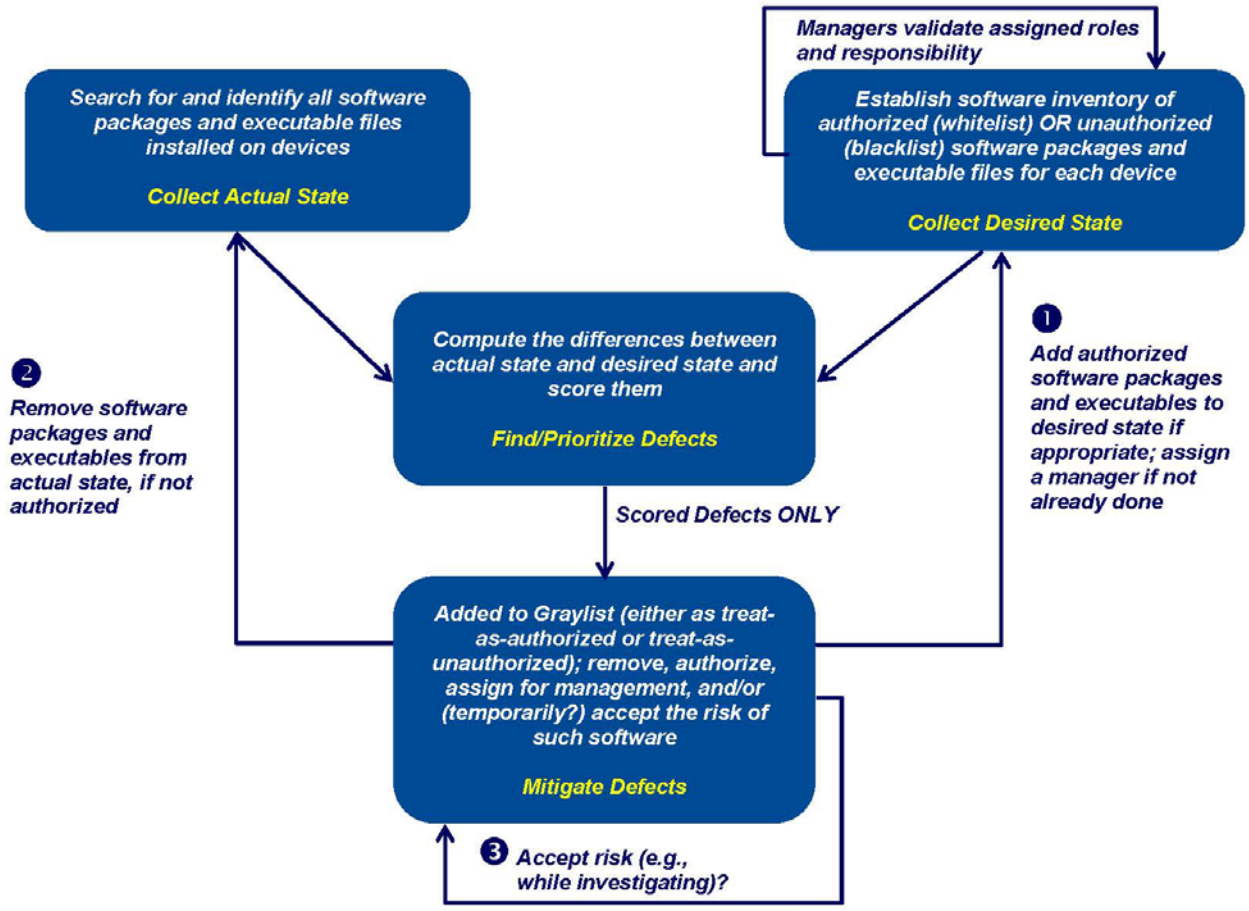


**Figure 4: SWAM Concept of Operations (CONOPS)**

The following is a brief description of the SWAM capability functionality:

> SWAM identifies software (including virtual machines) that is actually present on target network devices (the actual state) and compares it with the desired state inventory to determine if the identified software is authorized for operation and installation on target network devices.

### 2.5.1 Collect Actual State

Use tools to collect information about what software executables and products are installed on target network devices, including executables on mass storage, mobile code, firmware, and code in memory. Methods to detect (and possibly respond to) unauthorized software may include (but are not limited to):

- Identify software products through use of the operating system software database;

- Identify software executables through the use of trusted digital fingerprint repositories;
- Link products to executables through a SWID tag;
- Whitelist authorized software, and block all other software by default.
- Blacklist (and block by default) unauthorized and/or known malicious or unsafe software;
- Graylist (and block by default or allow by exception) until a determination is made of whether to authorize particular software.
- Require installation media to be digitally signed as close to the source as possible to prevent tampering in the supply chain.
- Require all mobile code to be digitally signed by a trusted source; and
- Use a trusted platform module to verify the software used to boot the system.

Implementing some of the methods above to detect unauthorized software may require an agent on the host device to check new software (and software about to be executed) against associated policy constraints. A process to remove unauthorized software might also be implemented.

Unauthorized software may include any software not explicitly whitelisted or any software explicitly blacklisted. When unauthorized and/or malicious software is modified, even slightly, it is rendered invisible to blacklists, making blacklisting increasingly ineffective as malware variants become more easily produced. Because software whitelisting can block *any* unknown software, it is much more effective against unauthorized and/or malicious software.

The ISCM data collection process identifies the software executables (and products) actually on the network and provides the information required to compare the software with the authorized inventory (desired state). Also, it is necessary to identify which devices in the target network are not reporting to discover the actual software operating on the devices.[10]

### 2.5.2 Collect Desired State

Create an authorized software inventory using policies, procedures, and processes suggested by the information security program or as otherwise defined by the organization. Expected output is an authorized software inventory that contains identifying information for software on a device—when it was authorized, when the authorization expires, and authorized digital signature. The digital signature may be contained in a SWID tag and/or in a separate trusted repository of known whitelisted/blacklisted software/signatures.

For maximum effectiveness, automated tools to manage software inventory using digital fingerprints include functionality to introduce new software into the trust repository. This functionality allows the organization to include custom software, unique to that organization, for example. However, care is taken not to inadvertently whitelist malicious code as part of the software introduction process.

[10] Most monitoring software misses some devices on any given scan. This is especially true for mobile devices that may be off-network, but also true for people who turn devices off while on vacation or official travel. The organization is expected to set a standard for how many non-reporting devices to accept, and perhaps for how long (based on their practices and data collectors). These are then measured by the data quality defect checks.

### 2.5.3 Find/Prioritize Defects

Comparing the list of software objects discovered on the network (actual state) with the authorized software inventory list (desired state) often reveals that software objects exist on one list and not on the other. The comparison identifies both unauthorized objects and missing authorized software that may indicate a security risk. Additional defects related to software asset management may be defined by the organization. Because of the high risk associated with unauthorized software installation, tools are available to block unauthorized software at first detection (which should occur before the software is executed). Usually software blocking tools allow automatic blocking, or the user is asked whether to block or execute the software. In any case, after the comparison is complete, identified defects are scored and prioritized[11] (using federal- and organization-defined criteria) so that the appropriate response action can be taken (i.e., so that higher risk problems are addressed first).

## *2.6 SP 800-53 Control Items that Support SWAM*

This section documents how control items that support SWAM were identified as well as the nomenclature used to clarify each control item's focus on software.

### 2.6.1 Process for Identifying Needed Controls

A section on Tracing Security Control Items to Capabilities explains the process used to determine the controls needed to support a capability—this process is described in detail in Volume 1 of this NISTIR. In short, the two steps are:

1. Use a keyword search of the control text to identify control items that might support the capability. See keyword rules in Appendix B.
2. Manually identify those that *do* support the capability (true positives) and ignore those that do not (false positives).

This produces three sets of controls:

1. The control items in the low, moderate, and high baselines that support the SWAM capability (listed in the section on SWAM Control (Item) Security Assessment Plan Narrative Tables and Templates and the section on Control Allocation Tables).
2. Control items in the low, moderate, and high baselines selected by the keyword search, but manually determined to be false positives (listed in Appendix C).
3. Control items not in a baseline, and not analyzed further after the keyword search. These include:
    a. Program management controls, because those controls do not apply to individual systems;

[11] A risk scoring methodology is necessary to score and prioritize defects but risk scoring is out of scope for this publication.

b. Not selected controls—controls that are in SP 800-53 but are not assigned to (selected in) a baseline; and

c. Privacy controls.

The unanalyzed controls are listed in Appendix D, in case the organization wants to develop automated tests.

In order to implement whitelisting/blacklisting in general, and software whitelisting/blacklisting in particular, SWAM will rely on some other capabilities. The supporting controls are not included in SWAM if more central to the other capability.

For example, configuration settings and/or user privilege lists are used to prevent anyone who is not a software manager from modifying the whitelists, graylists or blacklists. Moreover, the configuration settings and/or privileges are used to prevent the software managers from performing activities that could allow an outsider to misuse the software manager accounts to modify the desired state metadata. The same access controls are necessary to protect the actual state data. Assessment of such controls is left to the capabilities in which the control is central, rather than to the capability where applied (i.e., SWAM, in this case).

As a more specific example, PRIV controls are an important supplement to defect checks in all capabilities to ensure that only authorized persons can change the actual and desired state data, and the actual state of the system.

- For example, in SWAM, an attacker might try to change the trusted digital fingerprints of approved executables, so that they may add or substitute malicious code. If the number of accounts authorized to make additions/substitutions is limited and only assigned to trusted persons with adequate separation of duties, such additions/substitutions are rendered more difficult.
- Also, if only a limited number of accounts are authorized to install software, it is harder for an attacker to find and exploit an account to inject malicious code.

Privileges to protect desired and actual state data are tested in the PRIV capability, even though the privileges support SWAM and all other capabilities.

### 2.6.2 Control Item Nomenclature

Many control items that support the SWAM capability also support several other capabilities. For example, hardware, software products, software settings, and software patches may all benefit from configuration management controls. To clarify the scope of such control items as they relate to SWAM, expressions in the control item text are enclosed in curly brackets—for instance, {installed software}—to denote that a particular control item, as it supports the SWAM capability, focuses on, *and only on*, what is inside the curly brackets.

## *2.7 SWAM Specific Roles and Responsibilities*

Table 5: Operational and Managerial Roles for SWAM, describes SWAM-specific roles and the corresponding responsibilities. Figure 5: Primary Roles in Automated Assessment of SWAM, shows how the roles integrate with the concept of operations. An organization implementing

automated assessment can customize its approach by assigning (allocating) the responsibilities to persons in existing roles.

**Table 5: Operational and Managerial Roles for SWAM**

| Role Code | Role Title | Role Description | Role Type |
|---|---|---|---|
| DM | Device Manager (DM) | Assigned to a specific device or group of devices, device managers are (for HWAM) responsible for adding/removing devices from the network, and for configuring the hardware of each device (adding and removing hardware components). The device managers are specified in the desired state inventory specification. The device manager may be a person or a group. If a group, there is a group manager in charge.<br><br>In the absence of a SWMan, the DM may be assigned the task of removing unauthorized software. | Operational |
| DSM | Desired State Managers and Authorizers (DSM) | Desired State Managers are needed for both the ISCM Target Network and each assessment object. The desired state managers ensure that data specifying the desired state of the relevant capability is entered into the ISCM system's desired state data and is available to guide the actual state collection subsystem and to identify defects. The DSM for the ISCM Target Network also resolves any ambiguity about which system authorization boundary has defects (if any).<br><br>Authorizers share some of the responsibilities by authorizing specific items (e.g., devices, software, or settings), and thus defining the desired state. The desired state manager oversees and organizes this activity. | Operational |
| ISCM-Ops | ISCM Operators (ISCM-Ops) | ISCM operators are responsible for operating the ISCM system (see ISCM-Sys). | Operational |
| ISCM-Sys | The system that collects, analyzes and displays ISCM security-related information | The ISCM system: a) collects the desired state specification; b) collects security-related information from sensors (e.g., scanners, agents, training applications, etc.); and c) processes that information into a useful form.<br>To support task c) the system conducts specified defect check(s) and sends defect information to an ISCM dashboard covering the relevant system(s). The ISCM system is responsible for the assessment of most SP 800-53 security controls. | Operational |
| MAN | Manual Assessors | Assessments not automated by the ISCM system are conducted by human assessors using manual/procedural methods. Manual/procedural assessments might also be conducted to verify the automated security-related information collected by the ISCM system—when there is a concern about data quality. | Operational |
| RskEx | Risk Executive, System Owner, and/or Authorizing Official (RskEx) | Defined in SPs 800-37 and 800-39. | Managerial |
| SWMan | Software Manager | Assigned to specific devices and responsible for installing and/or removing software from the device. The key aspects of the | Operational |

| Role Code | Role Title | Role Description | Role Type |
|---|---|---|---|
| | | Software Manager responsibility are to ONLY install authorized software and to promptly remove ALL unauthorized software found. The software manager is also responsible for ensuring software media is available to support roll back of changes and restoration of software to prior states.<br><br>This role might be performed by the DM (Device Manager) and/or the PatMan (Patch Manager).<br><br>If users are authorized to install software, they are also SWMans (Software Managers) for the relevant devices. | |
| TBD | To be determined by the organization | Depends on specific use. TBD by the organization. | Unknown |

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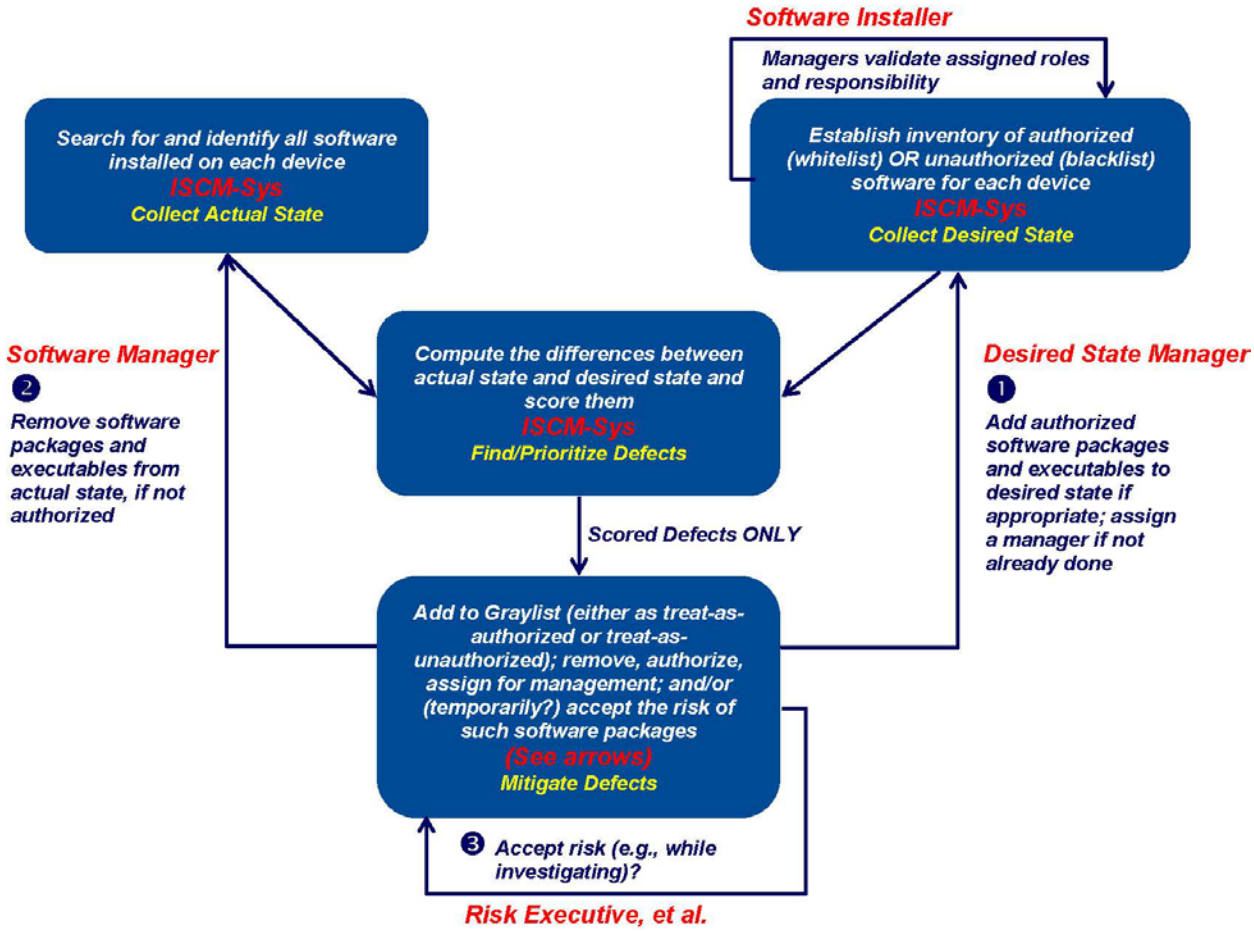


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605 **Figure 5: Primary Roles in Automated Assessment of SWAM**

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## 2.8 SWAM Assessment Boundary

The assessment boundary is ideally all software on an entire *network* of computers from the innermost enclave out to where the network either ends in an air-gap or interconnects to other network(s)—typically the Internet or the network(s) of a partner or partners. For SWAM, the boundary includes software on all devices inside this boundary and associated components, including removable devices. For more detail and definitions of some the terms applicable to the assessment boundary, see Section 4.3.2 in Volume 1 of this NISTIR.

## 2.9 SWAM Actual State and Desired State Specification

For information on the actual state and the desired state specification for SWAM, see the assessment criteria notes section of the defect check tables in Section 3.2.

Note that many controls in SWAM refer to developing and updating an inventory of software on devices (or other inventories). Note also, that per the SP 800-53A definition of *test*, testing of the SWAM controls implies the need for specification of both an actual state inventory and a desired state inventory, so that the test can compare the two inventories. The details of this are described in the defect check tables in Section 3.2.

## 2.10 SWAM Authorization Boundary and Inheritance

See Section 4.3.1 of Volume 1 of this NISTIR for information on how authorization boundaries are handled in automated assessment. In short, for SWAM, software on each device is assigned to one and only one authorization (system) boundary, per SP 800-53 CM-08(5), entitled "Information System Component Inventory | No Duplicate Accounting of Components." The ISCM dashboard can include a mechanism for recording the assignment of software to authorization boundaries, making sure all software are assigned to at least one authorization boundary, and that no software product is assigned to more than one authorization boundary.

For information on how inheritance is managed, see Section 4.3.3 of Volume 1 of this NISTIR. For SWAM, many utilities, database management software products, web server software objects, and parts of the operating system provide inheritable support and/or controls for other systems. The ISCM dashboard can include a mechanism to record such inheritance and use it in assessing the system's overall risk.

## 2.11 SWAM Assessment Criteria Recommended Scores and Risk-Acceptance Thresholds

General guidance on options for risk scores[12] to be used to set thresholds is outside the scope of this NISTIR and is being developed elsewhere. In any case, for SWAM, organizations are encouraged to use metrics that look at both average risk score and maximum risk score per device.

[12] A risk score, also called a *defect score*, in the context of SWAM, is a measure of how exploitable a defect is.

### *2.12 SWAM Assessment Criteria Device Groupings to Consider*

To support automated assessment and ongoing authorization, software is clearly grouped by authorization boundary [see Control Items CM-8a and CM-8(5) in SP 800-53] and by the software managers responsible for software installation on specific devices[13] [see Control Item CM-8(4) in SP 800-53]. In addition to these two important groupings, the organization may want to use other groupings for risk analysis, as discussed in Section 5.6 of Volume 1 of this NISTIR.

# 3. SWAM Security Assessment Plan Documentation Template

## *3.1 Introduction and Steps for Adapting This Plan*

This section provides templates for the security assessment plan in accordance with SP 800-37 and SP 800-53A. The documentation elements are described in Section 6 of Volume 1 of this NISTIR. Section 9 of the same volume specifically describes how the templates and documentation relate to the assessment tasks and work products defined in SP 800-37 and SP 800-53A. The following are suggested steps to adapt this plan to the organization's needs and implement automated monitoring.

Figure 6 shows the main steps in the adaptation process. The steps are expanded to more detail in the following three sections.

