Safeguard visualizations community project

“A visual guide” to The Center for Internet Security Critical Controls

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The objective of the following is to create a resourceful guide that assists security professionals in navigating through the alignment of their cybersecurity stack with the CIS Critical Controls™ and Safeguards. To do so this document presents visual representations of each safeguard's language broken down into specific taxonomical elements. Additional work has been done to help visualize the "interdependence" between the 153 safeguards that make up the CIS Critical Controls™.

Utilizing visual mappings of these elements, security teams have an effective way to evaluate their understanding of the breadth and depth of each safeguard, identify gaps, and plan for enhancements. While vendors may find this guide useful for aligning their products and service features with CIS Controls, the primary focus is supporting security teams in strengthening their preventative security measures.

These guides are born from an initiative utilizing these taxonomical elements to create a questionnaire that classifies vendors' products, and services, into the safeguards they aid. This involves a detailed evaluation criterion, including technical components and vendor attestation methods, to ensure comprehensive coverage capabilities for each respective safeguard. The resulting classifications and sorting of vendor tool products will additionally help reduce the curve of adoption of the CIS Critical Controls and will be available in many formats including in the Pax8 platform.

A note to the reader:

This publication is a result of a collaborative effort between Pax8, the Center of Internet Security (CIS), and a diverse group of industry leaders that span from practitioners to developers.

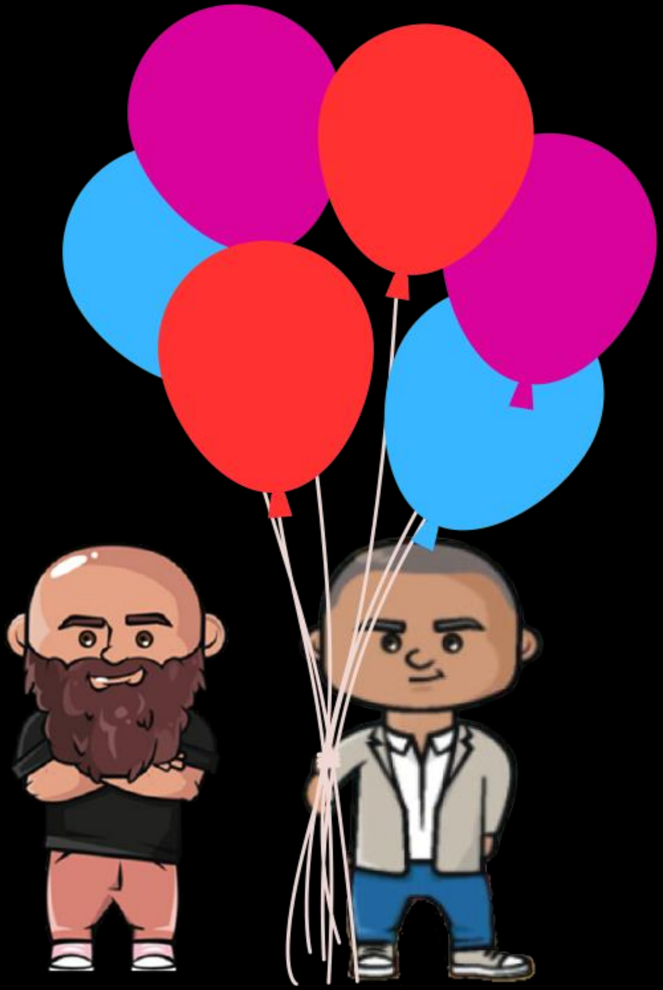
Nothing in this document should be taken to contradict or alter the existing CIS standards and/or guidelines. This guide is designed with the prerequisite understanding that the readers have a foundational knowledge of security principles. It is additionally helpful that the reader be aware of CIS Controls, CIS Implementation Groups, CIS Benchmarks, and the broader CIS body of work.

With a unified mission to level up cybersecurity best practices' businesses globally, this effort will continue to be a community collaboration of security professionals. We invite you to make the most of this freely available resource!

Thank you

Finally, we would like to thank all who collaborated and invested many hours in the success of this project.