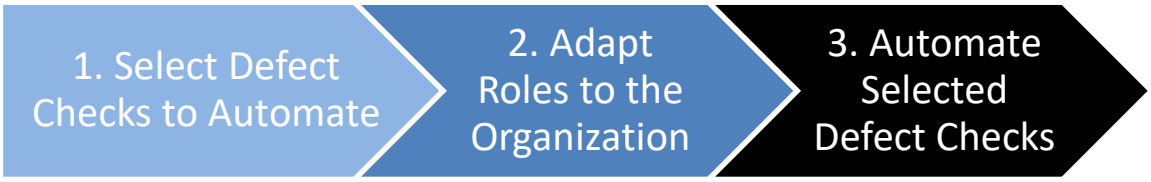


**Figure 6: Main Steps in Adapting the Plan Template**

### 3.1.1 Select Defect Checks to Automate

The main steps in selecting defect checks to automate are described in this section.


**Figure 7: Sub-Steps to Select Defect Checks to Automate**

[13] This role is the Software Manager (SWMan) responsible for installing on and removing software from the device, but it might be performed by the device manager or other responsible party in a specific organization.

Take the following steps to select which defect checks to automate:

(1) **Identify Assessment Boundary:** Identify the assessment boundary to be covered. (See Section 4.3 of Volume 1 of this NISTIR.)

(2) **Identify System Impact:** Identify the Federal Information Processing Standard (FIPS) 199-defined impact level (high water mark) for that assessment boundary. (See SP 800-60 and/or organizational categorization records.)

(3) **Review Security Assessment Plan Documentation:**

a. Review the defect checks documented in Section 3.2 to get an initial sense of the proposed items to be tested.

b. Review the security assessment plan narratives in Section 3.2 to understand how the defect checks apply to the controls that support Software Asset Management.

(4) **Select Defect Checks:**

a. Based on Steps (1) to (3) in this list and an understanding of the organization's risk tolerance, use Table 6: Mapping of Attack Steps to Security Sub-Capability, in Section 3.2.3 to identify the defect checks that would be necessary to test the effectiveness of controls required by the impact level and risk tolerance.

b. Mark the defect checks necessary as selected in Section 3.2.2. The organization is not required to use automation, but automation of testing adds value to the extent that it:

(i) Produces assessment results accurately, completely, and timely enough to better defend against attacks; and/or

(ii) Reduces the cost of assessment over the long term.

### 3.1.2 Adapt Roles to the Organization

The main steps to adapt the roles to the organization are described in this section.


**Figure 8: Sub-Steps to Adapt Roles to the Organization**

(1) **Review Proposed Roles**: Proposed roles are described in Section 2.7, SWAM Specific Roles and Responsibilities (Illustrative).

(2) **Address Missing Roles:** Identify any required roles not currently assigned in the organization. Determine how to assign the unassigned roles.

(3) **Rename Roles:** Identify the organization-specific names that match each role. (Note that more than one proposed role might be performed by the same organizational role.)

(4) **Adjust Documentation:** Map the organization-specific roles to the roles proposed herein, in one of two ways (either may be acceptable):

a. Add a column to the table in Section 2.7 for the organization-specific role and list it there; or

b. Use global replace to change the role names throughout the documentation from the names proposed here to the organization-specific names.

### 3.1.3 Automate Selected Defect Checks

The main steps to implement automation are described in this section.


**Figure 9: Sub-Steps to Automate Selected Defect Checks**

(1) **Add Defect Checks:** Review the defect check definition and add checks as needed based on organizational risk tolerance and expected attack types. [Role: DSM (See Section 2.7.)]

(2) **Adjust Data Collection:**

a. Review the actual state information needed and configure automated sensors to collect the required information. [Role: ISCM-Sys (See Section 2.7)]

b. Review the matching desired state specification that was specified or add additional specifications to match the added actual state to be checked. Configure the collection system to receive and store this desired state specification in a form that can be automatically compared to the actual state data. [Role: ISCM-Sys (See Section 2.7.)]

(3) **Operate the ISCM-System:**

a. Operate the collection system to identify both security and data quality defects.

b. Configure the collection system to send security and data quality information to the defect management dashboard.

(4) **Use the Results to Manage Risk:** Use the results to respond to higher risk findings first and to measure potential residual risk to inform aggregate risk acceptance decisions. If risk is determined to be too great for acceptance, the results may also be used to help prioritize further mitigation actions.

## *3.2 SWAM Sub-Capabilities and Defect Check Tables and Templates*

This section documents the specific test templates that are proposed and considered adequate to assess the control items that support Software Asset Management. See Section 5 of Volume 1 of this NISTIR for an overview of defect checks, and see Section 4.1 of Volume 1 for an overview

of the actual state and desired state specifications discussed in the Assessment Criteria Notes for each defect check. Sections 3.2.1 and 3.2.2 of this document describe the foundational and local defect checks, respectively. The *Supporting Control Item(s)* data in sections 3.2.1 and 3.2.2 specify which controls, when ineffective, might cause a particular defect check to fail. This provides further documentation on why the check (test) might be needed. Refer to Section 3.1 for how to adapt the defect checks (and roles specified therein) to the organization.

Data found in Section 3.2 can be used in both defect check selection and root cause analysis, as described there. Section 3.2.3 documents how each sub-capability (tested by a defect check) serves to support the overall capability by addressing certain example attack steps and/or data quality issues. Appendix G can also be used to support root cause analysis.

The Defect Check Templates are organized as follows:

- In the column headed "The purpose of this sub-capability…," the sub-capability being tested by the defect check is documented. (How the sub-capabilities block or delay certain example attack steps is described in Section 3.2.3.)
- The column headed "The defect check to assess…" describes the defect check name and the assessment criteria to be used to assess whether or not the sub-capability is effective in achieving its purpose.
- In the column headed *Example Mitigation/Responses*, the document describes examples of potential responses when the check finds a defect, and also what role is likely responsible.
- Finally, the column headed *Supporting Control Items* lists the control items that work together to support the sub-capability. This identification is based on the mapping of defect checks to control items in Section 3.3.

As noted in Section 3.1, this material is designed to be customized and adapted to become part of an organization's security assessment plan.

### 3.2.1 Foundational Sub-Capabilities and Corresponding Defect Checks

This document (NISTIR 8011) proposes two foundational security-oriented defect checks for the SWAM capability. The foundational checks are designated SWAM-F01 through SWAM-F04 and focus on security.

Four *data quality* defect checks are also proposed and are designated SWAM-Q01 through SWAM-Q04. The data quality defect checks are important because they provide the information necessary to document how reliable the overall assessment automation process is, information which can be used to decide how much to trust the other data (i.e., provide greater assurance about security control effectiveness). Defect checks may be computed for individual checks (e.g., foundational and/or local), or summarized for various groupings of devices (e.g., device manager, device owner, system, etc.) out to the full assessment boundary.

Each of the foundational and data quality defect checks is defined in terms of assessment criteria, mitigation methods, and responsibility described in the *Example Mitigation/Responses* section under each defect check.

The foundational and data quality defect checks were selected for their value for summary reporting. The *Selected* column indicates which of the checks to implement.

*Note for SWAM*: SWAM defect checks F01, F02 and F03 provide alternate ways to detect or limit execution of unauthorized software from a mass storage device. Organizations select one or more of the defect check(s) F01, F02, and/or F03 based on organizational assurance needs and organization-specific control implementations. SWAM defect check F04 is needed separately to detect malicious code in memory.

### *3.2.1.1* Prevent Unauthorized Software from Executing Sub-Capability and Defect Check SWAM-F01

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent unauthorized software from executing | Prevent or reduce the execution of unauthorized software (presumed malware). |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-F01 | Unauthorized software executes | Executable with digital fingerprint is executed (or attempted to execute) but not authorized to execute. | 1) The actual state is the list (inventory) of all executables that the system has loaded (or attempted to load) for execution, identified by digital fingerprints or equivalents, e.g., digitally signed executables or libraries.<br>2) The desired state specification is a list of all software executables authorized to be executed, identified by digital fingerprints or equivalents.<br>3) A defect is an executable that was executed (or attempted to be executed) that is not on the list of executables authorized to be executed.<br><br>*Note*: F01 covers distribution supply chain issues. IF the organization gets executable hashes (encrypted and signed) from the foundry or an equally reliable source. | Yes |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F01 | Automatically block execution on detection | ISCM-Ops |
| SWAM-F01 | Remove the software | SWMan |
| SWAM-F01 | Authorize the software | DSM |
| SWAM-F01 | Accept Risk | RskEx |

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F01 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-F01 | Low | CM-7(b) |
| SWAM-F01 | Low | CM-11(b) |
| SWAM-F01 | Low | SI-3(b) |
| SWAM-F01 | Low | SI-3(c) |
| SWAM-F01 | Moderate | CM-7(1)(b) |
| SWAM-F01 | Moderate | CM-7(2) |
| SWAM-F01 | Moderate | CM-7(4)(a) |
| SWAM-F01 | Moderate | CM-7(4)(b) |
| SWAM-F01 | Moderate | MA-3(2) |
| SWAM-F01 | Moderate | SC-18(a) |
| SWAM-F01 | Moderate | SC-18(b) |
| SWAM-F01 | Moderate | SC-18(c) |
| SWAM-F01 | Moderate | SI-3(1) |
| SWAM-F01 | Moderate | SI-7 |
| SWAM-F01 | High | CM-5(3) |
| SWAM-F01 | High | CM-7(5)(a) |
| SWAM-F01 | High | CM-7(5)(b) |
| SWAM-F01 | High | SA-12 |

#### *3.2.1.2* Prevent or Reduce Execution of Software from Unauthorized Installers Sub-Capability and Defect Check SWAM-F02

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce execution of software from unauthorized installers | Prevent or reduce the execution of software (presumed malware) not installed by an authorized installer. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-F02 | Unauthorized software installer | Software is executed (or attempted to execute) but was not installed by an authorized installer | 1) The actual state is the list (inventory) of all software (identified by the installer account or equivalent) that is being executed or has been loaded for execution | Yes |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | account. | over a specified period of time defined by the organization.<br>2) The desired state specification is a list of all software installed by an authorized installer account.<br>3) A defect is software that was executed (or attempted to execute) that was not installed by an authorized installer account. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F02 | Automatically block installation by unauthorized persons | ISCM-Ops |
| SWAM-F02 | Automatically block execution on detection | ISCM-Ops |
| SWAM-F02 | Remove the software | SWMan |
| SWAM-F02 | Authorize the software/installer | DSM |
| SWAM-F02 | Accept Risk | RskEx |
| SWAM-F02 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-F02 | Low | CM-11(a) |
| SWAM-F02 | Low | CM-11(b) |
| SWAM-F02 | Low | SI-3(b) |
| SWAM-F02 | Moderate | CM-7(1)(b) |
| SWAM-F02 | Moderate | CM-7(2) |
| SWAM-F02 | Moderate | CM-7(4)(a) |
| SWAM-F02 | Moderate | CM-7(4)(b) |
| SWAM-F02 | High | CM-7(5)(a) |
| SWAM-F02 | High | CM-7(5)(b) |

#### *3.2.1.3* Prevent or Reduce Software Execution from Unauthorized Location Sub-Capability and Defect Check SWAM-F03

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce software execution from unauthorized location | Prevent or reduce the execution of software (presumed malware) not loaded from a controlled and authorized location. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-F03 | Unauthorized software directory/folder location | Executable is executed (or attempted to execute) but was not loaded from an approved location. | 1) The actual state is the list (inventory) of all executables (identified by the location from which loaded, or equivalent) that are being executed or have been loaded for execution over a period of time defined by the organization. (The actual value to be stored in the inventory is a tuple consisting of the executable and the location from which loaded.)<br>2) The desired state specification is a list of all software executables that exist in the authorized location. (The actual value to be stored in the specification is one tuple for each authorized executable and a location from which it is permitted to be loaded.)<br>3) A defect is an executable that was executed (or attempted to be executed) that is not loaded from an authorized location. (The actual state tuple does not match a desired state tuple.)<br><br>*Note*: Authorized locations are to be restricted via access controls to be writable only by authorized installer accounts. | Yes |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F03 | Automatically block execution on detection of wrong location | ISCM-Ops |
| SWAM-F03 | Remove the software | SWMan |

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F03 | Authorize the software/location for execution | DSM |
| SWAM-F03 | Accept Risk | RskEx |
| SWAM-F03 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-F03 | Low | CM-7(b) |
| SWAM-F03 | Low | CM-11(b) |
| SWAM-F03 | Low | SI-3(b) |
| SWAM-F03 | Moderate | CM-7(1)(b) |
| SWAM-F03 | Moderate | CM-7(2) |
| SWAM-F03 | Moderate | CM-7(4)(a) |
| SWAM-F03 | Moderate | CM-7(4)(b) |
| SWAM-F03 | High | CM-7(5)(a) |
| SWAM-F03 | High | CM-7(5)(b) |

### *3.2.1.4* Ensure or Increase Trust of System Software at Startup Sub-Capability and Defect Check SWAM-F04

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure or increase trust of system software at startup | Prevent or reduce the insertion of malware into key system components before or during system startup. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-F04 | Untrusted core software | Unauthorized software state at startup. | 1) The actual state is data on the integrity of organizationally selected software components observed at startup. At a minimum, core components are expected to include root operating system elements, firmware, etc. Digital fingerprints are often used to identify components in the actual state.<br>2) The desired state specification is a list of the approved version of each software element using the same methods of identification (digital fingerprint, digital signature, etc.). | Yes |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | 3) A defect is software observed at startup that was not in the desired state specification. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-F04 | Lock the system and block use | ISCM-Ops |
| SWAM-F04 | Restore authorized state/software | SWMan |
| SWAM-F04 | Authorize the new state | DSM |
| SWAM-F04 | Accept Risk | RskEx |
| SWAM-F04 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-F04 | Low | CM-11(b) |
| SWAM-F04 | Low | SI-3(b) |
| SWAM-F04 | Moderate | CM-7(1)(b) |
| SWAM-F04 | Moderate | CM-7(4)(a) |
| SWAM-F04 | Moderate | CM-7(4)(b) |
| SWAM-F04 | Moderate | SI-3(1) |
| SWAM-F04 | Moderate | SI-7(1) |
| SWAM-F04 | High | CM-5(3) |
| SWAM-F04 | High | CM-7(5)(a) |
| SWAM-F04 | High | CM-7(5)(b) |

#### *3.2.1.5* Ensure Completeness of Device-Level Reporting Sub-Capability and Defect Check SWAM-Q01

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure completeness of device-level reporting | Ensure that devices are correctly reporting SWAM related information to the actual state inventory to prevent SWAM defects from going undetected. |

847 The defect check to assess whether this sub-capability is operating effectively is defined as
848 follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-Q01 | Non-reporting of device-level SWAM information | Device connected to the assessment boundary but not reporting SWAM actual state information. | 1) The actual state is the list of devices connected to the assessment boundary.<br>2) The desired state is that all the devices in the actual state are reporting SWAM information.<br>3) A defect occurs when a device in the actual state has not reported its SWAM information as recently as expected.<br>Criteria developed to define the threshold for "as recently as expected," for each device were discussed in the notes for HWAM-Q01. | Yes |

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850 **Example Responses:** The following potential responses (with example primary responsibility
851 assignments) are common actions and are appropriate when defects are discovered in this sub-
852 capability. The example primary responsibility assignments do not change the overall
853 management responsibilities defined in other NIST guidance. Moreover, the response actions
854 and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-Q01 | Restore device reporting of software | ISCM-Ops |
| SWAM-Q01 | Declare device missing (with software) | DM |
| SWAM-Q01 | Accept Risk | RskEx |
| SWAM-Q01 | Ensure Correct Response | ISCM-Ops |

855
856 **Supporting Control Items:** This sub-capability is supported by the following control items.
857 Thus, if any of the following supporting controls fail, the defect check fails and overall risk is
858 likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-Q01 | Low | CM-8(a) |

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### 861 *3.2.1.6* Ensure Completeness of Defect-Check-Level Reporting Sub-Capability and
862 Defect Check SWAM-Q02

863 The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure completeness of defect-check-level reporting | Ensure that defect check information is correctly reported in the actual state inventory to prevent systematic inability to check any defect on any device. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-Q02 | Non-reporting of defect checks | Defect checks are selected, but the SWAM Actual State Collection Manager does not report testing for all defects on all devices (Device level and defect check level defect). | 1) The actual state is the set of SWAM data that was collected in each collection cycle to support all implemented SWAM defect checks. 2) The desired state is the set of SWAM data that must be collected in each collection cycle to support all implemented SWAM defect checks. 3) The defect is any set of data needed for a defect check where not all the data was collected for an organizationally specified number of devices, indicating that the collection system is not providing enough information to perform a sufficiently thorough assessment. | Yes |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-Q02 | Restore defect check reporting | ISCM-Ops |
| SWAM-Q02 | Accept Risk | RskEx |
| SWAM-Q02 | Ensure Correct Response | ISCM-Ops |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-Q02 | Low | CM-8(a) |

### *3.2.1.7* Increase Overall Reporting Completeness Sub-Capability and Defect Check SWAM-Q03

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Increase overall reporting completeness | Ensure that data for as many defect checks as possible are correctly reported in the actual state inventory to prevent defects from persisting undetected across the assessment boundary. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-Q03 | Low completeness-metric | Completeness of the actual inventory collection is below an [organization-defined-threshold] (Summary of Q01 and Q02 for assessment boundary and other device grouping (e.g., system, device manager, etc.)). | The completeness metric is not a device-level defect, but is applied to any collection of devices – for example, those in a system authorization boundary. It is used in computing the maturity of the collection system.<br>1) The actual state is the number of specified defect checks provided by the collection system in a reporting window.<br>2) The desired state is the number of specified defect checks that should have been provided in that same reporting window.<br>3) Completeness is the metric defined as the actual state number divided by the desired state number – that is, it is the percentage of specified defect checks collected during the reporting window. Completeness measures long term ability to collect all needed data.<br>4) A defect is when completeness is too low (based on the defined threshold). This indicates risk because, when completeness is too low, there is a higher risk of defects being undetected. An acceptable level of completeness balances technical feasibility against the need for 100% completeness.<br><br>*Note on 1):* A specific check-device combination may only be counted once in the required | Yes |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | minimal reporting period. For example, if checks are to be done every 3 days, a check done twice in that timeframe would still count as 1 check. However, if there are 30 days in the reporting window, that check-device combination could be counted for each of the ten 3-day periods included. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-Q03 | Restore completeness | ISCM-Ops |
| SWAM-Q03 | Accept Risk | RskEx |
| SWAM-Q03 | Ensure Correct Response | ISCM-Ops |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-Q03 | Low | CM-8(a) |

#### *3.2.1.8* Ensure Overall Reporting Timeliness Sub-Capability and Defect Check SWAM-Q04

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure overall reporting timeliness | Ensure that data for as many defect checks as possible are reported in a timely manner in the actual state inventory to prevent defects from persisting undetected. To be effective, defects need to be found and mitigated considerably faster than they can be exploited. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-Q04 | Poor timeliness metric | Frequency of update (timeliness) of the actual inventory collection is lower than an [organization-defined-threshold] (Summary of Q03 and Q04 for assessment boundary and other device grouping (e.g., system, device manager, etc.)). | The Timeliness metric is not a device-level defect, but can be applied to any collection of devices – for example, those within a system (authorization boundary). It is used in computing the maturity of the collection system.<br>1) The actual state is the number of specified defect checks provided by the collection system in one collection cycle – the period in which each defect should be checked once.<br>2) The desired state is the number of specified defect checks that should have been provided in the collection cycle.<br>3) Timeliness is the metric defined as the actual state number divided by the desired state number – that is, it is the percentage of specified defect checks collected in the reporting cycle. Thus it measures the percentage of data that is currently timely (collected as recently as required).<br>4) A defect is when "timeliness" is too poor (based on the defined threshold). This indicates risk because when timeliness is poor there is a higher risk of defects not being detected quickly enough.<br><br>*Note on 1):* A specific check-device combination may only be counted once in the collection cycle.<br>*Note on 2):* Different devices may have different sets of specified checks, based on their role. | Yes |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-Q04 | Restore frequency | ISCM-Ops |
| SWAM-Q04 | Accept Risk | RskEx |
| SWAM-Q04 | Ensure Correct Response | ISCM-Ops |

910 **Supporting Control Items:** This sub-capability is supported by the following control items.
911 Thus, if any of the following supporting controls fail, the defect check fails and overall risk is
912 likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-Q04 | Low | CM-8(b) |
| SWAM-Q04 | Low | CM-11(c) |
| SWAM-Q04 | Moderate | CM-8(1) |

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### 3.2.2 Local Sub-Capabilities and Corresponding Defect Checks

This section includes local defect checks, as examples of what organizations may add to the foundational checks to support more complete automated assessment of SP 800-53 controls that support SWAM.

Organizations exercise authority to manage risk by choosing whether or not to select specific defect checks for implementation. In general, selecting more defect checks may lower risk (if there is capacity to address defects found) and provide greater assurance but may also increase cost of detection and mitigation. The organization selects defect checks for implementation (or not) to balance the benefits and costs and prioritize risk response actions by focusing first on the problems that pose greater risk (i.e., managing risk).

Note that each local defect check may also include options to make it more or less rigorous, as the risk tolerance of the organization deems appropriate.

The “Selected” column is present to indicate which of the checks the organization chooses to implement as documented or as modified by the organization.

#### *3.2.2.1* Ensure or Increase Integrity of Software Authorizers Sub-Capability and Defect Check SWAM-L01

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure or increase integrity of software authorizers | Prevent or reduce the insertion of malware into the list of approved software by unauthorized persons. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L01 | Unapproved authorizer | Software not approved by an authorized software authorizer. | 1) The actual state is the account (controlled by a credentialed and authenticated person) which authorized each instance of software.<br>2) The desired state specification is a list of the approved accounts which can authorize software<br>3) A defect is software that was authorized by an unapproved authorizer. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L01 | Block the software as unauthorized | ISCM-Ops |
| SWAM-L01 | Remove the software | SWMan |
| SWAM-L01 | Authorized person approves the software | DSM |
| SWAM-L01 | Accept Risk | RskEx |
| SWAM-L01 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L01 | Low | CM-4 |
| SWAM-L01 | Moderate | SI-7 |
| SWAM-L01 | High | SI-7(14)(b) |

#### *3.2.2.2* Prevent or Reduce (Careless or Malicious) Software Approval Sub-Capability and Defect Check SWAM-L02

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce (careless or malicious) software approval | Ensure checks and balances are in place to prevent a single individual from carelessly or maliciously changing authorization of software installation.<br><br>*Note 1:* The organization might choose to use access restrictions to enforce multiple approvals. If so, that would be assessed under the PRIV capability.<br>*Note 2:* See SWAM-L09 for authorization boundary. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L02 | Required authorizations missing | Software changes must be authorized by at least two authorized persons before execution. | 1) The actual state is the list of persons who authorized the change to the system, thus allowing the software item to be executed. This would typically be recorded in the desired state inventory as part of the configuration change control process.<br>2) The desired state is the list of persons who are authorized to approve system changes and allow software to be executed. This may include specifying first, second, etc., approver roles.<br>3) A defect occurs when the software item is authorized<br>a. by fewer than the required number of distinct and authorized approvers; or<br>b. by persons not authorized to approve software.<br><br>*Note:* An organization may wish to enhance this defect check by requiring different individuals to verify different attributes of the software, such as supply chain strength, vendors' attention to | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | security, etc. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L02 | Block the software as unauthorized | ISCM-Ops |
| SWAM-L02 | Remove the software | SWMan |
| SWAM-L02 | Authorized person(s) approves the software | DSM |
| SWAM-L02 | Accept Risk | RskEx |
| SWAM-L02 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L02 | Low | CM-4 |
| SWAM-L02 | Moderate | SI-7 |

#### *3.2.2.3* Promptly Determine and Address Needed Installation and Deinstallation of Software Sub-Capability and Defect Check SWAM-L03

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Promptly determine and address needed installation and deinstallation of software | Ensure that needed changes are addressed in a timely manner by flagging requested changes not considered (approved and implemented; or disapproved) in a timely manner as risks. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L03 | Expired actions on software authorization/deauthorization requests | Proposed changes not addressed within [organization-defined timeframe]. | 1) The actual state includes:<br>a. a list of proposed changes to the desired state.<br>b. a list of approved changes to the actual state, likely derived from the desired state specification.<br>c. the date the change was proposed and the date approved or rejected.<br>d. the date the change was implemented and the actual state automatically updated to reflect the change.<br>2) The desired state includes:<br>a. the timeframe within which proposed items are to be approved or rejected.<br>b. the timeframe within which approved changes are to be implemented in the actual state.<br>3) A defect occurs when a device in the assessment boundary:<br>a. includes a proposed change that has not been addressed within the time allowed in 2(a); or<br>b. includes an approved change that has not been implemented within the timeframe specified in 2(b). | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L03 | Automatically block unapproved changes | ISCM-Ops |
| SWAM-L03 | Automatically execute approved changes | SWMan |
| SWAM-L03 | Manually remove unapproved changes promptly | SWMan |

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L03 | Manually implement approved changes promptly | SWMan |
| SWAM-L03 | Change authorizations | DSM |
| SWAM-L03 | Accept Risk | RskEx |
| SWAM-L03 | Ensure Correct Response | DSM |

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969 **Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting
970 controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L03 | Low | SI-3(d) |
| SWAM-L03 | Moderate | SI-3(2) |
| SWAM-L03 | Moderate | SI-7 |
| SWAM-L03 | High | CM-3(1)(c) |

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### 972 *3.2.2.4* Prevent or Reduce Exploitation of Software on Devices Moving into or out of Protective Boundaries Sub-
973 Capability and Defect Check SWAM-L04

974 The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce exploitation of software on devices moving into or out of protective boundaries | Prevent exploitation of software on devices after removal, during use elsewhere, and after return (or other mobile use) by a) appropriately hardening the device prior to removal; b) checking for organizational software before removal; and c) sanitizing the device before introduction or reintroduction into the protective boundary. |

975
976 The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L04 | Devices moving in/out of protective boundaries not in | The desired state is that the device is approved for removal and reintroduction. The defect check fails if the device's | 1) The actual state includes:<br>a. the actual installed software configuration on devices approved for travel (i.e., removal and | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | policy compliance | software does not meet organization defined rules (for removal and/or reintroduction). | reintroduction). This typically consists of the presence or absence of specific software.<br>b. data identifying devices about to be used in travel (and to where).<br>c. data identifying devices reentering protective boundaries (and where else the device has been connected while removed. The locations might be validated from GPS and IP logging, if appropriate).<br>2) The desired state includes:<br>a. the list of devices authorized for travel.<br>b. the desired installed software strengthening (adding software protections and/or removing sensitive software) and/or sanitization (restoring software and/or finding and removing malicious software) for such devices, based on the location(s) to which connected while removed. (XREF to 1a and 1c)<br>3) A defect occurs when any of the following occur:<br>a. any device unauthorized for travel is either expected to be (or has actually been) traveling, regardless of installed software configuration.<br>b. a device approved for travel does not have the desired installed software configuration for the proposed uses.<br>c. a device approved for travel was connected to unapproved location(s) where its installed software configuration was not appropriate (matching the desired state) for those location(s). | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L04 | Correct configurations before allowing exit from boundary | SWMan |

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L04 | Correct configurations before allowing entry to boundary | SWMan |
| SWAM-L04 | Authorize the new state | DSM |
| SWAM-L04 | Accept Risk | RskEx |
| SWAM-L04 | Ensure Correct Response | DSM |

982
983 **Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting
984 controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L04 | Low | CM-11(b) |
| SWAM-L04 | Low | MP-6(a) |
| SWAM-L04 | Low | MP-6(b) |
| SWAM-L04 | Low | PS-4(d) |
| SWAM-L04 | Low | SI-3(b) |
| SWAM-L04 | Moderate | CM-2(7)(a) |
| SWAM-L04 | Moderate | CM-2(7)(b) |
| SWAM-L04 | Moderate | CM-7(1)(b) |
| SWAM-L04 | Moderate | CM-7(4)(a) |
| SWAM-L04 | Moderate | CM-7(4)(b) |
| SWAM-L04 | Moderate | MA-3(1) |
| SWAM-L04 | Moderate | MA-3(2) |
| SWAM-L04 | Moderate | SI-3(1) |
| SWAM-L04 | High | CM-7(5)(a) |
| SWAM-L04 | High | CM-7(5)(b) |
| SWAM-L04 | High | MP-6(1) |
| SWAM-L04 | High | MP-6(2) |
| SWAM-L04 | High | MP-6(3) |

#### 3.2.2.5 Enable Rollback and Recovery Sub-Capability and Defect Check SWAM-L05

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Enable rollback and recovery | Require the maintenance of enough prior versions of software to ensure the ability to rollback and recover in the event that issues are found with the newer software. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L05 | Number of prior versions of installed software inadequate | The number of prior versions, and/or the age of prior versions is inadequate. | 1) The actual state includes (for each device's software items):<br>a. the number of prior versions (replaced version) maintained.<br>b. the date each prior version was removed from the device.<br>c. the date the oldest version was put in service on that device.<br>2) The desired state includes:<br>a. the minimum number (n) of prior versions to be maintained.<br>b. the minimum time (t) prior versions are to be maintained.<br>3) A defect occurs when a device is connected to the assessment boundary where less than the minimum number of prior versions of the software item have been retained.<br>*Note:* The prior versions do not generally reside on the device itself, but typically on some backup media. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L05 | Reconstruct backup version(s) | SWMan |
| SWAM-L05 | Modify procedures to prevent future occurrences | RskEx |
| SWAM-L05 | Change requirements | DSM |
| SWAM-L05 | Accept Risk | RskEx |
| SWAM-L05 | Ensure Correct Response | RskEx |

995
996 **Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting
997 controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L05 | Low | CM-11(b) |
| SWAM-L05 | Moderate | CM-2(3) |

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999 ### *3.2.2.6* Prevent or Reduce Software Defects Sub-Capability and Defect Check SWAM-L06

1000 The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce software defects | Prevent or reduce the installation of software which has not been tested and validated prior to approval. |

1001
1002 The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L06 | testing and validation of software inadequate | Software items authorized and installed have inadequate testing and validation. | 1) The actual state includes (for each software item on one or more devices):<br>a. the testing and validation steps conducted for that software.<br>b. the attributes of this software (used to determine the desired level of testing, see desired state).<br>2) The desired state includes:<br>a. the software item attributes used to determine the correct amount and kind of testing and validation.<br>b) the specification of the correct amount and kind of testing and | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | validation for each combination of relevant attributes.<br>3) A defect occurs when a device connected to the assessment boundary has installed software where the amount and kind of testing and validation of the installed software is not at least as complete as the desired state specification for the software item's combination of relevant categories. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L06 | Automatically block execution of software | ISCM-Ops |
| SWAM-L06 | Remove the software | SWMan |
| SWAM-L06 | Change testing and validation requirements | DSM |
| SWAM-L06 | Accept Risk | RskEx |
| SWAM-L06 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L06 | Low | CM-4 |
| SWAM-L06 | Moderate | CM-3(2) |
| SWAM-L06 | High | CM-4(1) |

#### *3.2.2.7* Verify Ongoing Business Need for Software Sub-Capability and Defect Check SWAM-L07

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Verify ongoing business need for software | Require periodic and/or event driven consideration of whether a software item is still needed for system functionality to fulfill mission requirements in support of least functionality).<br><br>*Note:* Good practice might be to require DMs to review devices for unauthorized, unneeded or unmanaged software, and System Owners to review what software is needed in the authorization boundaries, compared to what is present. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L07 | Business need of software not recently verified | Track a software item business-need sunset date.<br>Track triggers that can require reassessment of the business need. | 1) The actual state includes (for each software item):<br>a. the date business need was last verified; and/or<br>b. whether or not a specified trigger event has occurred.<br>2) The desired state includes:<br>a. the maximum time before re-verification is required for each software item.<br>b. a software item sunset date and/or specific trigger events requiring consideration of software item relevance,<br>i. by device type and/or software item role/attributes.<br>ii. by device type and/or software item identity .<br>3) A defect occurs when a device connected to the assessment boundary:<br>a. has a software item with an expired sunset date; or<br>b. has a software item nearing an expired sunset date (to provide warning to desired state managers); or<br>c. a specified trigger event has occurred to this device or software item without re-verification of business need. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L07 | Verify business need | DSM |
| SWAM-L07 | Automatically block execution of software | ISCM-Ops |
| SWAM-L07 | Remove the software | SWMan |
| SWAM-L07 | Change requirement for verification of business need | RskEx |
| SWAM-L07 | Accept Risk | RskEx |
| SWAM-L07 | Ensure Correct Response | RskEx |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L07 | Low | CM-4 |
| SWAM-L07 | Low | CM-7(a) |
| SWAM-L07 | Moderate | CM-7(1)(a) |
| SWAM-L07 | Moderate | CM-7(4)(c) |
| SWAM-L07 | High | CM-7(5)(c) |

#### *3.2.2.8* Prevent or Reduce Unused (and thus Unneeded) Software Sub-Capability and Defect Check SWAM-L08

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce unused (and thus unneeded) software | Prevent or reduce the presence of unused (and thus unneeded) software as determined by actual usage on a given device. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L08 | Unused software present | Software items are unused long enough to provide evidence they are not needed. | 1) The actual state includes (for each software items on one or more devices):<br>a. actual software item attributes used to determine how much it | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | is expected to be used.<br>b. the last date of use.<br>c. the number of times used in an organizationally defined period.<br>2) The desired state includes:<br>a. the software item categories used to determine the expected amount of use.<br>b) the specification of the expected amount of use for each combination of relevant categories.<br>3) A defect occurs when a device connected to the assessment boundary has installed software where any of the following are true:<br>a) the last use is older than expected.<br>b) the rate of use is less than expected.<br><br>*Note:* For examples of software item attributes, some "quarterly report software" might only be expected to be used quarterly, while "annual report software" might only be used annually. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L08 | Remove the software | SWMan |
| SWAM-L08 | Change usage expectations | DSM |
| SWAM-L08 | Accept Risk | RskEx |
| SWAM-L08 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L08 | Low | CM-4 |
| SWAM-L08 | Low | CM-7(a) |
| SWAM-L08 | Moderate | CM-7(1)(a) |

#### *3.2.2.9* Ensure Software Is Required by a System Sub-Capability and Defect Check SWAM-L09

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure device-software-item level accountability | Ensure each unique combination of a device and software item (device-software-item) has accountability. Reduce duplication of effort by verifying that each unique combination of device and software-item is in one and only one authorization boundary.<br><br>*Note*: For this defect check, the relevant software item is more likely a software product than an executable. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L09 | Device-software-item assignment to authorization boundary is not 1:1 | Each device-software-item combination is assigned to one and only one authorization boundary. | 1) The actual state includes the authorization boundary(ies) to which the device-software-item combination is assigned in the desired state.<br>2) The desired state is that each device-software-item combination is in one and only one authorization boundary, and thus has a clearly defined management responsibility.<br>3) A defect occurs when an actual state device-software-item combination is:<br>a. not listed in any authorization boundary; or<br>b. listed in more than one authorization boundary. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the

overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L09 | Block the software | ISCM-Ops |
| SWAM-L09 | Remove the software | SWMan |
| SWAM-L09 | Adjust authorization boundary assignment | DSM |
| SWAM-L09 | Accept Risk | RskEx |
| SWAM-L09 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L09 | Low | CM-11(b) |
| SWAM-L09 | Moderate | CM-8(5) |

#### *3.2.2.10* Ensure that Software Complies with License Agreements Sub-Capability and Defect Check SWAM-L10

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure that software complies with license agreements | Ensure that actual usage of software products complies with license agreements. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L10 | Unlicensed software | In aggregate, software products are used in compliance with license terms and conditions. | 1) The actual state includes<br>a) the inventory of each unique combination of a device and software product (device-software-products) installed.<br>b) data (such as number installed, numbers concurrently used, amount of use, copies of installation media, protection of media) to | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | determine the extent of license compliance for each software product.<br>2) The desired state includes the criteria (such as number allowed to be installed, number concurrently allowed to be used, limits to installation on specific devices, and amount of use) needed to determine license compliance for each software product.<br>3) A defect occurs when the actual state of a software-product is not in compliance with the desired state. For example:<br>a. the criteria in 2) might be that 80 copies may be installed, but the actual state of 1.a) is that 85 are installed<br>b) the criteria in 2) might limit concurrent users to 100, but the actual state in 1.b) might indicate that there are periods with up to 125 concurrent users.<br>c) The criteria in 2) might limit hours of use to 1000, but the actual state in 1.b) might indicate that 1010 hours were used.<br><br>Note 1: The criteria in 2) might limit the use of installation media to organizationally owned devices, but 1) and 2) might be expanded to indicate that such media have been distributed to be used on other devices. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L10 | Block the software | ISCM-Ops |
| SWAM-L10 | Remove the software | SWMan |
| SWAM-L10 | Obtain/Renew the license | SWMan |
| SWAM-L10 | Adjust usage | RskEx |
| SWAM-L10 | Accept Risk | RskEx |
| SWAM-L10 | Ensure Correct Response | RskEx |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L10 | Low | CM-4 |
| SWAM-L10 | Low | CM-10(a) |
| SWAM-L10 | Low | CM-10(b) |
| SWAM-L10 | Low | CM-10(c) |
| SWAM-L10 | Low | CM-11(b) |

#### *3.2.2.11* Avoid Self-Denial of Service Sub-Capability and Defect Check SWAM-L11

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Avoid self-denial of service | Ensure that required software is present. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L11 | Required software not installed | Required software is not installed. | 1) The actual state includes the inventory of software installed on the device(s).<br>2) The desired state includes the list of required software for the device(s).<br>3) A defect occurs when a software item is required and not installed. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L11 | Install missing required software | SWMan |
| SWAM-L11 | Remove requirement | DSM |
| SWAM-L11 | Accept Risk | RskEx |
| SWAM-L11 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L11 | Low | CM-4 |
| SWAM-L11 | Low | CM-11(b) |

#### *3.2.2.12* Ensure that Software is Managed Sub-Capability and Defect Check SWAM-L12

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Ensure that software is managed | Ensure clear responsibility for software installation/deinstallation to facilitate the actual installation of only the authorized software for the device. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L12 | Unmanaged software | Authorized software product is installed on a device, but does not have an authorized installer. | 1) The actual state is the list of software product installation managers assigned to manage each installed software product (and/or to remove unauthorized products) on each device.<br>2) The desired state specification the list of approved software product installation managers for:<br>a) each software product type or product; and<br>b) each device type or device.<br>3) A defect is an authorized installed software product where<br>a) no software product installation manager is specified, or | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | b) the specified software product installation manager is not authorized for that software product (or type) on that device (or type).<br><br>*Note:* The SWAM-F01, SWAM-F02, and SWAM-F03 status must be known to assess HWAM-F02, in order to avoid requiring an installer account for unauthorized software. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L12 | Block the software | ISCM-Ops |
| SWAM-L12 | Remove the software when no SWMan assigned | DM |
| SWAM-L12 | Assign an appropriate SWMan | DSM |
| SWAM-L12 | Accept Risk | RskEx |
| SWAM-L12 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L12 | Low | CM-8(4) |
| SWAM-L12 | Low | CM-11(b) |

### *3.2.2.13* Increase Software Maintainability and Integrity Sub-Capability and Defect Check SWAM-L13

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Increase software maintainability and integrity | Ensures that only software with warranty and/or source code is authorized so that it can be maintained. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L13 | Software without warranty and/or source code | Software products have warranty and/or source code, as determined necessary. | 1) The actual state includes, for each software product installed on at least one device in the assessment boundary the availability of (based on having such items under configuration management):<br>a) source code for the product.<br>b) a general warranty for the product.<br>c) a commitment to find and fix security defects for the product and information about the software product necessary to determine which of the preceding items is required for that product (e.g., whether software is COTS, GOTS, or custom software).<br>2) The desired state includes:<br>the criteria (needed to determine whether source code and/or specific warranty terms are required for a software product.<br>3) A defect occurs when a software-product's nature requires the organization to have source code and or specific warranty terms, which the software product does not provide. | TBD |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L13 | Automatically block execution of software | ISCM-Ops |
| SWAM-L13 | Manually remove the software | SWMan |
| SWAM-L13 | Obtain the missing warranty, documentation, etc. | RskEx |
| SWAM-L13 | Accept Risk | RskEx |
| SWAM-L13 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L13 | Low | CM-4 |
| SWAM-L13 | Low | CM-11(b) |
| SWAM-L13 | High | SI-7(14)(a) |

#### *3.2.2.14* Prevent or Reduce Malware Sub-Capability and Defect Check SWAM-L14

The purpose of this sub-capability is defined as follows:

| Sub-Capability Name | Sub-Capability Purpose |
|---|---|
| Prevent or reduce malware | Ensures that legacy black-listing methods such as anti-virus protection and spam filters are in place to block the most obvious sources of malware, as judged needed by the organization. |

The defect check to assess whether this sub-capability is operating effectively is defined as follows:

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| SWAM-L14 | Poor AV protection | Blacklisting products in use have current blacklist definitions, and are operating with an organizationally defined frequency. | 1) The actual state is the:<br>a) list of software blacklisting products or mechanisms operating.<br>b) the kinds of operations they are doing.<br>c) the date the blacklist was last updated.<br>2) The desired state specification the list of approved software product installation managers for:<br>a) list of software blacklisting products or mechanisms expected to be operating.<br>b) the kinds of operations they are expected to be doing.<br>c) the expected frequency with which they are to be updated. | TBD |

| Defect Check ID | Defect Check Name | Assessment Criteria Summary | Assessment Criteria Notes | Selected |
|---|---|---|---|---|
| | | | 3) A defect is a blacklisting product or mechanism:<br>a) expected to be present, but which is not; or<br>b) not performing its expected operations; or<br>c) not last updated within the expected frequency. | |

**Example Responses:** The following potential responses (with example primary responsibility assignments) are common actions and are appropriate when defects are discovered in this sub-capability. The example primary responsibility assignments do not change the overall management responsibilities defined in other NIST guidance. Moreover, the response actions and responsibilities can be customized by each organization to best adapt to local circumstances.

| Defect Check ID | Potential Response Action | Primary Responsibility |
|---|---|---|
| SWAM-L14 | Install Blacklisting solutions where missing | SWMan |
| SWAM-L14 | Remove the requirement | DSM |
| SWAM-L14 | Accept Risk | RskEx |
| SWAM-L14 | Ensure Correct Response | DSM |

**Supporting Control Items:** This sub-capability is supported by the following control items. Thus, if any of the following supporting controls fail, the defect check fails and overall risk is likely to increase.

| Defect Check ID | Baseline | SP 800-53 Control Item Code |
|---|---|---|
| SWAM-L14 | Low | CM-4 |
| SWAM-L14 | Low | SI-3(a) |
| SWAM-L14 | Low | SI-3(b) |
| SWAM-L14 | Low | SI-3(c) |

### 3.2.3 Security Impact of Each Sub-Capability on an Attack Step Model

Table 6 shows the primary ways the defect checks derived from the SP 800-53 security controls contribute to blocking attacks/events as described in Figure 1: SWAM Impact on an Attack Step Model.