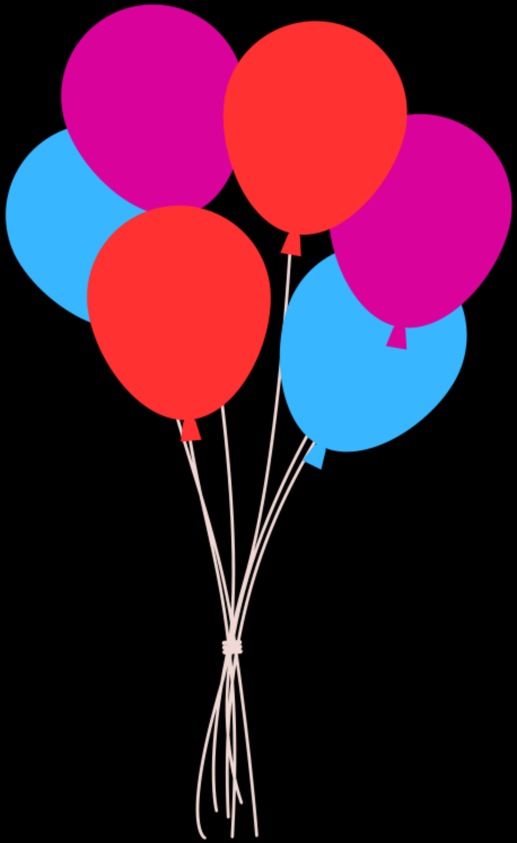
Understanding safeguard visualizations using balloons



A helpful precursor to the visualizations

Video Walkthrough

https://go.cybermattlee.com/balloonsafeguards



CONTROL 1

Inventory and Control of Enterprise Assets

Safeguards: 5	IG1: 2/5	IG2: 4/5	IG3: 5/5

Overview

Actively manage (inventory, track, and correct) all enterprise assets (end-user devices, including portable and mobile; network devices; non-computing/Internet of Things (IoT) devices; and servers) connected to the infrastructure physically, virtually, remotely, and those within cloud environments, to accurately know the totality of assets that need to be monitored and protected within the enterprise. This will also support identifying unauthorized and unmanaged assets to remove or remediate.

Group Validated

1.1

Process Oriented Safeguard

IG1

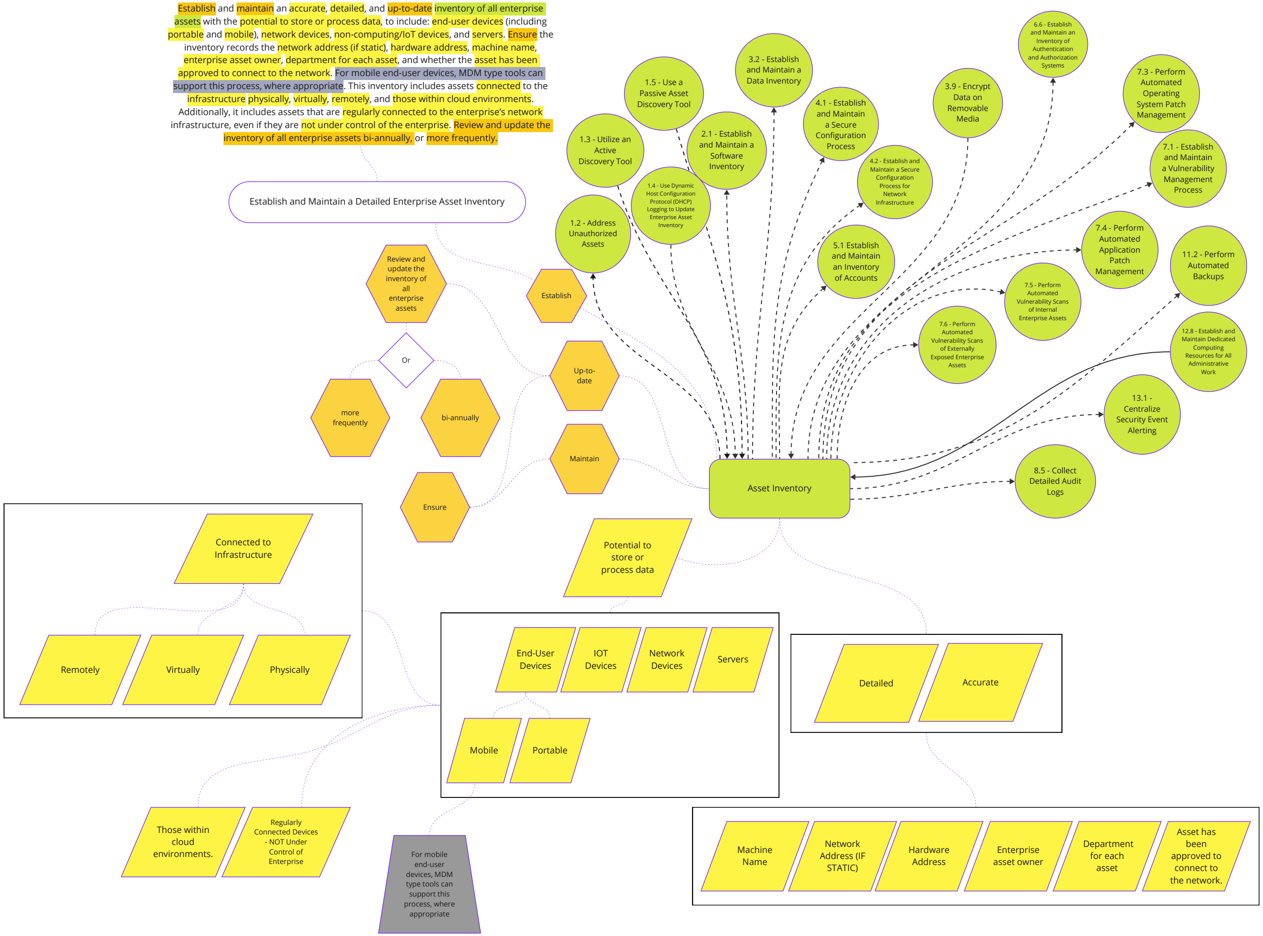
Asset Management

Identify

Devices

Enterprise Asset Management Policy / Process

Enterprise and Software Asset Management Tool



Establish and maintain an accurate, detailed, and up-to-date inventory of all enterprise assets with the potential to store or process data, to include: end-user devices (including portable and mobile), network devices, non-computing/IoT devices, and servers. Ensure the inventory records the network address (if static), hardware address, machine name, enterprise asset owner, department for each asset, and whether the asset has been approved to connect to the network. For mobile end-user devices, MDM type tools can support this process, where appropriate. This inventory includes assets connected to the infrastructure physically, virtually, remotely, and those within cloud environments. Additionally, it includes assets that are regularly connected to the enterprise's network infrastructure, even if they are not under control of the enterprise. Review and update the inventory of all enterprise assets bi-annually, or more frequently.

Establish and Maintain a Detailed Enterprise Asset Inventory

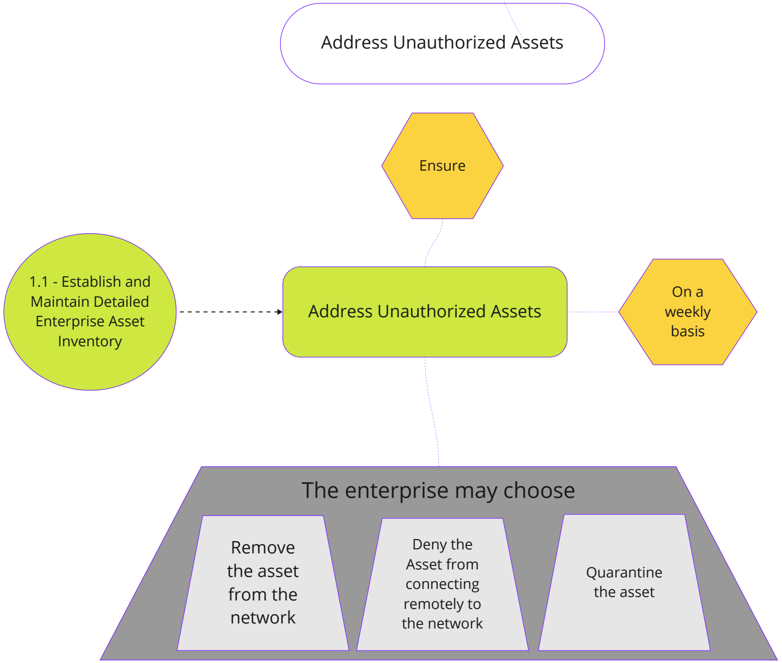
For mobile end-user devices, MDM type tools can support this process, where appropriate