**Table 6: Mapping of Attack Steps to Security Sub-Capability**

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| 1) Gain Internal Entry | The attacker is outside the target boundaries and seeks entry. Examples include: spear phishing email sent; DDoS attack against .gov initiated; unauthorized person attempts to gain physical access to restricted facility. | Ensure that software is managed SWAM-L12 | Ensure clear responsibility for software installation/deinstallation to facilitate the actual installation of only the authorized software for the device. |
| 1) Gain Internal Entry | The attacker is outside the target boundaries and seeks entry. Examples include: spear phishing email sent; DDoS attack against .gov initiated; unauthorized person attempts to gain physical access to restricted facility. | Prevent or reduce exploitation of software on devices moving into or out of protective boundaries SWAM-L04 | Prevent exploitation of software on devices after removal, during use elsewhere, and after return (or other mobile use) by a) appropriately hardening the device prior to removal; b) checking for organizational software before removal; and c) sanitizing the device before introduction or reintroduction into the protective boundary. |
| 1) Gain Internal Entry | The attacker is outside the target boundaries and seeks entry. Examples include: spear phishing email sent; DDoS attack against .gov initiated; unauthorized person attempts to gain physical access to restricted facility. | Prevent or reduce software defects SWAM-L06 | Prevent or reduce the installation of software which has not been tested and validated prior to approval. |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence. Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | Ensure or increase integrity of software authorizers SWAM-L01 | Prevent or reduce the insertion of malware into the list of approved software by unauthorized persons. |

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | Increase software maintainability and integrity SWAM-L13 | Ensures that only software with warranty and/or source code is authorized so that it can be maintained. |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | Prevent or reduce (careless or malicious) software approval SWAM-L02 | Ensure checks and balances are in place to prevent a single individual from carelessly or maliciously changing authorization of software installation.<br><br>*Note 1*: The organization might choose to use access restrictions to enforce multiple approvals. If so, that would be assessed under the PRIV capability.<br>*Note 2:* See SWAM-L09 for authorization boundary. |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | Prevent or reduce execution of software from unauthorized installers SWAM-F02 | Prevent or reduce the execution of software (presumed malware) not installed by an authorized installer. |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and | Prevent or reduce software defects SWAM-L06 | Prevent or reduce the installation of software which has not been tested and validated prior to approval. |

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| | initiates call back; person gains unauthorized access to server room. | | |
| 3) Gain Foothold | The attacker has gained entry to the assessment object and achieves enough compromise to gain a foothold, but without persistence.<br>Examples include: Unauthorized user successfully logs in with authorized credentials; browser exploit code successfully executed in memory and initiates call back; person gains unauthorized access to server room. | Prevent unauthorized software from executing SWAM-F01 | Prevent or reduce the execution of unauthorized software (presumed malware). |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence.<br>Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Ensure device-software-item level accountability SWAM-L09 | Ensure each unique combination of a device and software item (device-software-item) has accountability. Reduce duplication of effort by verifying that each unique combination of device and software-item is in one and only one authorization boundary.<br><br>*Note:* For this defect check, the relevant software item is more likely a software product than an executable. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence.<br>Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Ensure or increase integrity of software authorizers SWAM-L01 | Prevent or reduce the insertion of malware into the list of approved software by unauthorized persons. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence.<br>Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized | Ensure or increase trust of system software at startup SWAM-F04 | Prevent or reduce the insertion of malware into key system components before or during system startup. |

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| | personnel added to ACL for server room. | | |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Ensure that software complies with license agreements SWAM-L10 | Ensure that actual usage of software products complies with license agreements. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Ensure that software is managed SWAM-L12 | Ensure clear responsibility for software installation/deinstallation to facilitate the actual installation of only the authorized software for the device. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Increase software maintainability and integrity SWAM-L13 | Ensures that only software with warranty and/or source code is authorized so that it can be maintained. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Prevent or reduce (careless or malicious) software approval SWAM-L02 | Ensure checks and balances are in place to prevent a single individual from carelessly or maliciously changing authorization of software installation.<br><br>*Note 1:* The organization might choose to use access restrictions to enforce multiple approvals. If so, that would be assessed under the PRIV capability.<br>*Note 2:* See SWAM-L09 for authorization boundary. |
| 4) Gain Persistence | The attack has gained a foothold on the | Prevent or reduce | Prevent or reduce the execution of software (presumed |

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| | object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | execution of software from unauthorized installers SWAM-F02 | malware) not installed by an authorized installer. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Prevent or reduce malware SWAM-L14 | Ensures that legacy black-listing methods such as anti-virus protection and spam filters are in place to block the most obvious sources of malware, as judged needed by the organization. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Prevent or reduce software execution from unauthorized location SWAM-F03 | Prevent or reduce the execution of software (presumed malware) not loaded from a controlled and authorized location. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Prevent or reduce unused (and thus unneeded) software SWAM-L08 | Prevent or reduce the presence of unused (and thus unneeded) software as determined by actual usage on a given device. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on | Promptly determine and address needed installation and | Ensure that needed changes are addressed in a timely manner by flagging requested changes not considered (approved and implemented; or disapproved) in a timely |

| Attack Step | Attack Step Description | Sub-Capability Name and ID | Sub-Capability Purpose |
|---|---|---|---|
| | host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | deinstallation of software SWAM-L03 | manner as risks. |
| 4) Gain Persistence | The attack has gained a foothold on the object and now achieves persistence. Examples include: Malware installed on host that survives reboot or log off; BIOS or kernel modified; new/privileged account created for unauthorized user; unauthorized person issued credentials/allowed access; unauthorized personnel added to ACL for server room. | Verify ongoing business need for software SWAM-L07 | Require periodic and/or event driven consideration of whether a software item is still needed for system functionality to fulfill mission requirements in support of least functionality).<br><br>*Note:* Good practice might be to require DMs to review devices for unauthorized, unneeded or unmanaged software, and System Owners to review what software is needed in the authorization boundaries, compared to what is present. |
| 6) Achieve Attack Objective | The attacker achieves an objective. Loss of confidentiality, integrity, or availability of data or system capability. Examples include: Exfiltration of files; modification of database entries; deletion of file or application; denial of service; disclosure of PII. | Avoid self-denial of service SWAM-L11 | Ensure that required software is present. |
| 6) Achieve Attack Objective | The attacker achieves an objective. Loss of confidentiality, integrity, or availability of data or system capability. Examples include: Exfiltration of files; modification of database entries; deletion of file or application; denial of service; disclosure of PII. | Enable rollback and recovery SWAM-L05 | Require the maintenance of enough prior versions of software to ensure the ability to rollback and recover in the event that issues are found with the newer software. |
| 6) Achieve Attack Objective | The attacker achieves an objective. Loss of confidentiality, integrity, or availability of data or system capability. Examples include: Exfiltration of files; modification of database entries; deletion of file or application; denial of service; disclosure of PII. | Ensure that software complies with license agreements SWAM-L10 | Ensure that actual usage of software products complies with license agreements. |

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## 3.3 SWAM Control (Item) Security Assessment Plan Narrative Tables and Templates

The security assessment plan narratives in this section are designed to provide the core of an assessment plan for the automated assessment, as described in Section 6 of Volume 1 of this NISTIR. The narratives are supplemented by the other material in this section, including defect check tables (defining the tests to be used) and are summarized in the Control Allocation Tables in Section 3.4.

The roles referenced in the narratives match the roles defined by NIST in relevant special publications (SP 800-37, etc.) and/or the SWAM-specific roles defined in Section 2.7. The roles can be adapted and/or customized to the organization as described in the introduction to Section 3.

The determination statements listed here have been derived from the relevant control item language, specifically modified by the following adjustments:

(1) The phrase {software} has been added where necessary for control items that apply to more areas than just SWAM. This language tailors the control item to remain within SWAM. In this case, the same control item is likely to appear in other capabilities with the relevant scoping for that capability. For example, most Configuration Management (CM) family controls apply not only to hardware CM, but also to software CM. Only the software CM aspect is relevant to the SWAM capability, so that is what is covered in this volume.

(2) The phrases {actual state} or {desired state specification} have been added to determination statements where both actual and desired state are needed for automated testing but where this was implicit in the original statement of the control. For example, CM-8a has two determination statements that are identical except that determination statement CM-8a(1) applies to the actual state, and determination statement CM-8a(2) applies to the desired state specification.

(3) Where a control item includes inherently different actions that are best assessed by different defect checks (typically, because the assessment criteria are different), the control item may be divided into multiple SWAM-applicable determination statements.

(4) Part of a control item may not apply to SWAM, while another part does. To address this issue, the determination statements in this volume include only the portion of the control item applicable to the SWAM capability. The portion of the control item that does not apply is documented by a note under the control item and included with other capabilities, as appropriate.

### 3.3.1 Outline Followed for Each Control Item

The literal text of the control item follows the heading *Control Item Text*.

There may be one or more determination statements for each control item. Each determination statement is documented in a table, noting the:

- determination statement ID (Control Item ID concatenated with the Determination Statement Number, where Determination Number is enclosed in curly brackets);
- determination statement text;
- implemented by (responsibility);
- assessment boundary;
- assessment responsibility;
- assessment method;
- selected column (TBD by the organization);
- rationale for risk acceptance (thresholds) (TBD by the organization);
- frequency of assessment;[14] and
- impact of not implementing the defect check (TBD by the organization).

The determination statement details are followed by a table showing the defect checks (and related sub-capability) that might be caused to fail if the control being tested fails.

The resulting text provides a template for the organization to edit, as described in Section 3.1.

### 3.3.2 Outline Organized by Baselines

This section includes security control items selected in the SP 800-53 Low, Moderate, and High baselines and that support the SWAM capability. For convenience, the control items are presented in three sections as follows:

(1) **Low Baseline Control Items** (Section 3.3.3). Security control items in the low baseline, which are required for all systems.

(2) **Moderate Baseline Control Items** (Section 3.3.4). Security control items in the moderate baseline, which are also required for the high baseline.

(3) **High Baseline Control Items** (Section 3.3.5). Security control items that are required only for the high baseline.

Table 7 illustrates the applicability of the security control items to each baseline.

[14] While automated tools may be able to assess as frequently as every 3-4 days, organizations determine the appropriate assessment frequency in accordance with the ISCM strategy.

1195 **Table 7: Applicability of Control Items**

| FIPS-199[a] (SP 800-60)[b] System Impact Level | (1) Low Control Items (Section 3.3.3) | (2) Moderate Control Items (Section 3.3.4) | (3) High Control Items (Section 3.3.5) |
|---|---|---|---|
| Low | Applicable | | |
| Moderate | Applicable | Applicable | |
| High | Applicable | Applicable | Applicable |

1196 [a] FIPS-199 defines Low, Moderate, and High overall potential impact designations.
1197 [b] See SP 800-60, Section 3.2.

## 3.3.3 Low Baseline Security Control Item Narratives

### *3.3.3.1* Control Item CM-4: SECURITY IMPACT ANALYSIS

**Control Item Text**

Control: The organization analyzes changes to the information system to determine potential security impacts prior to change implementation.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-4{1} | Determine if the organization: analyzes changes to the information system {software} to determine potential security impacts prior to change implementation. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-4{1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in analyzing changes to the information system {software} to determine potential security impacts prior to change implementation related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-4{1} | SWAM-L01 | Unapproved authorizer | lack of verification that software was authorized by approved accounts (persons). |
| CM-4{1} | SWAM-L02 | Required authorizations | careless or malicious authorization of software. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in analyzing changes to the information system {software} to determine potential security impacts prior to change implementation related to this control item** might be the cause of ... |
|---|---|---|---|
| | | missing | |
| CM-4{1} | SWAM-L06 | testing and validation of software inadequate | lack of adequate testing and validation. |
| CM-4{1} | SWAM-L07 | Business need of software not recently verified | the presence of software without a recently verified need. |
| CM-4{1} | SWAM-L08 | Unused software present | the presence of unneeded software and an increase in the attack surface. |
| CM-4{1} | SWAM-L10 | Unlicensed software | use of software not in compliance with license agreements. |
| CM-4{1} | SWAM-L11 | Required software not installed | absence of required software. |
| CM-4{1} | SWAM-L13 | Software without warranty and/or source code | the presence of software without warranty and/or source code. |
| CM-4{1} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

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### *3.3.3.2* Control Item CM-7(a): LEAST FUNCTIONALITY

**Control Item Text**

Control: The organization:

a. Configures the information system to provide only essential capabilities.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(a){1} | Determine if the organization: configures the system {installed software} to provide only essential capabilities. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in configuring the system {installed software} to provide only essential capabilities related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(a){1} | SWAM-L07 | Business need of software not recently verified | the presence of software without a recently verified need. |
| CM-7(a){1} | SWAM-L08 | Unused software present | the presence of unneeded software and an increase in the attack surface. |

### *3.3.3.3* Control Item CM-7(b): LEAST FUNCTIONALITY

**Control Item Text**

Control: The organization:

b. Prohibits or restricts the use of the following functions, ports, protocols, and/or services: [Assignment: organization-defined prohibited or restricted functions, ports, protocols, and/or services].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(b){1} | Determine if the organization: prohibits or restricts the use of the following {installed software} functions and/or services: [Assignment: organization-defined prohibited or restricted functions and/or services]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in prohibiting or restricting the use of specified {installed software} functions and/or services related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(b){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |

### *3.3.3.4* Control Item CM-8(a): INFORMATION SYSTEM COMPONENT INVENTORY

**Control Item Text**

Control: The organization:

a. Develops and documents an inventory of information system components that:

1. Accurately reflects the current information system;

2. Includes all components within the authorization boundary of the information system;

3. Is at the level of granularity deemed necessary for tracking and reporting; and

4. Includes [Assignment: organization-defined information deemed necessary to achieve effective information system component accountability].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(a){1} | Determine if the organization: develops and documents an inventory of system components {for software} that: (1) accurately reflects the current system; and (2) includes all components within the authorization boundary of the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

1253 **Defect Check Rationale Table:**

1254 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in developing and documenting an inventory of system components which is accurate, complete, detailed, and has specified information related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(a){1} | SWAM-Q01 | Non-reporting of device-level SWAM information | a device failing to report within the specified time frame. |
| CM-8(a){1} | SWAM-Q02 | Non-reporting of defect checks | specific defect checks failing to report. |
| CM-8(a){1} | SWAM-Q03 | Low completeness-metric | completeness of overall ISCM reporting not meeting the threshold. |

1255

1256 **Determination Statement 2:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(a){2} | Determine if the organization: develops and documents an inventory of system components {for software} that is at the level of granularity deemed necessary for tracking and reporting [by the organization]. |

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1258 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(a){2} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

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1260 **Defect Check Rationale Table:**

1261 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in developing and documenting the inventory of system components {software} at the level of granularity deemed necessary by the organization for tracking and reporting related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(a){2} | SWAM-Q01 | Non-reporting of device-level SWAM information | a device failing to report within the specified time frame. |
| CM-8(a){2} | SWAM-Q02 | Non-reporting of defect checks | specific defect checks failing to report. |
| CM-8(a){2} | SWAM-Q03 | Low completeness-metric | completeness of overall ISCM reporting not meeting the threshold. |

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### *3.3.3.5* Control Item CM-8(b): INFORMATION SYSTEM COMPONENT INVENTORY

**Control Item Text**

Control: The organization:

b. Reviews and updates the information system component inventory [Assignment: organization-defined frequency].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(b){1} | Determine if the organization: updates the system component inventory {for software} [Assignment: organization-defined frequency]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in updating the system {installed software} component inventory with the organization-defined frequency related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(b){1} | SWAM-Q04 | Poor timeliness metric | poor timeliness of overall ISCM reporting. |

1279 **Determination Statement 2:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(b){2} | Determine if the organization: reviews the system component inventory {for software} [Assignment: organization-defined frequency]. |

1280

1281 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(b){2} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

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1283 **Defect Check Rationale Table:**

1284 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in reviewing the system component {software} inventory with the organization-defined frequency related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(b){2} | SWAM-Q04 | Poor timeliness metric | poor timeliness of overall ISCM reporting. |

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### *3.3.3.6* Control Item CM-8(4): INFORMATION SYSTEM COMPONENT INVENTORY | ACCOUNTABILITY INFORMATION

**Control Item Text**

The organization includes in the information system component inventory information, a means for identifying by [Selection (one or more): name; position; role], individuals responsible/accountable for administering those components.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(4){1} | Determine if the organization: includes in the {installed software} system component inventory information, a means for identifying by [Selection (one or more): name; position; role], individuals responsible/accountable for administering those components. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(4){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in including in the {installed software} system component inventory information a means for identifying individuals responsible or accountable for administering those components related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(4){1} | SWAM-L12 | Unmanaged software | the presence of unmanaged software. |

### *3.3.3.7* Control Item CM-10(a): SOFTWARE USAGE RESTRICTIONS

**Control Item Text**

Control: The organization:

a. Uses software and associated documentation in accordance with contract agreements and copyright laws.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-10(a){1} | Determine if the organization: uses software and associated documentation in accordance with contract agreements and copyright laws. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-10(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in using software and associated documentation in accordance with contract agreements and copyright laws related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-10(a){1} | SWAM-L10 | Unlicensed software | use of software not in compliance with license agreements. |

### *3.3.3.8* Control Item CM-10(b): SOFTWARE USAGE RESTRICTIONS

**Control Item Text**

Control: The organization:

b. Tracks the use of software and associated documentation protected by quantity licenses to control copying and distribution.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-10(b){1} | Determine if the organization: tracks the use of software protected by quantity licenses to control copying and distribution. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-10(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in tracking the use of software protected by quantity licenses to control copying and distribution related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-10(b){1} | SWAM-L10 | Unlicensed software | use of software not in compliance with license agreements. |

1331 **Determination Statement 2:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-10(b){2} | Determine if the organization: tracks the use of software associated documentation protected by quantity licenses to control copying and distribution. |

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1333 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-10(b){2} | DSM | ISCM-TN | MAN | TBD | | | | |

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1335 **Defect Check Rationale Table:**