Review and update the inventory of all enterprise assets
Or
more frequently
bi-annually
Establish
Up-to-date
Maintain
Ensure
Asset Inventory
1.2 - Address Unauthorized Assets
1.3 - Utilize an Active Discovery Tool
1.4 - Use Dynamic Host Configuration Protocol (DHCP) Logging to Update Enterprise Asset Inventory
1.5 - Use a Passive Asset Discovery Tool
2.1 - Establish and Maintain a Software Inventory
3.2 - Establish and Maintain a Data Inventory
4.1 - Establish and Maintain a Secure Configuration Process
4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure
5.1 Establish and Maintain an Inventory of Accounts
3.9 - Encrypt Data on Removable Media
6.6 - Establish and Maintain an Inventory of Authentication and Authorization Systems
7.3 - Perform Automated Operating System Patch Management
7.1 - Establish and Maintain a Vulnerability Management Process
7.4 - Perform Automated Application Patch Management
7.5 - Perform Automated Vulnerability Scans of Internal Enterprise Assets
7.6 - Perform Automated Vulnerability Scans of Externally Exposed Enterprise Assets
11.2 - Perform Automated Backups
12.8 - Establish and Maintain Dedicated Computing Resources for All Administrative Work
13.1 - Centralize Security Event Alerting
8.5 - Collect Detailed Audit Logs
Potential to store or process data
Connected to Infrastructure
Remotely
Virtually
Physically
End-User Devices
IOT Devices
Network Devices
Servers
Mobile
Portable
Detailed
Accurate
Those within cloud environments.
Regularly Connected Devices - NOT Under Control of Enterprise
Machine Name
Network Address (IF STATIC)
Hardware Address
Enterprise asset owner
Department for each asset
Asset has been approved to connect to the network.

Group Validated

1.2

Ensure that a process exists to address unauthorized assets on a weekly basis. The enterprise may choose to remove the asset from the network, deny the asset from connecting remotely to the network, or quarantine the asset.



Address Unauthorized Assets

Ensure

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

Address Unauthorized Assets

On a weekly basis

The enterprise may choose

Remove the asset from the network

Deny the Asset from connecting remotely to the network

Quarantine the asset

IG1

Respond

Devices

Asset management

Enterprise and Software Asset Management Tool

Group Validated

1.3

Utilize an active discovery tool to identify assets connected to the enterprise's network. Configure the active discovery tool to execute daily, or more frequently.

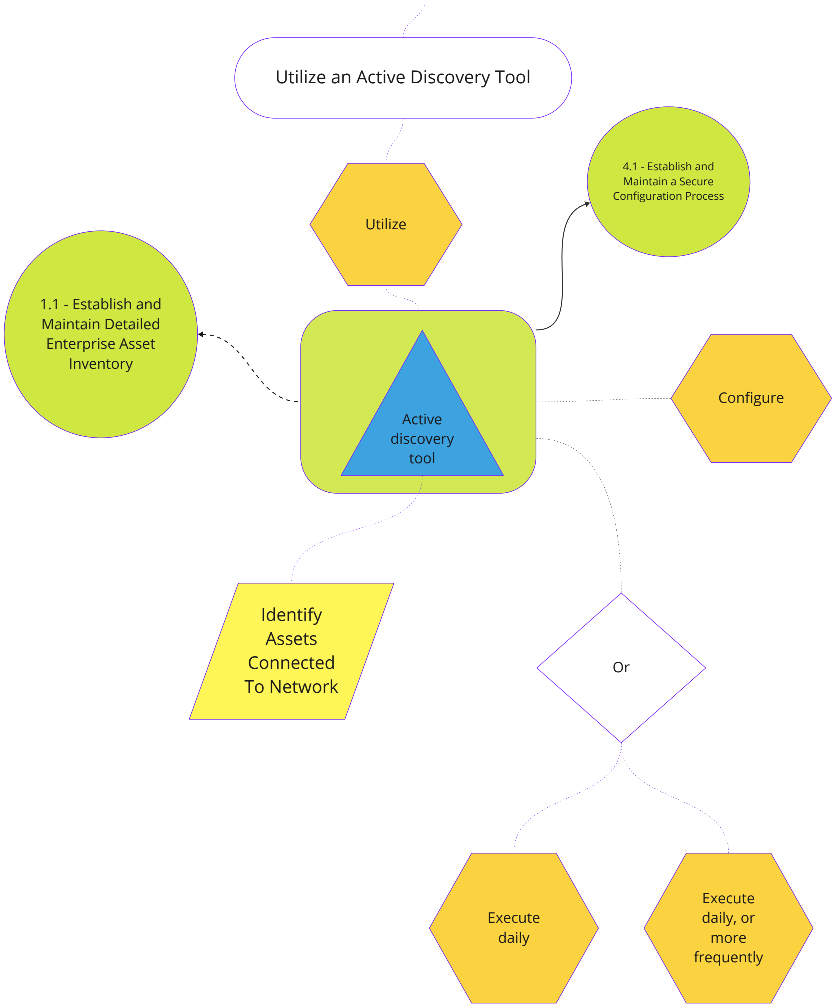
IG2

Asset Management

Detect

Devices

Software and Asset Discovery Tool


Utilize an Active Discovery Tool
Utilize
4.1 - Establish and Maintain a Secure Configuration Process
1.1 - Establish and Maintain Detailed Enterprise Asset Inventory
Active discovery tool
Configure
Identify Assets Connected To Network
Or
Execute daily
Execute daily, or more frequently

Group Validated

1.4

Use DHCP logging on all DHCP servers or Internet Protocol (IP) address management tools to update the enterprise's asset inventory. Review and use logs to update the enterprise's asset inventory weekly, or more frequently.