1336 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

1337 N/A because tested manually.

1338

1339

### *3.3.3.9* Control Item CM-10(c): SOFTWARE USAGE RESTRICTIONS

**Control Item Text**

Control: The organization:

c. Controls and documents the use of peer-to-peer file sharing technology to ensure that this capability is not used for the unauthorized distribution, display, performance, or reproduction of copyrighted work.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-10(c){1} | Determine if the organization: controls and documents the use of peer-to-peer file sharing technology to ensure that this capability is not used for the unauthorized distribution, display, performance, or reproduction of copyrighted work. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-10(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in controlling and documenting the use of peer-to-peer file sharing technology related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-10(c){1} | SWAM-L10 | Unlicensed software | use of software not in compliance with license agreements. |

### *3.3.3.10* Control Item CM-11(a): USER-INSTALLED SOFTWARE

**Control Item Text**

Control: The organization:

a. Establishes [Assignment: organization-defined policies] governing the installation of software by users.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-11(a){1} | Determine if the organization: establishes [Assignment: organization-defined policies] governing the installation of software by users. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-11(a){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in establishing policies governing the installation of software by users related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-11(a){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |

### *3.3.3.11* Control Item CM-11(b): USER-INSTALLED SOFTWARE

**Control Item Text**

Control: The organization:

b. Enforces software installation policies through [Assignment: organization-defined methods].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-11(b){1} | Determine if the organization: enforces software installation policies through [Assignment: organization-defined methods]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-11(b){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in enforcing software installation policies through specified methods related to this control item** might be the cause of .. |
|---|---|---|---|
| CM-11(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-11(b){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-11(b){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in enforcing software installation policies through specified methods related to this control item** might be the cause of .. |
|---|---|---|---|
| CM-11(b){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| CM-11(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |
| CM-11(b){1} | SWAM-L05 | Number of prior versions of installed software inadequate | lack of prior versions of installed software to enable rollback and recovery. |
| CM-11(b){1} | SWAM-L09 | Device-software-item assignment to authorization boundary is not 1:1 | unclear management responsibility that could lead to unmanaged components. |
| CM-11(b){1} | SWAM-L10 | Unlicensed software | use of software not in compliance with license agreements. |
| CM-11(b){1} | SWAM-L11 | Required software not installed | absence of required software. |
| CM-11(b){1} | SWAM-L12 | Unmanaged software | the presence of unmanaged software. |
| CM-11(b){1} | SWAM-L13 | Software without warranty and/or source code | the presence of software without warranty and/or source code. |

### *3.3.3.12* Control Item CM-11(c): USER-INSTALLED SOFTWARE

**Control Item Text**

Control: The organization:

c. Monitors policy compliance at [Assignment: organization-defined frequency].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-11(c){1} | Determine if the organization: monitors policy compliance for {installed software} at [Assignment: organization-defined frequency]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-11(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in monitoring policy compliance for {installed software} at the specified frequency related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-11(c){1} | SWAM-Q04 | Poor timeliness metric | poor timeliness of overall ISCM reporting. |

### *3.3.3.13* Control Item MP-6(a): MEDIA SANITIZATION

**Control Item Text**

Control: The organization:

a. Sanitizes [Assignment: organization-defined information system media] prior to disposal, release out of organizational control, or release for reuse using [Assignment: organization-defined sanitization techniques and procedures] in accordance with applicable federal and organizational standards and policies.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MP-6(a){1} | Determine if the organization: sanitizes {to remove software} [Assignment: organization-defined information system media] prior to disposal, release out of organizational control, or release for reuse using [Assignment: organization-defined sanitization techniques and procedures] in accordance with applicable federal and organizational standards and policies. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MP-6(a){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in sanitizing {to remove software} media before moving to high risk areas, as required, using approved methods related to this control item** might be the cause of ... |
|---|---|---|---|
| MP-6(a){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.3.14* Control Item MP-6(b): MEDIA SANITIZATION

**Control Item Text**

Control: The organization:

b. Employs sanitization mechanisms with the strength and integrity commensurate with the security category or classification of the information.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MP-6(b){1} | Determine if the organization: employs sanitization mechanisms {to remove software} with the strength and integrity commensurate with the security category or classification of the information. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MP-6(b){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing sanitization mechanisms {to remove software} with the strength and integrity commensurate with the security category or classification of the information related to this control item** might be the cause of ... |
|---|---|---|---|
| MP-6(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.3.15* Control Item PS-4(d): PERSONNEL TERMINATION

**Control Item Text**

Control: The organization, upon termination of individual employment:

d. Retrieves all security-related organizational information system-related property.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| PS-4(d){1} | Determine if the organization: retrieves all security-related organizational system-related {software and software media} property. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| PS-4(d){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in retrieving all security-related organizational system-related {software and software media} property related to this control item** might be the cause of ... |
|---|---|---|---|
| PS-4(d){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.3.16* Control Item SI-3(a): MALICIOUS CODE PROTECTION

**Control Item Text**

Control: The organization:

a. Employs malicious code protection mechanisms at information system entry and exit points to detect and eradicate malicious code.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(a){1} | Determine if the organization: employs malicious code protection mechanisms at system entry and exit points to detect and eradicate malicious code. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing malicious code protection mechanisms at system entry and exit points to detect and eradicate malicious code related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(a){1} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

### *3.3.3.17* Control Item SI-3(b): MALICIOUS CODE PROTECTION

**Control Item Text**

Control: The organization:

b. Updates malicious code protection mechanisms whenever new releases are available in accordance with organizational configuration management policy and procedures.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(b){1} | Determine if the organization: updates malicious code protection mechanisms whenever new releases are available in accordance with organizational configuration management policy and procedures. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(b){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in updating malicious code protection mechanisms whenever new releases are available in accordance with organizational configuration management policy and procedures related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| SI-3(b){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| SI-3(b){1} | SWAM- | Unauthorized software | the execution of software not loaded from an approved directory/folder location. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in updating malicious code protection mechanisms whenever new releases are available in accordance with organizational configuration management policy and procedures related to this control item** might be the cause of ... |
|---|---|---|---|
| | F03 | directory/folder location | |
| SI-3(b){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| SI-3(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |
| SI-3(b){1} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

### *3.3.3.18* Control Item SI-3(c): MALICIOUS CODE PROTECTION

**Control Item Text**

Control: The organization:

c. Configures malicious code protection mechanisms to:

1. Perform periodic scans of the information system [Assignment: organization-defined frequency] and real-time scans of files from external sources at [Selection (one or more); endpoint; network entry/exit points] as the files are downloaded, opened, or executed in accordance with organizational security policy; and

2. [Selection (one or more): block malicious code; quarantine malicious code; send alert to administrator; [Assignment: organization-defined action]] in response to malicious code detection.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(c){1} | Determine if the organization: configures malicious code protection mechanisms to perform periodic scans of [software and files that might include hidden software] at an [Assignment: organization-defined frequency] on [devices]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in configuring malicious code protection mechanisms to perform periodic scans of {software and files} on mass storage, as specified related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(c){1} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

1483
1484 **Determination Statement 2:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(c){2} | Determine if the organization: configures malicious code protection mechanisms to perform scans of software and files that might include hidden software at network entry/exit points as the files are downloaded. |

1485
1486 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(c){2} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

1487
1488 **Defect Check Rationale Table:**
1489 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in configuring malicious code protection mechanisms to perform periodic scans of {software and files} at entry and exit points related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(c){2} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

1490
1491 **Determination Statement 3:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(c){3} | Determine if the organization: configures malicious code protection mechanisms to perform scans of [software and files that might include hidden software] when opened or executed. |

1492

1493 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(c){3} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

1494

1495 **Defect Check Rationale Table:**

1496 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in configuring malicious code protection mechanisms to perform periodic scans of {software and files} when opened or executed related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(c){3} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| SI-3(c){3} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

1497

1498 **Determination Statement 4:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(c){4} | Determine if the organization: configures malicious code protection mechanisms to take one or more of the following action(s) when malicious software is detected: [Selection (one or more): block malicious code; quarantine malicious code; send alert to administrator]. |

1499

1500 **Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(c){4} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

1501

1502 **Defect Check Rationale Table:**

1503 **A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in configuring malicious code protection mechanisms to take specific protective actions when malicious software is detected related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(c){4} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| SI-3(c){4} | SWAM-L14 | Poor AV protection | absence of methods to block obvious sources of malware. |

1504
1505
1506

### *3.3.3.19* Control Item SI-3(d): MALICIOUS CODE PROTECTION

**Control Item Text**

Control: The organization:

d. Addresses the receipt of false positives during malicious code detection and eradication and the resulting potential impact on the availability of the information system.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(d){1} | Determine if the organization: addresses the receipt of false positives during malicious code detection and eradication and the resulting potential impact on the availability of the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(d){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in addressing the receipt of false positives during malicious code detection and eradication and the resulting potential impact on the availability of the system related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(d){1} | SWAM-L03 | Expired actions on software authorization/deauthorization requests | requested changes not being addressed in a timely manner. |

## 3.3.4 Moderate Baseline Security Control Item Narratives

### *3.3.4.1* Control Item CM-2(3): BASELINE CONFIGURATION | RETENTION OF PREVIOUS CONFIGURATIONS

**Control Item Text**

The organization retains [Assignment: organization-defined previous versions of baseline configurations of the information system] to support rollback.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-2(3){1} | Determine if the organization: retains [Assignment: organization-defined previous versions of baseline configurations of the information system] to support rollback. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-2(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in maintaining an adequate number of prior software baseline versions to support rollback related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-2(3){1} | SWAM-L05 | Number of prior versions of installed software inadequate | lack of prior versions of installed software to enable rollback and recovery. |

### *3.3.4.2* Control Item CM-2(7)(a): BASELINE CONFIGURATION | CONFIGURE SYSTEMS, COMPONENTS, OR DEVICES FOR HIGH-RISK AREAS

**Control Item Text**

The organization:

(a) Issues [Assignment: organization-defined information systems, system components, or devices] with [Assignment: organization-defined configurations] to individuals traveling to locations that the organization deems to be of significant risk.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-2(7)(a){1} | Determine if the organization: issues [Assignment: organization-defined information systems, system components, or devices] with [Assignment: organization-defined configurations] to individuals traveling to locations that the organization deems to be of significant risk. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-2(7)(a){1} | SWMan | ISCM-TN | ISCM-Sys | TEST | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>above [the organization-defined threshold], **then defects in issuing [Assignment: organization-defined information systems, system components, or devices] with [Assignment: organization-defined configurations] to individuals traveling to locations that the organization deems to be of significant risk related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-2(7)(a){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** above [the organization-defined threshold], **then defects in issuing [Assignment: organization-defined information systems, system components, or devices] with [Assignment: organization-defined configurations] to individuals traveling to locations that the organization deems to be of significant risk related to this control item** might be the cause of ... |
|---|---|---|---|
| | | policy compliance | |

### *3.3.4.3* Control Item CM-2(7)(b): BASELINE CONFIGURATION | CONFIGURE SYSTEMS, COMPONENTS, OR DEVICES FOR HIGH-RISK AREAS

**Control Item Text**

The organization:

(b) Applies [Assignment: organization-defined security safeguards] to the devices when the individuals return.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-2(7)(b){1} | Determine if the organization: applies [Assignment: organization-defined security safeguards] to the devices when the individuals return. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-2(7)(b){1} | SWMan | ISCM-TN | ISCM-Sys | TEST | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in applying [Assignment: organization-defined security safeguards] to the devices when the individuals return related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-2(7)(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.4* Control Item CM-3(b): CONFIGURATION CHANGE CONTROL

**Control Item Text**

Control: The organization:

b. Reviews proposed configuration-controlled changes to the information system and approves or disapproves such changes with explicit consideration for security impact analyses.

**Determination Statement 2:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-3(b){2} | Determine if the organization: explicitly considers security impact analysis when reviewing proposed configuration-controlled changes to the {software of the} system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-3(b){2} | DSM | ISCM-TN | MAN | TBD | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

N/A because tested manually.

### *3.3.4.5* Control Item CM-7(1)(a): LEAST FUNCTIONALITY | PERIODIC REVIEW

**Control Item Text**

The organization:

(a) Reviews the information system [Assignment: organization-defined frequency] to identify unnecessary and/or nonsecure functions, ports, protocols, and services.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(1)(a){1} | Determine if the organization: reviews the system {installed software} [Assignment: organization-defined frequency] to identify unnecessary and/or nonsecure functions and services. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(1)(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in reviewing the system {installed software} often enough to identify unnecessary and/or nonsecure functions and services related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(1)(a){1} | SWAM-L07 | Business need of software not recently verified | the presence of software without a recently verified need. |
| CM-7(1)(a){1} | SWAM-L08 | Unused software present | the presence of unneeded software and an increase in the attack surface. |

### *3.3.4.6* Control Item CM-7(1)(b): LEAST FUNCTIONALITY | PERIODIC REVIEW

**Control Item Text**

The organization:

(b) Disables [Assignment: organization-defined functions, ports, protocols, and services within the information system deemed to be unnecessary and/or nonsecure].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(1)(b){1} | Determine if the organization: disables [Assignment: organization-defined {installed software} functions and services within the system deemed to be unnecessary and/or nonsecure]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(1)(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in disabling specified functions and services within the system deemed to be unnecessary and/or nonsecure related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(1)(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(1)(b){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(1)(b){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in disabling specified functions and services within the system deemed to be unnecessary and/or nonsecure related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(1)(b){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| CM-7(1)(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.7* Control Item CM-7(2): LEAST FUNCTIONALITY | PREVENT PROGRAM EXECUTION

**Control Item Text**

The information system prevents program execution in accordance with [Selection (one or more): [Assignment: organization-defined policies regarding software program usage and restrictions]; rules authorizing the terms and conditions of software program usage].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(2){1} | Determine if the organization: prevents {installed software} program execution in accordance with [Selection (one or more): [Assignment: organization-defined policies regarding software program usage and restrictions]; rules authorizing the terms and conditions of software program usage]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(2){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in preventing {installed software} program execution as specified related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(2){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(2){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(2){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |

### *3.3.4.8* Control Item CM-7(4)(a): LEAST FUNCTIONALITY | UNAUTHORIZED SOFTWARE / BLACKLISTING

**Control Item Text**

The organization:

(a) Identifies [Assignment: organization-defined software programs not authorized to execute on the information system].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(4)(a){1} | Determine if the organization: identifies [Assignment: organization-defined software programs not authorized to execute on the system]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(4)(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in identifying specified software programs not authorized to execute related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(4)(a){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(4)(a){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(4)(a){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in identifying specified software programs not authorized to execute related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(4)(a){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| CM-7(4)(a){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.9* Control Item CM-7(4)(b): LEAST FUNCTIONALITY | UNAUTHORIZED SOFTWARE / BLACKLISTING

**Control Item Text**

The organization:

(b) Employs an allow-all, deny-by-exception policy to prohibit the execution of unauthorized software programs on the information system.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(4)(b){1} | Determine if the organization: employs an allow-all, deny-by-exception policy to prohibit the execution of unauthorized software programs on the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(4)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing an allow-all, deny-by-exception policy to prohibit the execution of unauthorized software programs (blacklisting) related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(4)(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(4)(b){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(4)(b){1} | SWAM- | Unauthorized software | the execution of software not loaded from an approved directory/folder location. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing an allow-all, deny-by-exception policy to prohibit the execution of unauthorized software programs (blacklisting) related to this control item** might be the cause of ... |
|---|---|---|---|
| | F03 | directory/folder location | |
| CM-7(4)(b){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| CM-7(4)(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.10* Control Item CM-7(4)(c): LEAST FUNCTIONALITY | UNAUTHORIZED SOFTWARE / BLACKLISTING

**Control Item Text**

The organization:

(c) Reviews and updates the list of unauthorized software programs [Assignment: organization-defined frequency].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(4)(c){1} | Determine if the organization: reviews and updates the list of unauthorized software programs [Assignment: organization-defined frequency]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(4)(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in reviewing and updating the list of unauthorized software programs frequently enough related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(4)(c){1} | SWAM-L07 | Business need of software not recently verified | the presence of software without a recently verified need. |

### *3.3.4.11* Control Item CM-8(1): INFORMATION SYSTEM COMPONENT INVENTORY | UPDATES DURING INSTALLATIONS / REMOVALS

**Control Item Text**

The organization updates the inventory of information system components as an integral part of component installations, removals, and information system updates.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(1){1} | Determine if the organization: updates the inventory of system {installed software} components as an integral part of component installations, removals, and system updates. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(1){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in updating the inventory of system {installed software} components as an integral part of component installations, removals, and system updates related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(1){1} | SWAM-Q04 | Poor timeliness metric | poor timeliness of overall ISCM reporting. |

### *3.3.4.12* Control Item CM-8(5): INFORMATION SYSTEM COMPONENT INVENTORY | NO DUPLICATE ACCOUNTING OF COMPONENTS

**Control Item Text**

The organization verifies that all components within the authorization boundary of the information system are not duplicated in other information system inventories.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-8(5){1} | Determine if the organization: verifies that all {installed software} components within the authorization boundary of the system are not duplicated in other system inventories. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-8(5){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in verifying that all {installed software} components within the authorization boundary of the system are not duplicated in other system inventories related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-8(5){1} | SWAM-L09 | Device-software-item assignment to authorization boundary is not 1:1 | unclear management responsibility that could lead to unmanaged components. |

### *3.3.4.13* Control Item MA-3(1): MAINTENANCE TOOLS | INSPECT TOOLS

**Control Item Text**

The organization inspects the maintenance tools carried into a facility by maintenance personnel for improper or unauthorized modifications.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MA-3(1){1} | Determine if the organization: inspects the maintenance tools with {installed software} carried into a facility by maintenance personnel for improper or unauthorized modifications to the {installed software}. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MA-3(1){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in inspecting the maintenance tools with {installed software} carried into a facility by maintenance personnel for improper or unauthorized modifications to the {installed software} related to this control item** might be the cause of ... |
|---|---|---|---|
| MA-3(1){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.14* Control Item MA-3(2): MAINTENANCE TOOLS | INSPECT MEDIA

**Control Item Text**

The organization checks media containing diagnostic and test programs for malicious code before the media are used in the information system.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MA-3(2){1} | Determine if the organization: checks media containing diagnostic and test programs for malicious code before the media are used in the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MA-3(2){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in checking media containing diagnostic and test programs for malicious code before the media are used in the system related to this control item** might be the cause of ... |
|---|---|---|---|
| MA-3(2){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| MA-3(2){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.15* Control Item SC-18(a): MOBILE CODE

**Control Item Text**

Control: The organization:

a. Defines acceptable and unacceptable mobile code and mobile code technologies.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SC-18(a){1} | Determine if the organization: defines acceptable and unacceptable mobile code and mobile code technologies. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SC-18(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in defining acceptable and unacceptable mobile code and mobile code technologies related to this control item** might be the cause of ... |
|---|---|---|---|
| SC-18(a){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |

### *3.3.4.16* Control Item SC-18(b): MOBILE CODE

**Control Item Text**

Control: The organization:

b. Establishes usage restrictions and implementation guidance for acceptable mobile code and mobile code technologies.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SC-18(b){1} | Determine if the organization: establishes usage restrictions and implementation guidance for acceptable mobile code and mobile code technologies. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SC-18(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale** If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in establishing usage restrictions and implementation guidance for acceptable mobile code and mobile code technologies related to this control item** might be the cause of ... |
|---|---|---|---|
| SC-18(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |

### *3.3.4.17* Control Item SC-18(c): MOBILE CODE

**Control Item Text**

Control: The organization:

c. Authorizes, monitors, and controls the use of mobile code within the information system.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SC-18(c){1} | Determine if the organization: authorizes, monitors, and controls the use of mobile code within the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SC-18(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in authorizing, monitoring, and controlling the use of mobile code within the system related to this control item** might be the cause of ... |
|---|---|---|---|
| SC-18(c){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |

### *3.3.4.18* Control Item SI-3(1): MALICIOUS CODE PROTECTION | CENTRAL MANAGEMENT

**Control Item Text**

The organization centrally manages malicious code protection mechanisms.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(1){1} | Determine if the organization: centrally manages malicious code protection mechanisms. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(1){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in centrally managing malicious code protection mechanisms related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(1){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| SI-3(1){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |
| SI-3(1){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.4.19* Control Item SI-3(2): MALICIOUS CODE PROTECTION | AUTOMATIC UPDATES

**Control Item Text**

The information system automatically updates malicious code protection mechanisms.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-3(2){1} | Determine if the organization: automatically updates malicious code protection mechanisms. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-3(2){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in automatically updating malicious code protection mechanisms related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-3(2){1} | SWAM-L03 | Expired actions on software authorization/deauthorization requests | requested changes not being addressed in a timely manner. |

### *3.3.4.20* Control Item SI-7: SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY

**Control Item Text**

Control: The organization employs integrity verification tools to detect unauthorized changes to [Assignment: organization-defined software, firmware, and information].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-7{1} | Determine if the organization: employs integrity verification tools to detect unauthorized changes to [Assignment: an organization-defined subset of software, firmware, and information]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-7{1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing integrity verification tools to detect unauthorized changes to specified software related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-7{1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| SI-7{1} | SWAM-L01 | Unapproved authorizer | lack of verification that software was authorized by approved accounts (persons). |
| SI-7{1} | SWAM-L02 | Required authorizations missing | careless or malicious authorization of software. |
| SI-7{1} | SWAM-L03 | Expired actions on software authorization/deauthorization requests | requested changes not being addressed in a timely manner. |

### *3.3.4.21* Control Item SI-7(1): SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRITY CHECKS

**Control Item Text**

The information system performs an integrity check of [Assignment: organization-defined software, firmware, and information] [Selection (one or more): at startup; at [Assignment: organization-defined transitional states or security-relevant events]; [Assignment: organization-defined frequency]].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-7(1){1} | Determine if the organization: performs an integrity check of [Assignment: organization-defined software, firmware, and information] [Selection (one or more): at startup; at [Assignment: organization-defined transitional states or security-relevant events]; [Assignment: organization-defined frequency]]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-7(1){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in performing an integrity check of specified software at specified times related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-7(1){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |

### *3.3.4.22* Control Item SI-16: MEMORY PROTECTION

**Control Item Text**

Control: The information system implements [Assignment: organization-defined security safeguards] to protect its memory from unauthorized code execution.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-16{1} | Determine if the organization: implements [Assignment: organization-defined security safeguards] to protect its memory from unauthorized code execution. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-16{1} | TBD | ISCM-TN | MAN | TBD | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

N/A because tested manually.

## 3.3.5 High Baseline Security Control Item Narratives

### *3.3.5.1* Control Item CM-3(1)(c): CONFIGURATION CHANGE CONTROL | AUTOMATED DOCUMENT / NOTIFICATION / PROHIBITION OF CHANGES

**Control Item Text**

The organization employs automated mechanisms to:

(c) Highlight proposed changes to the information system that have not been approved or disapproved by [Assignment: organization-defined time period].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-3(1)(c){1} | Determine if the organization: employs automated mechanisms to highlight proposed changes to the system {installed software} that have not been approved or disapproved by [Assignment: organization-defined time period]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-3(1)(c){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing automated mechanisms to highlight proposed changes to the system {installed software} that have not been approved or disapproved by [Assignment: organization-defined time period] related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-3(1)(c){1} | SWAM-L03 | Expired actions on software authorization/deauthorization requests | requested changes not being addressed in a timely manner. |

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### 3.3.5.2 Control Item CM-4: SECURITY IMPACT ANALYSIS | SEPARATE TEST ENVIRONMENTS

**Control Item Text**

The organization analyzes changes to the information system in a separate test environment before implementation in an operational environment, looking for security impacts due to flaws, weaknesses, incompatibility, or intentional malice.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-4(1){1} | Determine if the organization: analyzes changes to the information system {software} in a separate test environment before implementation in an operational environment, looking for security impacts due to flaws, weaknesses, incompatibility, or intentional malice. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-4(1){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in analyzing changes to the information system {software}, looking for security impacts due to flaws, weaknesses, incompatibility, or intentional malice. related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-4(1){1} | SWAM-L06 | testing and validation of software inadequate | lack of adequate testing and validation. |

### *3.3.5.3* Control Item CM-5(3): ACCESS RESTRICTIONS FOR CHANGE | SIGNED COMPONENTS

**Control Item Text**

The information system prevents the installation of [Assignment: organization-defined software and firmware components] without verification that the component has been digitally signed using a certificate that is recognized and approved by the organization.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-5(3){1} | Determine if the organization: verifies that the {software} component has been digitally signed using a certificate that is recognized and approved by the organization before installation of [Assignment: organization-defined software and firmware components]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-5(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in verifying that the {software} component has been digitally signed using a certificate that is recognized and approved by the organization before installation of specific components related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-5(3){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-5(3){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |

### *3.3.5.4* Control Item CM-7(5)(a): LEAST FUNCTIONALITY | AUTHORIZED SOFTWARE / WHITELISTING

**Control Item Text**

The organization:

(a) Identifies [Assignment: organization-defined software programs authorized to execute on the information system].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(5)(a){1} | Determine if the organization: identifies [Assignment: organization-defined software programs authorized to execute on the system]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(5)(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in identifying specific software programs authorized to execute on the system related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(5)(a){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(5)(a){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(5)(a){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |
| CM-7(5)(a){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in identifying specific software programs authorized to execute on the system related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(5)(a){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.5.5* Control Item CM-7(5)(b): LEAST FUNCTIONALITY | AUTHORIZED SOFTWARE / WHITELISTING

**Control Item Text**

The organization:

(b) Employs a deny-all, permit-by-exception policy to allow the execution of authorized software programs on the information system.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(5)(b){1} | Determine if the organization: employs a deny-all, permit-by-exception policy to allow the execution of authorized software programs on the system. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(5)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing a deny-all, permit-by-exception policy to allow the execution of authorized software programs (whitelisting) related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(5)(b){1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |
| CM-7(5)(b){1} | SWAM-F02 | Unauthorized software installer | the execution of software not installed by an authorized installer. |
| CM-7(5)(b){1} | SWAM-F03 | Unauthorized software directory/folder location | the execution of software not loaded from an approved directory/folder location. |
| CM-7(5)(b){1} | SWAM-F04 | Untrusted core software | lack of core software integrity at start-up. |

| Determination Statement ID | Defect Check ID | Defect Check Name | **Rationale**<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in employing a deny-all, permit-by-exception policy to allow the execution of authorized software programs (whitelisting) related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(5)(b){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.5.6* Control Item CM-7(5)(c): LEAST FUNCTIONALITY | AUTHORIZED SOFTWARE / WHITELISTING

**Control Item Text**

The organization:

(c) Reviews and updates the list of authorized software programs [Assignment: organization-defined frequency].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| CM-7(5)(c){1} | Determine if the organization: reviews and updates the list of authorized software programs [Assignment: organization-defined frequency]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-7(5)(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in reviewing and updating the list of authorized software programs at the required frequency related to this control item** might be the cause of ... |
|---|---|---|---|
| CM-7(5)(c){1} | SWAM-L07 | Business need of software not recently verified | the presence of software without a recently verified need. |

### *3.3.5.7* Control Item CM-6(1): MEDIA SANITIZATION | REVIEW / APPROVE / TRACK / DOCUMENT / VERIFY

**Control Item Text**

The organization reviews, approves, tracks, documents, and verifies media sanitization and disposal actions.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MP-6(1){1} | Determine if the organization: reviews, approves, tracks, documents, and verifies media sanitization and disposal actions {to remove software}. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MP-6(1){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in reviewing, approving, tracking, documenting, and verifying media sanitization and disposal actions {to remove software} related to this control item** might be the cause of ... |
|---|---|---|---|
| MP-6(1){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.5.8* Control Item CM-6(2): MEDIA SANITIZATION | EQUIPMENT TESTING

**Control Item Text**

The organization tests sanitization equipment and procedures [Assignment: organization-defined frequency] to verify that the intended sanitization is being achieved.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MP-6(2){1} | Determine if the organization: tests sanitization equipment and procedures [Assignment: organization-defined frequency] to verify that the intended sanitization {to remove software} is being achieved. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MP-6(2){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in testing sanitization equipment and procedures [Assignment: organization-defined frequency] to verify that the intended sanitization {to remove software} is being achieved. related to this control item** might be the cause of ... |
|---|---|---|---|
| MP-6(2){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.5.9* Control Item CM-6(3): MEDIA SANITIZATION | NONDESTRUCTIVE TECHNIQUES

**Control Item Text**

The organization applies nondestructive sanitization techniques to portable storage devices prior to connecting such devices to the information system under the following circumstances: [Assignment: organization-defined circumstances requiring sanitization of portable storage devices].

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| MP-6(3){1} | Determine if the organization: applies nondestructive sanitization techniques {to remove software} to portable storage devices prior to connecting such devices to the information system under the following circumstances: [Assignment: organization-defined circumstances requiring sanitization of portable storage devices]. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| MP-6(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in applying nondestructive sanitization techniques {to remove software} to portable storage devices prior to connecting such devices to the information system when moved from high risk areas related to this control item** might be the cause of ... |
|---|---|---|---|
| MP-6(3){1} | SWAM-L04 | Devices moving in/out of protective boundaries not in policy compliance | devices' software not being adequately strengthened and/or sanitized for movement into or out of protective boundaries. |

### *3.3.5.10* Control Item SA-12: SUPPLY CHAIN PROTECTION

**Control Item Text**

Control: The organization protects against supply chain threats to the information system, system component, or information system service by employing [Assignment: organization-defined security safeguards] as part of a comprehensive, defense-in-breadth information security strategy.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SA-12{1} | Determine if the organization: protects against supply chain threats to the system {installed software} by employing [Assignment: organization-defined security safeguards] as part of a comprehensive, defense-in-breadth information security strategy. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SA-12{1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in protecting against supply chain threats to the system as specified related to this control item** might be the cause of ... |
|---|---|---|---|
| SA-12{1} | SWAM-F01 | Unauthorized software executes | The execution of unauthorized software. |

### *3.3.5.11* Control Item SI-7(14)(a): SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | BINARY OR MACHINE EXECUTABLE CODE

**Control Item Text**

The organization:

(a) Prohibits the use of binary or machine-executable code from sources with limited or no warranty and without the provision of source code.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-7(14)(a){1} | Determine if the organization: prohibits the use of binary or machine-executable code from sources with limited or no warranty and/or without the provision of source code. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-7(14)(a){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in prohibiting the use of binary or machine-executable code from sources with limited or no warranty and/or without the provision of source code related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-7(14)(a){1} | SWAM-L13 | Software without warranty and/or source code | the presence of software without warranty and/or source code. |

### *3.3.5.12* Control Item SI-7(14)(b): SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | BINARY OR MACHINE EXECUTABLE CODE

**Control Item Text**

The organization:

(b) Provides exceptions to the source code requirement only for compelling mission/operational requirements and with the approval of the authorizing official.

**Determination Statement 1:**

| Determination Statement ID | Determination Statement Text |
|---|---|
| SI-7(14)(b){1} | Determine if the organization: provides exceptions to the source code requirement only for compelling mission/operational requirements and with the approval of the authorizing official. |

**Roles and Assessment Methods:**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| SI-7(14)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

**Defect Check Rationale Table:**

**A failure in control item effectiveness results in a defect in one or more of the following defect checks:**

| Determination Statement ID | Defect Check ID | Defect Check Name | Rationale<br>If an [organization-defined measure] for this defect check is above [the organization-defined threshold], **then defects in providing exceptions to the source code requirement only for compelling mission/operational requirements and with the approval of the authorizing official related to this control item** might be the cause of ... |
|---|---|---|---|
| SI-7(14)(b){1} | SWAM-L01 | Unapproved authorizer | lack of verification that software was authorized by approved accounts (persons). |

## 3.4 Control Allocation Tables (CATs)

Table 8: Low Baseline Control (Item) Allocation Table, Table 9: Moderate Baseline Control (Item) Allocation Table, and Table 10: High Baseline Control (Item) Allocation Table, provide the low, moderate, and high baseline control allocations, respectively. The following is a summary of the material in the security plan assessment narrative for each determination statement in Section 3.3. It provides a concise summary of the assessment plan.

### 3.4.1 Low Baseline Control Allocation Table

**Table 8: Low Baseline Control (Item) Allocation Table**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-4{1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(a){2} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(b){2} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(4){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-10(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-10(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-10(b){2} | DSM | ISCM-TN | MAN | TBD | | | | |
| CM-10(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-11(a){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-11(b){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-11(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| MP-6(a){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| MP-6(b){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| PS-4(d){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(b){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(c){2} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(c){3} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(c){4} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(d){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |

2005 ## 3.4.2 Moderate Baseline Control Allocation Table

2006 **Table 9: Moderate Baseline Control (Item) Allocation Table**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-2(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(1)(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(1)(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(2){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(4)(a){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(4)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(4)(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(1){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-8(5){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| MA-3(1){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| MA-3(2){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| SC-18(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| SC-18(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| SC-18(c){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(1){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-3(2){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-7{1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-7(1){1} | ISCM-Ops | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-16{1} | TBD | ISCM-TN | MAN | TBD | | | | |

2007

2008

### 3.4.3 High Baseline Control Allocation Table

**Table 10: High Baseline Control (Item) Allocation Table**

| Determination Statement ID | Implemented By | Assessment Boundary | Assessment Responsibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Implementing |
|---|---|---|---|---|---|---|---|---|
| CM-3(1)(c){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-4(1){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-5(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(5)(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(5)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |
| CM-7(5)(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| MP-6(1){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| MP-6(2){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| MP-6(3){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | |
| SA-12{1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-7(14)(a){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |
| SI-7(14)(b){1} | RskEx | ISCM-TN | ISCM-Sys | Test | | | | |

# Appendix A. Traceability of SWAM Control Items to Example Attack Steps

*Note:* This Appendix includes only those control items that can be assessed (at least in part) via automation.

| Example Attack Step | SP 800-53 Control Item Code |
|---|---|
| 1) Gain Internal Entry | CM-2(7)(a) |
| 1) Gain Internal Entry | CM-2(7)(b) |
| 1) Gain Internal Entry | CM-4 |
| 1) Gain Internal Entry | CM-4(1) |
| 1) Gain Internal Entry | CM-7(1)(b) |
| 1) Gain Internal Entry | CM-7(4)(a) |
| 1) Gain Internal Entry | CM-7(4)(b) |
| 1) Gain Internal Entry | CM-7(5)(a) |
| 1) Gain Internal Entry | CM-7(5)(b) |
| 1) Gain Internal Entry | CM-8(4) |
| 1) Gain Internal Entry | CM-11(b) |
| 1) Gain Internal Entry | MA-3(1) |
| 1) Gain Internal Entry | MA-3(2) |
| 1) Gain Internal Entry | MP-6(a) |
| 1) Gain Internal Entry | MP-6(b) |
| 1) Gain Internal Entry | MP-6(1) |
| 1) Gain Internal Entry | MP-6(2) |
| 1) Gain Internal Entry | MP-6(3) |
| 1) Gain Internal Entry | PS-4(d) |
| 1) Gain Internal Entry | SI-3(b) |
| 1) Gain Internal Entry | SI-3(1) |
| 3) Gain Foothold | CM-4 |
| 3) Gain Foothold | CM-4(1) |
| 3) Gain Foothold | CM-5(3) |
| 3) Gain Foothold | CM-7(b) |
| 3) Gain Foothold | CM-7(1)(b) |
| 3) Gain Foothold | CM-7(2) |
| 3) Gain Foothold | CM-7(4)(a) |
| 3) Gain Foothold | CM-7(4)(b) |
| 3) Gain Foothold | CM-7(5)(a) |
| 3) Gain Foothold | CM-7(5)(b) |
| 3) Gain Foothold | CM-11(a) |
| 3) Gain Foothold | CM-11(b) |
| 3) Gain Foothold | MA-3(2) |
| 3) Gain Foothold | SA-12 |
| 3) Gain Foothold | SC-18(a) |
| 3) Gain Foothold | SC-18(b) |
| 3) Gain Foothold | SC-18(c) |
| 3) Gain Foothold | SI-3(b) |
| 3) Gain Foothold | SI-3(c) |
| 3) Gain Foothold | SI-3(1) |
| 3) Gain Foothold | SI-7 |
| 3) Gain Foothold | SI-7(14)(a) |
| 3) Gain Foothold | SI-7(14)(b) |

| Example Attack Step | SP 800-53 Control Item Code |
|---|---|
| 4) Gain Persistence | CM-3(1)(c) |
| 4) Gain Persistence | CM-4 |
| 4) Gain Persistence | CM-5(3) |
| 4) Gain Persistence | CM-7(a) |
| 4) Gain Persistence | CM-7(b) |
| 4) Gain Persistence | CM-7(1)(a) |
| 4) Gain Persistence | CM-7(1)(b) |
| 4) Gain Persistence | CM-7(2) |
| 4) Gain Persistence | CM-7(4)(a) |
| 4) Gain Persistence | CM-7(4)(b) |
| 4) Gain Persistence | CM-7(4)(c) |
| 4) Gain Persistence | CM-7(5)(a) |
| 4) Gain Persistence | CM-7(5)(b) |
| 4) Gain Persistence | CM-7(5)(c) |
| 4) Gain Persistence | CM-8(4) |
| 4) Gain Persistence | CM-8(5) |
| 4) Gain Persistence | CM-10(a) |
| 4) Gain Persistence | CM-10(b) |
| 4) Gain Persistence | CM-10(c) |
| 4) Gain Persistence | CM-11(a) |
| 4) Gain Persistence | CM-11(b) |
| 4) Gain Persistence | SI-3(a) |
| 4) Gain Persistence | SI-3(b) |
| 4) Gain Persistence | SI-3(c) |
| 4) Gain Persistence | SI-3(d) |
| 4) Gain Persistence | SI-3(1) |
| 4) Gain Persistence | SI-3(2) |
| 4) Gain Persistence | SI-7 |
| 4) Gain Persistence | SI-7(1) |
| 4) Gain Persistence | SI-7(14)(a) |
| 4) Gain Persistence | SI-7(14)(b) |
| 6) Achieve Attack Objective | CM-2(3) |
| 6) Achieve Attack Objective | CM-4 |
| 6) Achieve Attack Objective | CM-10(a) |
| 6) Achieve Attack Objective | CM-10(b) |
| 6) Achieve Attack Objective | CM-10(c) |
| 6) Achieve Attack Objective | CM-11(b) |

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# Appendix B. Keyword Rules Used to Identify Controls that Support SWAM

Automated keyword searches were employed to identify SP 800-53 controls that might support each ISCM capability. Controls returned by the keyword search were then examined manually, to separate those that do support the capability (true positives) from those that do not (false positives). The specific keyword rules used for the searches are in the table below

| Keyword Rule | Rationale |
|---|---|
| *anti-counterfeit* | Applies to counterfeit software. |
| *authorized software* | The organization authorizes software using either a deny-by-exception or allow-by-exception strategy. |
| *automatic* AND *execution* | Reduce the chance that newly inserted unapproved software will execute. |
| *change control* | The organization needs a change control process to determine authorized software. |
| *flaw remediation* | CVEs and CWEs (whether flaws have been remediated) should be considered when approving software. |
| *function isolation* | CVEs and CWEs related to function isolation should be considered when approving software. |
| *heterogen* | Having heterogeneous software is a strategy to make a system less attackable. |
| *high-risk areas* | Software should be more controlled in high risk areas and types of software. When returning from a high risk area, the software should be suspect, as it may have been modified. |
| *inventory* | The organization must know its current inventory, to compare to the authorized inventory. |
| *least func* NOT *software program* | Unneeded software and software functions should be removed or disabled. |
| *malicious code* OR *malware* | Reduce the chance that unapproved software will execute. |
| *mobile code* | Mobile code requires extra and/or different protections. |
| *non-persisten* OR *persisten* | Reduce the chance that unapproved software will execute and/or persist |
| *operating system-independent application* OR *platform-independent application* | These types of software are often attacked more frequently as they are present on more devices. |
| *peer-to-peer* | This addresses copyright issues, but peer-to-peer software also introduces special security vulnerabilities. |
| *process isolation* | The degree of process isolation present should be considered when authorizing software. Does it have enough? |
| *property* | Licensed software needs control as property to avoid licensing violations, which could lead to non-patching and other issues. |
| *supply chain* NOT *monitoring* | Only software from an approved supply chain should be authorized (and present) |

| Keyword Rule | Rationale |
|---|---|
| *software* AND *restrict* | Only authorized software should be present on the target network |
| *software usage restriction* NOT *peer-to-peer* | Only authorized software should be present on the target network |
| *tamper resistance* | Only software from an approved supply chain should be authorized (and present). Methods to resist tampering need to be deployed. |
| *unsupport* AND *system* | Unsupported software becomes increasingly vulnerable and should not be approved. Lack of support may be due to software age or vendor negligence. |
| *user* AND *software* AND *install* | Only authorized installers should be able to install software. |
| *user* AND *software* AND *govern* | A process is needed to govern installed software. |
| *user* AND *software* AND *polic* | Policy is needed to govern installed software. |