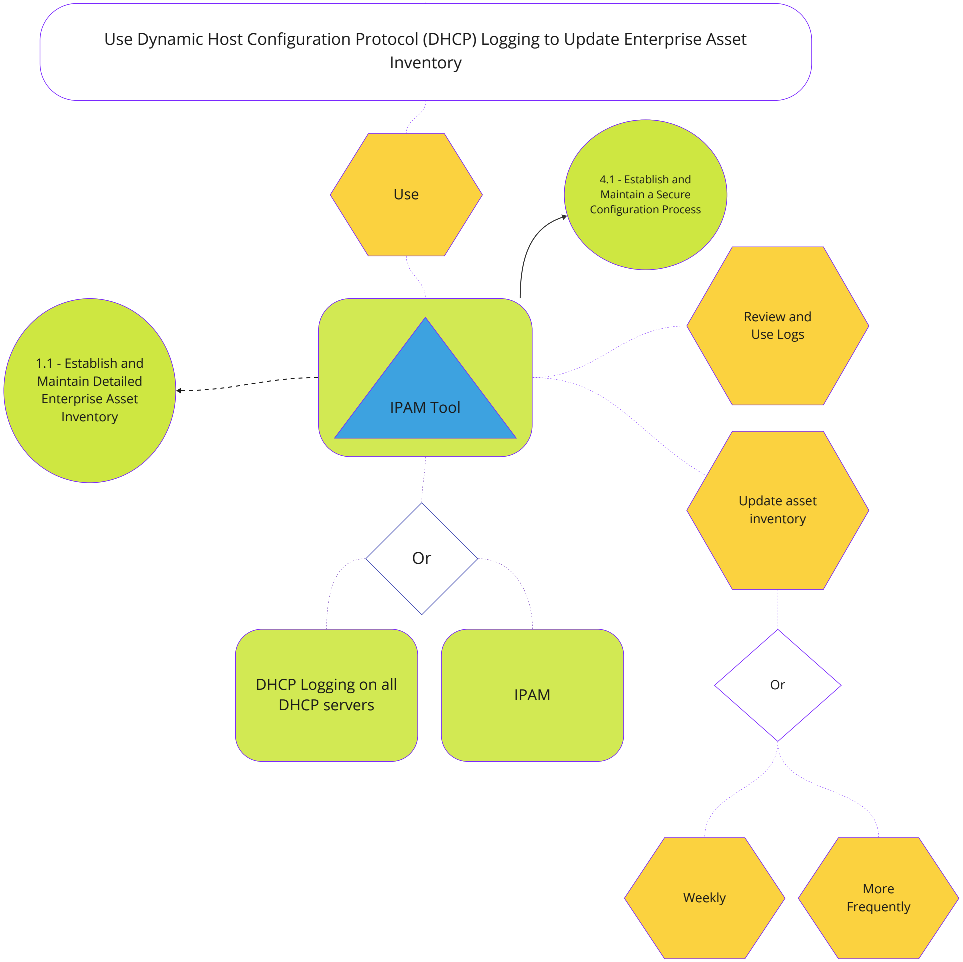
IG2

Identify

Devices

Asset Management

Software and Asset Discovery Tool



Use Dynamic Host Configuration Protocol (DHCP) Logging to Update Enterprise Asset Inventory

Use

4.1 - Establish and Maintain a Secure Configuration Process

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

IPAM Tool

Review and Use Logs

Update asset inventory

Or

DHCP Logging on all DHCP servers

IPAM

Or

Weekly

More Frequently

Group Validated

1.5

Use a passive discovery tool to identify assets connected to the enterprise's network. Review and use scans to update the enterprise's asset inventory at least weekly, or more frequently.