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# Appendix C. Control Items in the Low-High Baseline that were Selected by the Keyword Search for Controls that Support SWAM, but were Manually Determined to be False Positives

| SP 800-53 Control Item | Control Text | Level | Rationale for Calling a False Positive |
|---|---|---|---|
| AC-6 (1) | LEAST PRIVILEGE \| AUTHORIZE ACCESS TO SECURITY FUNCTIONS<br>The organization explicitly authorizes access to [Assignment: organization-defined security functions (deployed in hardware, software, and firmware) and security-relevant information]. | Moderate | Relates to privileges and accounts |
| SA-11 | DEVELOPER SECURITY TESTING AND EVALUATION<br>Control: The organization requires the developer of the information system, system component, or information system service to:<br>d. Implement a verifiable flaw remediation process. | Moderate | Relates to flaw remediation (VULN) rather than software asset management (SWAM) |
| SC-39 | PROCESS ISOLATION<br>Control: The information system maintains a separate execution domain for each executing process. | Low | Relates to separation of processes (internal boundaries - BOUND), rather than to SWAM |
| SI-2 | FLAW REMEDIATION<br>Control: The organization:<br>b. Tests software and firmware updates related to flaw remediation for effectiveness and potential side effects before installation. | Low | Relates to flaw remediation (VULN) rather than to SWAM |
| SI-2 (1) | FLAW REMEDIATION \| CENTRAL MANAGEMENT<br>The organization centrally manages the flaw remediation process. | High | Relates to flaw remediation (VULN) rather than to SWAM |
| SI-2 (2) | FLAW REMEDIATION \| AUTOMATED FLAW REMEDIATION STATUS<br>The organization employs automated mechanisms [Assignment: organization-defined frequency] to determine the state of information system components with regard to flaw remediation. | Moderate | Relates to flaw remediation (VULN) rather than to SWAM |
| SI-7 (2) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| AUTOMATED NOTIFICATIONS OF INTEGRITY VIOLATIONS<br>The organization employs automated tools that provide notification to [Assignment: organization-defined personnel or roles] upon discovering discrepancies during integrity verification. | High | Relates to behavioral expectations (BEHAVE) rather than SWAM |

| SP 800-53 Control Item | Control Text | Level | Rationale for Calling a False Positive |
|---|---|---|---|
| SI-7 (5) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| AUTOMATED RESPONSE TO INTEGRITY VIOLATIONS<br>The information system automatically [Selection (one or more): shuts the information system down; restarts the information system; implements [Assignment: organization-defined security safeguards]] when integrity violations are discovered. | High | Focus is on detect incidents and contingencies (DETECT) and respond to incidents and contingencies (RESPOND) rather than SWAM |
| SI-7 (7) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| INTEGRATION OF DETECTION AND RESPONSE<br>The organization incorporates the detection of unauthorized [Assignment: organization-defined security-relevant changes to the information system] into the organizational incident response capability. | Moderate | Relates to preparation for events (PREPARE) rather than SWAM |

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# Appendix D. Control Items Not in the Low, Moderate, or High Baselines

The following security controls items are not included in an SP 800-53 baseline and thus were not analyzed further after the keyword search:

- the Program Management (PM) Family, because the PM controls do not apply to individual systems;
- the *SWAM keyword selected* controls that are not assigned to a baseline; and
- the Privacy Controls.

The control items matching the criteria in the bulleted list above are provided in this appendix in case an organization wants to develop its own automated tests.

| SP 800-53 Control Item | Control Text |
|---|---|
| AT-3 (4) | SECURITY TRAINING \| SUSPICIOUS COMMUNICATIONS AND ANOMALOUS SYSTEM BEHAVIOR<br>The organization provides training to its personnel on [Assignment: organization-defined indicators of malicious code] to recognize suspicious communications and anomalous behavior in organizational information systems. |
| CM-3 (3) | CONFIGURATION CHANGE CONTROL \| AUTOMATED CHANGE IMPLEMENTATION<br>The organization employs automated mechanisms to implement changes to the current information system baseline and deploys the updated baseline across the installed base. |
| CM-3 (4) | CONFIGURATION CHANGE CONTROL \| SECURITY REPRESENTATIVE<br>The organization requires an information security representative to be a member of the [Assignment: organization-defined configuration change control element]. |
| CM-3 (5) | CONFIGURATION CHANGE CONTROL \| AUTOMATED SECURITY RESPONSE<br>The information system implements [Assignment: organization-defined security responses] automatically if baseline configurations are changed in an unauthorized manner. |
| CM-3 (6) | CONFIGURATION CHANGE CONTROL \| CRYPTOGRAPHY MANAGEMENT<br>The organization ensures that cryptographic mechanisms used to provide [Assignment: organization-defined security safeguards] are under configuration management. |
| CM-5 (6) | ACCESS RESTRICTIONS FOR CHANGE \| LIMIT LIBRARY PRIVILEGES<br>The organization limits privileges to change software resident within software libraries. |
| CM-7 (3) | LEAST FUNCTIONALITY \| REGISTRATION COMPLIANCE<br>The organization ensures compliance with [Assignment: organization-defined registration requirements for functions, ports, |

| SP 800-53 Control Item | Control Text |
|---|---|
| | protocols, and services]. |
| CM-8 (6) | INFORMATION SYSTEM COMPONENT INVENTORY \| ASSESSED CONFIGURATIONS / APPROVED DEVIATIONS<br>The organization includes assessed component configurations and any approved deviations to current deployed configurations in the information system component inventory. |
| CM-8 (7) | INFORMATION SYSTEM COMPONENT INVENTORY \| CENTRALIZED REPOSITORY<br>The organization provides a centralized repository for the inventory of information system components. |
| CM-8 (8) | INFORMATION SYSTEM COMPONENT INVENTORY \| AUTOMATED LOCATION TRACKING<br>The organization employs automated mechanisms to support tracking of information system components by geographic location. |
| CM-8 (9) | INFORMATION SYSTEM COMPONENT INVENTORY \| ASSIGNMENT OF COMPONENTS TO SYSTEMS<br>The organization:<br>(a) Assigns [Assignment: organization-defined acquired information system components] to an information system. |
| CM-8 (9) | INFORMATION SYSTEM COMPONENT INVENTORY \| ASSIGNMENT OF COMPONENTS TO SYSTEMS<br>The organization:<br>(b) Receives an acknowledgement from the information system owner of this assignment. |
| CM-10 (1) | SOFTWARE USAGE RESTRICTIONS \| OPEN SOURCE SOFTWARE<br>The organization establishes the following restrictions on the use of open source software: [Assignment: organization-defined restrictions]. |
| CM-11 (1) | USER-INSTALLED SOFTWARE \| ALERTS FOR UNAUTHORIZED INSTALLATIONS<br>The information system alerts [Assignment: organization-defined personnel or roles] when the unauthorized installation of software is detected. |
| CM-11 (2) | USER-INSTALLED SOFTWARE \| PROHIBIT INSTALLATION WITHOUT PRIVILEGED STATUS<br>The information system prohibits user installation of software without explicit privileged status. |
| CP-10 (6) | INFORMATION SYSTEM RECOVERY AND RECONSTITUTION \| COMPONENT PROTECTION<br>The organization protects backup and restoration hardware, firmware, and software. |
| IR-4 (10) | INCIDENT HANDLING \| SUPPLY CHAIN COORDINATION<br>The organization coordinates incident handling activities involving supply chain events with other organizations involved in the supply chain. |
| IR-6 (3) | INCIDENT REPORTING \| COORDINATION WITH SUPPLY CHAIN<br>The organization provides security incident information to other organizations involved in the supply chain for information systems or information system components related to the incident. |
| IR-10 | INTEGRATED INFORMATION SECURITY ANALYSIS TEAM |

| SP 800-53 Control Item | Control Text |
|---|---|
| | Control: The organization establishes an integrated team of forensic/malicious code analysts, tool developers, and real-time operations personnel. |
| PM-5 | INFORMATION SYSTEM INVENTORY<br>Control: The organization develops and maintains an inventory of its information systems. |
| SA-10 (1) | DEVELOPER CONFIGURATION MANAGEMENT \| SOFTWARE / FIRMWARE INTEGRITY VERIFICATION<br>The organization requires the developer of the information system, system component, or information system service to enable integrity verification of software and firmware components. |
| SA-10 (4) | DEVELOPER CONFIGURATION MANAGEMENT \| TRUSTED GENERATION<br>The organization requires the developer of the information system, system component, or information system service to employ tools for comparing newly generated versions of security-relevant hardware descriptions and software/firmware source and object code with previous versions. |
| SA-10 (5) | DEVELOPER CONFIGURATION MANAGEMENT \| MAPPING INTEGRITY FOR VERSION CONTROL<br>The organization requires the developer of the information system, system component, or information system service to maintain the integrity of the mapping between the master build data (hardware drawings and software/firmware code) describing the current version of security-relevant hardware, software, and firmware and the on-site master copy of the data for the current version. |
| SA-10 (6) | DEVELOPER CONFIGURATION MANAGEMENT \| TRUSTED DISTRIBUTION<br>The organization requires the developer of the information system, system component, or information system service to execute procedures for ensuring that security-relevant hardware, software, and firmware updates distributed to the organization are exactly as specified by the master copies. |
| SA-12 (1) | SUPPLY CHAIN PROTECTION \| ACQUISITION STRATEGIES / TOOLS / METHODS<br>The organization employs [Assignment: organization-defined tailored acquisition strategies, contract tools, and procurement methods] for the purchase of the information system, system component, or information system service from suppliers. |
| SA-12 (2) | SUPPLY CHAIN PROTECTION \| SUPPLIER REVIEWS<br>The organization conducts a supplier review prior to entering into a contractual agreement to acquire the information system, system component, or information system service |
| SA-12 (5) | SUPPLY CHAIN PROTECTION \| LIMITATION OF HARM<br>The organization employs [Assignment: organization-defined security safeguards] to limit harm from potential adversaries identifying and targeting the organizational supply chain. |
| SA-12 (7) | SUPPLY CHAIN PROTECTION \| ASSESSMENTS PRIOR TO SELECTION / ACCEPTANCE / UPDATE<br>The organization conducts an assessment of the information system, system component, or information system service prior to selection, acceptance, or update. |
| SA-12 (8) | SUPPLY CHAIN PROTECTION \| USE OF ALL-SOURCE INTELLIGENCE |

| SP 800-53 Control Item | Control Text |
|---|---|
| | The organization uses all-source intelligence analysis of suppliers and potential suppliers of the information system, system component, or information system service. |
| SA-12 (9) | SUPPLY CHAIN PROTECTION \| OPERATIONS SECURITY<br>The organization employs [Assignment: organization-defined Operations Security (OPSEC) safeguards] in accordance with classification guides to protect supply chain-related information for the information system, system component, or information system service. |
| SA-12 (10) | SUPPLY CHAIN PROTECTION \| VALIDATE AS GENUINE AND NOT ALTERED<br>The organization employs [Assignment: organization-defined security safeguards] to validate that the information system or system component received is genuine and has not been altered. |
| SA-12 (11) | SUPPLY CHAIN PROTECTION \| PENETRATION TESTING / ANALYSIS OF ELEMENTS, PROCESSES, AND ACTORS<br>The organization employs [Selection (one or more): organizational analysis, independent third-party analysis, organizational penetration testing, independent third-party penetration testing] of [Assignment: organization-defined supply chain elements, processes, and actors] associated with the information system, system component, or information system service. |
| SA-12 (12) | SUPPLY CHAIN PROTECTION \| INTER-ORGANIZATIONAL AGREEMENTS<br>The organization establishes inter-organizational agreements and procedures with entities involved in the supply chain for the information system, system component, or information system service. |
| SA-12 (13) | SUPPLY CHAIN PROTECTION \| CRITICAL INFORMATION SYSTEM COMPONENTS<br>The organization employs [Assignment: organization-defined security safeguards] to ensure an adequate supply of [Assignment: organization-defined critical information system components]. |
| SA-12 (14) | SUPPLY CHAIN PROTECTION \| IDENTITY AND TRACEABILITY<br>The organization establishes and retains unique identification of [Assignment: organization-defined supply chain elements, processes, and actors] for the information system, system component, or information system service. |
| SA-12 (15) | SUPPLY CHAIN PROTECTION \| PROCESSES TO ADDRESS WEAKNESSES OR DEFICIENCIES<br>The organization establishes a process to address weaknesses or deficiencies in supply chain elements identified during independent or organizational assessments of such elements. |
| SA-17 (2) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| SECURITY-RELEVANT COMPONENTS<br>The organization requires the developer of the information system, system component, or information system service to:<br>(a) Define security-relevant hardware, software, and firmware. |
| SA-17 (2) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| SECURITY-RELEVANT COMPONENTS<br>The organization requires the developer of the information system, system component, or information system service to:<br>(b) Provide a rationale that the definition for security-relevant hardware, software, and firmware is complete. |
| SA-17 (3) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| FORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to: |

| SP 800-53 Control Item | Control Text |
|---|---|
| | (a) Produce, as an integral part of the development process, a formal top-level specification that specifies the interfaces to security-relevant hardware, software, and firmware in terms of exceptions, error messages, and effects. |
| SA-17 (3) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| FORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(c) Show via informal demonstration, that the formal top-level specification completely covers the interfaces to security-relevant hardware, software, and firmware. |
| SA-17 (3) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| FORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(d) Show that the formal top-level specification is an accurate description of the implemented security-relevant hardware, software, and firmware. |
| SA-17 (3) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| FORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(e) Describe the security-relevant hardware, software, and firmware mechanisms not addressed in the formal top-level specification but strictly internal to the security-relevant hardware, software, and firmware. |
| SA-17 (4) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| INFORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(a) Produce, as an integral part of the development process, an informal descriptive top-level specification that specifies the interfaces to security-relevant hardware, software, and firmware in terms of exceptions, error messages, and effects. |
| SA-17 (4) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| INFORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(c) Show via informal demonstration, that the descriptive top-level specification completely covers the interfaces to security-relevant hardware, software, and firmware. |
| SA-17 (4) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| INFORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(d) Show that the descriptive top-level specification is an accurate description of the interfaces to security-relevant hardware, software, and firmware. |
| SA-17 (4) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| INFORMAL CORRESPONDENCE<br>The organization requires the developer of the information system, system component, or information system service to:<br>(e) Describe the security-relevant hardware, software, and firmware mechanisms not addressed in the descriptive top-level specification but strictly internal to the security-relevant hardware, software, and firmware. |
| SA-17 (5) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| CONCEPTUALLY SIMPLE DESIGN<br>The organization requires the developer of the information system, system component, or information system service to:<br>(a) Design and structure the security-relevant hardware, software, and firmware to use a complete, conceptually simple protection mechanism with precisely defined semantics. |

| SP 800-53 Control Item | Control Text |
|---|---|
| SA-17 (5) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| CONCEPTUALLY SIMPLE DESIGN<br>The organization requires the developer of the information system, system component, or information system service to:<br>(b) Internally structure the security-relevant hardware, software, and firmware with specific regard for this mechanism. |
| SA-17 (6) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| STRUCTURE FOR TESTING<br>The organization requires the developer of the information system, system component, or information system service to structure security-relevant hardware, software, and firmware to facilitate testing. |
| SA-17 (7) | DEVELOPER SECURITY ARCHITECTURE AND DESIGN \| STRUCTURE FOR LEAST PRIVILEGE<br>The organization requires the developer of the information system, system component, or information system service to structure security-relevant hardware, software, and firmware to facilitate controlling access with least privilege. |
| SA-18 | TAMPER RESISTANCE AND DETECTION<br>Control: The organization implements a tamper protection program for the information system, system component, or information system service. |
| SA-18 (1) | TAMPER RESISTANCE AND DETECTION \| MULTIPLE PHASES OF SDLC<br>The organization employs anti-tamper technologies and techniques during multiple phases in the system development life cycle including design, development, integration, operations, and maintenance. |
| SA-18 (2) | TAMPER RESISTANCE AND DETECTION \| INSPECTION OF INFORMATION SYSTEMS, COMPONENTS, OR DEVICES<br>The organization inspects [Assignment: organization-defined information systems, system components, or devices] [Selection (one or more): at random; at [Assignment: organization-defined frequency], upon [Assignment: organization-defined indications of need for inspection]] to detect tampering. |
| SA-19 | COMPONENT AUTHENTICITY<br>Control: The organization:<br>a. Develops and implements anti-counterfeit policy and procedures that include the means to detect and prevent counterfeit components from entering the information system. |
| SA-19 (1) | COMPONENT AUTHENTICITY \| ANTI-COUNTERFEIT TRAINING<br>The organization trains [Assignment: organization-defined personnel or roles] to detect counterfeit information system components (including hardware, software, and firmware). |
| SA-19 (4) | COMPONENT AUTHENTICITY \| ANTI-COUNTERFEIT TRAINING<br>The organization scans for counterfeit information system components [Assignment: organization-defined frequency]. |
| SA-22 | UNSUPPORTED SYSTEM COMPONENTS<br>Control: The organization:<br>a. Replaces information system components when support for the components is no longer available from the developer, vendor, or manufacturer. |
| SA-22 | UNSUPPORTED SYSTEM COMPONENTS |

| SP 800-53 Control Item | Control Text |
|---|---|
| | Control: The organization:<br>b. Provides justification and documents approval for the continued use of unsupported system components required to satisfy mission/business needs. |
| SA-22 (1) | UNSUPPORTED SYSTEM COMPONENTS \| ALTERNATIVE SOURCES FOR CONTINUED SUPPORT<br>The organization provides [Selection (one or more): in-house support; [Assignment: organization-defined support from external providers]] for unsupported information system components. |
| SC-3 (1) | SECURITY FUNCTION ISOLATION \| HARDWARE SEPARATION<br>The information system utilizes underlying hardware separation mechanisms to implement security function isolation. |
| SC-3 (2) | SECURITY FUNCTION ISOLATION \| ACCESS / FLOW CONTROL FUNCTIONS<br>The information system isolates security functions enforcing access and information flow control from nonsecurity functions and from other security functions. |
| SC-3 (3) | SECURITY FUNCTION ISOLATION \| MINIMIZE NONSECURITY FUNCTIONALITY<br>The organization minimizes the number of nonsecurity functions included within the isolation boundary containing security functions. |
| SC-3 (4) | SECURITY FUNCTION ISOLATION \| MODULE COUPLING AND COHESIVENESS<br>The organization implements security functions as largely independent modules that maximize internal cohesiveness within modules and minimize coupling between modules. |
| SC-3 (5) | SECURITY FUNCTION ISOLATION \| LAYERED STRUCTURES<br>The organization implements security functions as a layered structure minimizing interactions between layers of the design and avoiding any dependence by lower layers on the functionality or correctness of higher layers. |
| SC-18 (1) | MOBILE CODE \| IDENTIFY UNACCEPTABLE CODE / TAKE CORRECTIVE ACTIONS<br>The information system identifies [Assignment: organization-defined unacceptable mobile code] and takes [Assignment: organization-defined corrective actions]. |
| SC-18 (2) | MOBILE CODE \| ACQUISITION / DEVELOPMENT / USE<br>The organization ensures that the acquisition, development, and use of mobile code to be deployed in the information system meets [Assignment: organization-defined mobile code requirements]. |
| SC-18 (3) | MOBILE CODE \| PREVENT DOWNLOADING / EXECUTION<br>The information system prevents the download and execution of [Assignment: organization-defined unacceptable mobile code]. |
| SC-18 (4) | MOBILE CODE \| PREVENT AUTOMATIC EXECUTION<br>The information system prevents the automatic execution of mobile code in [Assignment: organization-defined software applications] and enforces [Assignment: organization-defined actions] prior to executing the code. |

| SP 800-53 Control Item | Control Text |
|---|---|
| SC-18 (5) | MOBILE CODE \| ALLOW EXECUTION ONLY IN CONFINED ENVIRONMENTS<br>The organization allows execution of permitted mobile code only in confined virtual machine environments. |
| SC-27 | PLATFORM-INDEPENDENT APPLICATIONS<br>Control: The information system includes: [Assignment: organization-defined platform-independent applications]. |
| SC-29 | HETEROGENEITY<br>Control: The organization employs a diverse set of information technologies for [Assignment: organization-defined information system components] in the implementation of the information system. |
| SC-29 (1) | HETEROGENEITY \| VIRTUALIZATION TECHNIQUES<br>The organization employs virtualization techniques to support the deployment of a diversity of operating systems and applications that are changed [Assignment: organization-defined frequency]. |
| SC-34 (1) | NON-MODIFIABLE EXECUTABLE PROGRAMS \| NO WRITABLE STORAGE<br>The organization employs [Assignment: organization-defined information system components] with no writeable storage that is persistent across component restart or power on/off. |
| SC-34 (3) | NON-MODIFIABLE EXECUTABLE PROGRAMS \| HARDWARE-BASED PROTECTION<br>The organization:<br>(a) Employs hardware-based, write-protect for [Assignment: organization-defined information system firmware components]. |
| SC-34 (3) | NON-MODIFIABLE EXECUTABLE PROGRAMS \| HARDWARE-BASED PROTECTION<br>The organization:<br>(b) Implements specific procedures for [Assignment: organization-defined authorized individuals] to manually disable hardware write-protect for firmware modifications and re-enable the write-protect prior to returning to operational mode. |
| SC-35 | HONEYCLIENTS<br>Control: The information system includes components that proactively seek to identify malicious websites and/or web-based malicious code. |
| SC-39 (1) | PROCESS ISOLATION \| HARDWARE SEPARATION<br>The information system implements underlying hardware separation mechanisms to facilitate process separation. |
| SC-39 (2) | PROCESS ISOLATION \| THREAD ISOLATION<br>The information system maintains a separate execution domain for each thread in [Assignment: organization-defined multi-threaded processing]. |
| SE-1 | INVENTORY OF PERSONALLY IDENTIFIABLE INFORMATION<br>Control: The organization:<br>a. Establishes, maintains, and updates [Assignment: organization-defined frequency] an inventory that contains a listing of all programs and information systems identified as collecting, using, maintaining, or sharing personally identifiable information (PII). |

| SP 800-53 Control Item | Control Text |
|---|---|
| SE-1 | INVENTORY OF PERSONALLY IDENTIFIABLE INFORMATION<br>Control: The organization:<br>b. Provides each update of the PII inventory to the CIO or information security official [Assignment: organization-defined frequency] to support the establishment of information security requirements for all new or modified information systems containing PII. |
| SI-2 (3) | FLAW REMEDIATION \| TIME TO REMEDIATE FLAWS / BENCHMARKS FOR CORRECTIVE ACTIONS<br>The organization:<br>(a) Measures the time between flaw identification and flaw remediation. |
| SI-2 (3) | FLAW REMEDIATION \| TIME TO REMEDIATE FLAWS / BENCHMARKS FOR CORRECTIVE ACTIONS<br>The organization:<br>(b) Establishes [Assignment: organization-defined benchmarks] for taking corrective actions. |
| SI-2 (5) | FLAW REMEDIATION \| AUTOMATIC SOFTWARE / FIRMWARE UPDATES<br>The organization installs [Assignment: organization-defined security-relevant software and firmware updates] automatically to [Assignment: organization-defined information system components]. |
| SI-2 (6) | FLAW REMEDIATION \| REMOVAL OF PREVIOUS VERSIONS OF SOFTWARE / FIRMWARE<br>The organization removes [Assignment: organization-defined software and firmware components] after updated versions have been installed. |
| SI-3 (4) | MALICIOUS CODE PROTECTION \| UPDATES ONLY BY PRIVILEGED USERS<br>The information system updates malicious code protection mechanisms only when directed by a privileged user. [MAPCAT-ACPR] |
| SI-3 (6) | MALICIOUS CODE PROTECTION \| TESTING / VERIFICATION<br>The organization:<br>(a) Tests malicious code protection mechanisms [Assignment: organization-defined frequency] by introducing a known benign, non-spreading test case into the information system. |
| SI-3 (6) | MALICIOUS CODE PROTECTION \| TESTING / VERIFICATION<br>The organization:<br>(b) Verifies that both detection of the test case and associated incident reporting occur. |
| SI-3 (7) | MALICIOUS CODE PROTECTION \| NONSIGNATURE-BASED DETECTION<br>The information system implements nonsignature-based malicious code detection mechanisms. |
| SI-3 (8) | MALICIOUS CODE PROTECTION \| DETECT UNAUTHORIZED COMMANDS<br>The information system detects [Assignment: organization-defined unauthorized operating system commands] through the kernel application programming interface at [Assignment: organization-defined information system hardware components] and [Selection (one or more): issues a warning; audits the command execution; prevents the execution of the command]. |

| SP 800-53 Control Item | Control Text |
|---|---|
| SI-3 (9) | MALICIOUS CODE PROTECTION \| AUTHENTICATE REMOTE COMMANDS<br>The information system implements [Assignment: organization-defined security safeguards] to authenticate [Assignment: organization-defined remote commands]. |
| SI-3 (10) | MALICIOUS CODE PROTECTION \| MALICIOUS CODE ANALYSIS<br>The organization:<br>(a) Employs [Assignment: organization-defined tools and techniques] to analyze the characteristics and behavior of malicious code. |
| SI-3 (10) | MALICIOUS CODE PROTECTION \| MALICIOUS CODE ANALYSIS<br>The organization:<br>(b) Incorporates the results from malicious code analysis into organizational incident response and flaw remediation processes. |
| SI-7 (3) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| CENTRALLY-MANAGED INTEGRITY TOOLS<br>The organization employs centrally managed integrity verification tools. |
| SI-7 (6) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| CRYPTOGRAPHIC PROTECTION<br>The information system implements cryptographic mechanisms to detect unauthorized changes to software, firmware, and information. |
| SI-7 (8) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| AUDITING CAPABILITY FOR SIGNIFICANT EVENTS<br>The information system, upon detection of a potential integrity violation, provides the capability to audit the event and initiates the following actions: [Selection (one or more): generates an audit record; alerts current user; alerts [Assignment: organization-defined personnel or roles]; [Assignment: organization-defined other actions]]. |
| SI-7 (9) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| VERIFY BOOT PROCESS<br>The information system verifies the integrity of the boot process of [Assignment: organization-defined devices]. |
| SI-7 (10) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| PROTECTION OF BOOT FIRMWARE<br>The information system implements [Assignment: organization-defined security safeguards] to protect the integrity of boot firmware in [Assignment: organization-defined devices]. |
| SI-7 (11) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| CONFINED ENVIRONMENTS WITH LIMITED PRIVILEGES<br>The organization requires that [Assignment: organization-defined user-installed software] execute in a confined physical or virtual machine environment with limited privileges. |
| SI-7 (12) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| INTEGRITY VERIFICATION<br>The organization requires that the integrity of [Assignment: organization-defined user-installed software] be verified prior to execution. |

| SP 800-53 Control Item | Control Text |
|---|---|
| SI-7 (13) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| CODE EXECUTION IN PROTECTED ENVIRONMENTS<br>The organization allows execution of binary or machine-executable code obtained from sources with limited or no warranty and without the provision of source code only in confined physical or virtual machine environments and with the explicit approval of [Assignment: organization-defined personnel or roles]. |
| SI-7 (15) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| CODE AUTHENTICATION<br>The information system implements cryptographic mechanisms to authenticate [Assignment: organization-defined software or firmware components] prior to installation. |
| SI-7 (16) | SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY \| TIME LIMIT ON PROCESS EXECUTION W/O SUPERVISION<br>The organization does not allow processes to execute without supervision for more than [Assignment: organization-defined time period]. |
| SI-14 | NON-PERSISTENCE<br>Control: The organization implements non-persistent [Assignment: organization-defined information system components and services] that are initiated in a known state and terminated [Selection (one or more): upon end of session of use; periodically at [Assignment: organization-defined frequency]]. |
| SI-14 (1) | NON-PERSISTENCE \| REFRESH FROM TRUSTED SOURCES<br>The organization ensures that software and data employed during information system component and service refreshes are obtained from [Assignment: organization-defined trusted sources]. |

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# Appendix E. SWAM-Specific Acronyms and Abbreviations

SWID – Software Identification

# Appendix F. Glossary

| | |
|---|---|
| Core Software | An organizationally defined set of software that, at a minimum, includes firmware and root operating system elements used to boot the system. Core software merits specialized monitoring as it may be difficult for commonly used whitelisting software to check. |
| Cryptographic Hash Value | The result of applying a cryptographic hash function to data (e.g., a message). (Source: SP 800-57). Also see Message Digest. |
| Digital Fingerprint | See Message Digest. |
| Digital Signature | An asymmetric key operation where the private key is used to digitally sign data and the public key is used to verify the signature. Digital signatures provide authenticity protection, integrity protection, and non-repudiation, but not confidentiality protection. (Source: SP 800-63) |
| Installation (as used herein) | Any of the following actions:<br>• Executing an installer to load software.<br>• Listing software in the operating system software directory<br>• (Merely) placing executable software on a medium from which it can be executed, even if no installer software is run and there is no listing for it in the operating system software directory.<br>• Any other action that allows an executable file to be loaded into the CPU (e.g., browsing a website that downloads software; opening an e-mail (or attachment) that downloads software; etc.) |
| Message Digest | The result of applying a hash function to a message. Also known as a “hash value” or “hash output”. (Source: SP 800-107)<br>A digital signature that uniquely identifies data and has the property that changing a single bit in the data will cause a completely different message digest to be generated. (Source: SP 800-92)<br>A cryptographic checksum, typically generated for a file that can be used to detect changes to the file. Synonymous with hash value/result. (Source: CNSSI-4009). |
| SWID Tag | A SWID tag is an ISO 19770-2 compliant XML file describing a software product. It is typically digitally signed by the software |

| | |
|---|---|
| | manufacturer to verify its validity. Ideally, for purposes of software asset management, the SWID tag will contain the digests (digital fingerprints) of each executable installed or placed on the device with the product. |
| Zero-Day Attack | An attack that exploits a previously unknown hardware, firmware, or software vulnerability. |

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# Appendix G. Control Items Affecting Desired and/or Actual State from All Defect Checks in this Volume.

This table is to support root cause analysis when a specific defect check fails. Such a failure might be caused not only by a failure of the specific control items mapped to that defect check in the defect check narratives, but also by a failure in any of the following control items. As used here, these controls apply to potential defects in the desired state (DS) and/or actual state (AS). The rationale column explains how a defect in the control item might cause the defect check to fail.

Note: These items are not explicitly included in the control item assessment narratives, unless they also apply to CM of items other than the desired and actual states, *for assessment.*

| Determination Statement ID | Determination Statement Text | Impact Level | Affects DS and/or AS | Rationale |
|---|---|---|---|---|
| CM-2{1} | Determine if the organization: develops, documents, and maintains under configuration control, a current baseline configuration of the information system. | Low | DS | Otherwise, there is no desired state for testing. |
| CM-2(1)(a){1} | Determine if the organization: reviews and updates the baseline configuration of the information system:<br>(a) [Assignment: organization-defined frequency]. | Moderate | DS | Otherwise, the desired state might not be updated as needed to maintain appropriate security. |
| CM-2(1)(b){1} | Determine if the organization: reviews and updates the baseline configuration of the information system:<br>(b) When required due to [Assignment organization-defined circumstances]. | Moderate | DS | Otherwise, desired state might not be updated based on the organization-defined circumstances. |
| CM-2(1)(c){1} | Determine if the organization: reviews and updates the baseline configuration of the information system:<br>(c) As an integral part of information system component installations and upgrades. | Moderate | DS | Otherwise, desired state might not be updated as appropriate when component installations and updates occur. |
| CM-2(2){1} | Determine if the organization: employs automated mechanisms to maintain an up-to-date, complete, accurate, and readily available baseline configuration of the information system. | High | DS | Otherwise accurate testing information might not be provided. |

| Determination Statement ID | Determination Statement Text | Impact Level | Affects DS and/or AS | Rationale |
|---|---|---|---|---|
| CM-3(a){1} | Determine if the organization: employs automated mechanisms to determine the types of changes to the system {installed software} that are configuration-controlled. | Moderate | DS | Otherwise, the desired state might not specify all {machine-readable} data needed for implemented defect checks. |
| CM-3(b){1} | Determine if the organization: reviews proposed configuration-controlled changes to the {software of the} system and approves or disapproves such changes. | Moderate | DS | Otherwise, the decisions on desired state might not adequately reflect security impact of changes. |
| CM-3(b){2} | Determine if the organization: explicitly considers security impact analysis when reviewing proposed configuration-controlled changes to the {software of the} system. | Moderate | DS | Otherwise, the decisions on desired state might not adequately reflect security impact of changes. |
| CM-3(c){1} | Determine if the organization: documents configuration change decisions associated with the system {installed software}. | Moderate | DS | Otherwise changes to the desired state specification might not be documented and available {as machine-readable data}. |
| CM-3(d){1} | Determine if the organization: implements approved configuration-controlled changes to the system {installed software}. | Moderate | AS | Otherwise, defect checks might fail because changes were not implemented in the actual state. |
| CM-3(f){1} | Determine if the organization: audits activities associated with configuration-controlled changes to the {software of the} system. | Moderate | DS | Otherwise, errors in the desired state might not be detected. |
| CM-3(f){2} | Determine if the organization: reviews activities associated with configuration-controlled changes to the {software of the} system. | Moderate | DS | Otherwise, errors in the desired state might not be detected. |
| CM-3(g){1} | Determine if the organization: coordinates configuration change control activities {of software} through [Assignment: organization-defined configuration change control element (e.g., committee, board)] that convenes [Selection (one or more): [Assignment: organization-defined frequency]; [Assignment: organization-defined configuration change conditions]. | Moderate | DS | Otherwise, the persons authorized to make change approval decisions, and the scope of their authority, might not be clearly defined to enable knowing what decisions are authorized. |
| CM-3(g){2} | Determine if the organization: provides | Moderate | DS | Otherwise, the persons authorized to make |

| Determination Statement ID | Determination Statement Text | Impact Level | Affects DS and/or AS | Rationale |
|---|---|---|---|---|
| | oversight for configuration change control activities {of software} through [Assignment: organization-defined configuration change control element (e.g., committee, board)] that convenes [Selection (one or more): [Assignment: organization-defined frequency]; [Assignment: organization-defined configuration change conditions]. | | | change approval decisions, and the scope of their authority, might not be clearly defined to enable knowing what decisions are authorized. |
| CM-3(1)(a){1} | Determine if the organization: employs automated mechanisms to document proposed changes to the system {installed software}. | High | DS | Otherwise changes to the desired state specification might not be documented and available for assessment. |
| CM-3(1)(b){1} | Determine if the organization: employs automated mechanisms to notify [Assignment: organized-defined approval authorities] of proposed changes to the system {installed software} and request change approval. | High | DS | Otherwise, needed changes might not be reviewed in a timely manner. |
| CM-3(1)(c){1} | Determine if the organization: employs automated mechanisms to highlight proposed changes to the system {installed software} that have not been approved or disapproved by [Assignment: organization-defined time period]. | High | DS | Otherwise, needed changes might not be reviewed in a timely manner. |
| CM-3(1)(d){1} | Determine if the organization: employs automated mechanisms to prohibit changes to the system {installed software} until designated approvals are received. | High | DS | Otherwise, unapproved changes might be implemented. |
| CM-3(1)(e){1} | Determine if the organization: employs automated mechanisms to document all changes to the system {installed software}. | High | AS | Otherwise, documented changes might not reflect the actual state of the system. |
| CM-3(1)(f){1} | Determine if the organization: employs automated mechanisms to notify [Assignment: organization-defined personnel] when approved changes to the system {installed software} are completed. | High | DS | Otherwise, required changes might be missed. |
| CM-3(2){1} | Determine if the organization: tests, | Moderate | DS and AS | Otherwise, changes might increase risk by |

| Determination Statement ID | Determination Statement Text | Impact Level | Affects DS and/or AS | Rationale |
|---|---|---|---|---|
| | validates, and documents changes to the {software of the} system before implementing the changes on the operational system.<br>N/A in the operational environment.<br>This should be assessed via manual reauthorization prior to placing policy in the desired state. Because it occurs as part of system engineering, it is outside the scope of this operational capability. | | | creating operational or security defects. |
| CM-8(a){1} | Determine if the organization: develops and documents an inventory of system components {for software} that: (1) accurately reflects the current system; and (2) includes all components within the authorization boundary of the system. | Low | DS and AS | Otherwise the desired state and actual state inventories might have errors related to accuracy, completeness, and/or content. |
| CM-8(a){2} | Determine if the organization: develops and documents an inventory of system components {for software} that is at the level of granularity deemed necessary for tracking and reporting [by the organization]. | Low | DS and AS | Otherwise the desired state and actual state inventories might have errors related to level of detail. |
| CM-8(b){1} | Determine if the organization: updates the system component inventory {for software} [Assignment: organization-defined frequency]. | Low | DS and AS | Otherwise, defects in the desired state and actual state inventories, and related processes, might not be detected. |
| CM-8(b){2} | Determine if the organization: reviews the system component inventory {for software} [Assignment: organization-defined frequency]. | Low | DS and AS | Otherwise, defects in the desired state and actual state inventories, and related processes, might not be detected. |
| CM-8(1){1} | Determine if the organization: updates the inventory of system {installed software} components as an integral part of component installations, removals, and system updates. | Moderate | DS and AS | Otherwise, defects in desired state and actual state inventories and related processes might not be detected. |
| CM-8(2){1} | Determine if the organization: employs automated mechanisms to help maintain an up-to-date, complete, accurate, and | High | DS and AS | Otherwise, an up to date and accurate desired state and actual state inventories might not be available for automated |

| Determination Statement ID | Determination Statement Text | Impact Level | Affects DS and/or AS | Rationale |
|---|---|---|---|---|
| | readily available inventory of system {installed software} components. | | | assessment. |
| CM-8(3)(a){1} | Determine if the organization: employs automated mechanisms [Assignment: organization-defined frequency] to detect the presence of unauthorized software and firmware components within the system. | Moderate | AS | Otherwise, inventory accuracy (e.g., completeness and timeliness) might be difficult or impossible to maintain. |
| CM-8(3)(b){1} | Determine if the organization: takes the following actions when unauthorized {installed software} components are detected: [Selection (one or more): disables network access by such components; isolates the components; notifies [Assignment: organization-defined personnel or roles]]. | Moderate | AS | Otherwise, detected security defects might not be mitigated. |
| CM-8(4){1} | Determine if the organization: includes in the {installed software} system component inventory information, a means for identifying by [Selection (one or more): name; position; role], individuals responsible/accountable for administering those components. | Low | DS | Otherwise, when defects are detected, the automated systems cannot know what persons or groups to notify to take appropriate action. |

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2061 **Control Allocation Table for Appendix G**

| Determination Statement ID | Imple-mented By | Assess-ment Boundary | Assessment Respon-sibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Imple-menting | Level |
|---|---|---|---|---|---|---|---|---|---|
| CM-2{1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Low |
| CM-2(1)(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-2(1)(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-2(1)(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-2(2){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-3(a){1} | DSM | ISCM-TN | MAN | TBD | | | | | Moderate |
| CM-3(b){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(c){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(d){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(e){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(f){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(f){2} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(g){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(g){2} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-3(1)(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-3(1)(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-3(1)(c){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-3(1)(d){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | High |

| Determination Statement ID | Imple-mented By | Assess-ment Boundary | Assessment Respon-sibility | Assessment Methods | Selected | Rationale for Risk Acceptance | Frequency of Assessment | Impact of Not Imple-menting | Level |
|---|---|---|---|---|---|---|---|---|---|
| CM-3(1)(e){1} | ISCM-Sys | ISCM-TN | MAN | TBD | | | | | High |
| CM-3(1)(f){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-3(2){1} | DSM | ISCM-TN | MAN | TBD | | | | | Moderate |
| CM-8(a){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Low |
| CM-8(a){2} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Low |
| CM-8(b){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Low |
| CM-8(b){2} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Low |
| CM-8(1){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-8(2){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | High |
| CM-8(3)(a){1} | ISCM-Sys | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-8(3)(b){1} | SWMan | ISCM-TN | ISCM-Sys | Test | | | | | Moderate |
| CM-8(4){1} | DSM | ISCM-TN | ISCM-Sys | Test | | | | | Low |

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