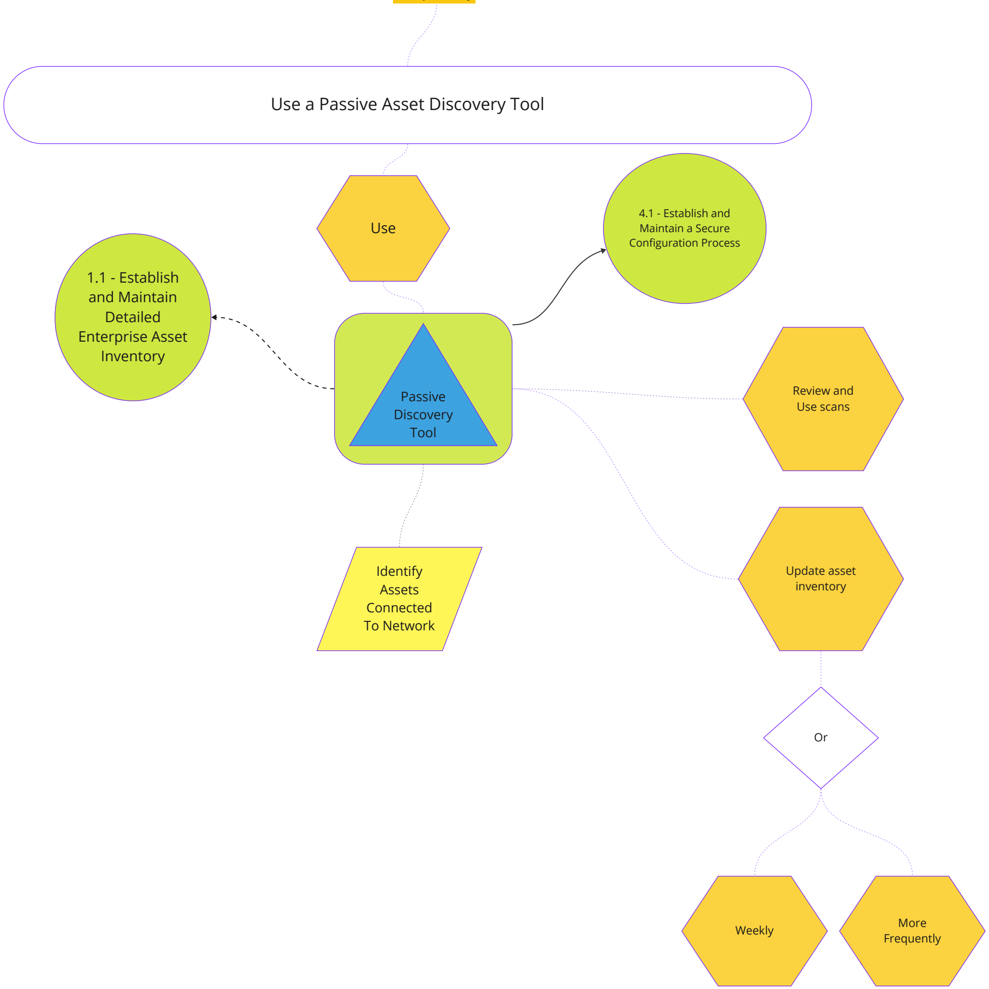
IG3

Asset Management

Detect

Software and Asset Discovery Tool

Devices



Use a Passive Asset Discovery Tool

Use

4.1 - Establish and Maintain a Secure Configuration Process

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

Passive Discovery Tool

Review and Use scans

Update asset inventory

Identify Assets Connected To Network

Or

Weekly

More Frequently

CONTROL 2

Inventory and Control of Software Assets

Safeguards: 7	IG1: 3/7	IG2: 6/7	IG3: 7/7

Overview

Actively manage (inventory, track, and correct) all software (operating systems and applications) on the network so that only authorized software is installed and can execute, and that unauthorized and unmanaged software is found and prevented from installation or execution.

Group Validated

2.1

Establish and maintain a detailed inventory of all licensed software installed on enterprise assets. The software inventory must document the title, publisher, initial install/use date, and business purpose for each entry; where appropriate, include the Uniform Resource Locator (URL), app store(s), version(s), deployment mechanism, and decommission date. Review and update the software inventory bi-annually, or more frequently.

Process Oriented Safeguard

IG1

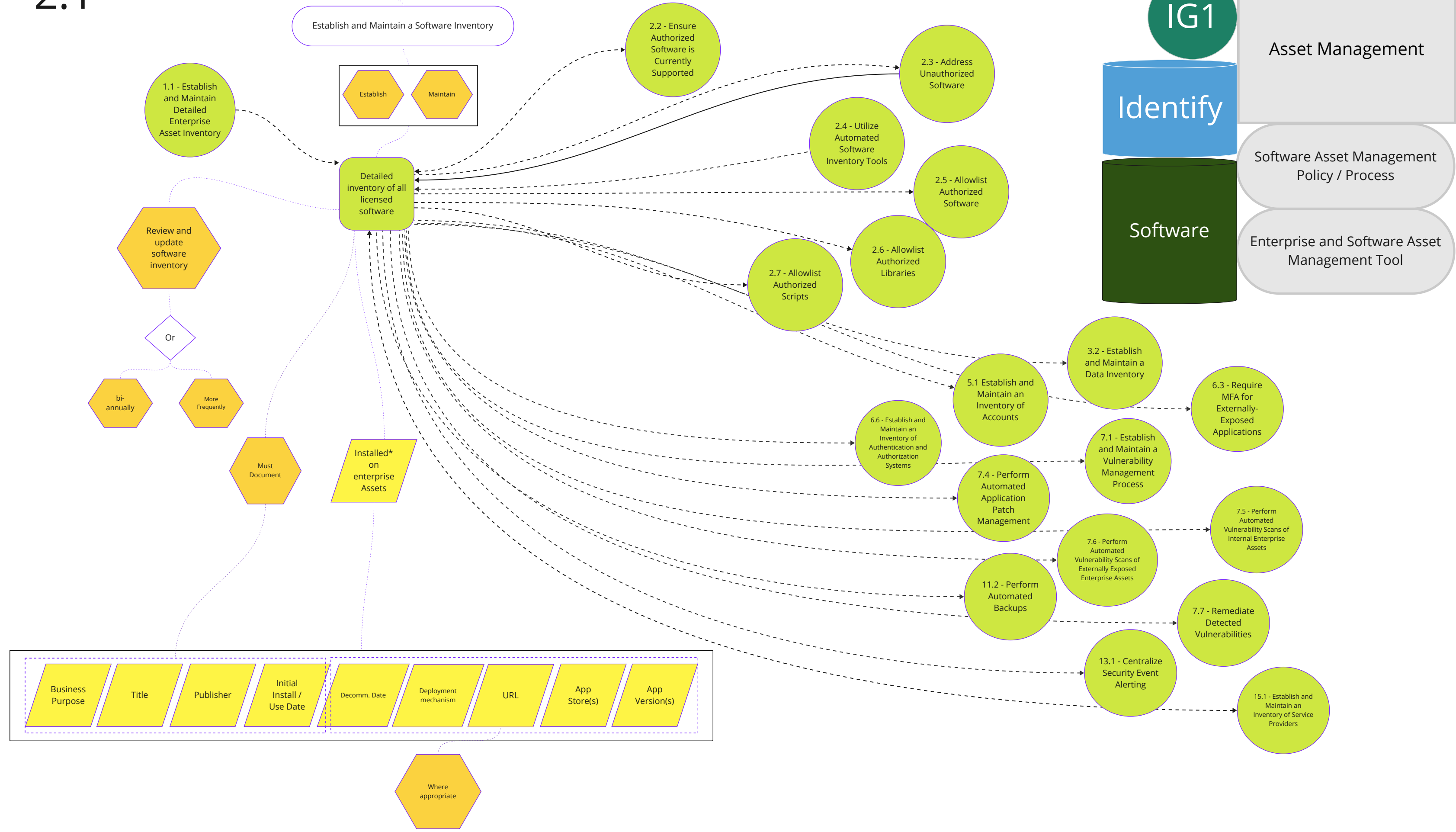
Asset Management

Identify

Software

Software Asset Management Policy / Process

Enterprise and Software Asset Management Tool



Establish and Maintain a Software Inventory

Establish

Maintain

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

Detailed inventory of all licensed software

2.2 - Ensure Authorized Software is Currently Supported

2.3 - Address Unauthorized Software

2.4 - Utilize Automated Software Inventory Tools

2.5 - Allowlist Authorized Software

2.6 - Allowlist Authorized Libraries

2.7 - Allowlist Authorized Scripts

3.2 - Establish and Maintain a Data Inventory

5.1 Establish and Maintain an Inventory of Accounts

6.3 - Require MFA for Externally-Exposed Applications

6.6 - Establish and Maintain an Inventory of Authentication and Authorization Systems

7.1 - Establish and Maintain a Vulnerability Management Process

7.4 - Perform Automated Application Patch Management

7.5 - Perform Automated Vulnerability Scans of Internal Enterprise Assets

7.6 - Perform Automated Vulnerability Scans of Externally Exposed Enterprise Assets

7.7 - Remediate Detected Vulnerabilities

11.2 - Perform Automated Backups

13.1 - Centralize Security Event Alerting

15.1 - Establish and Maintain an Inventory of Service Providers

Review and update software inventory

Or

bi-annually

More Frequently

Must Document

Installed* on enterprise Assets

Business Purpose

Title

Publisher

Initial Install / Use Date

Decomm. Date

Deployment mechanism

URL

App Store(s)

App Version(s)

Where appropriate

Group Validated

2.2

Ensure that only currently supported software is designated as authorized in the software inventory for enterprise assets. If software is unsupported, yet necessary for the fulfillment of the enterprise's mission, document an exception detailing mitigating controls and residual risk acceptance. For any unsupported software without an exception documentation, designate as unauthorized. Review the software list to verify software support at least monthly, or more frequently.

Process Oriented Safeguard

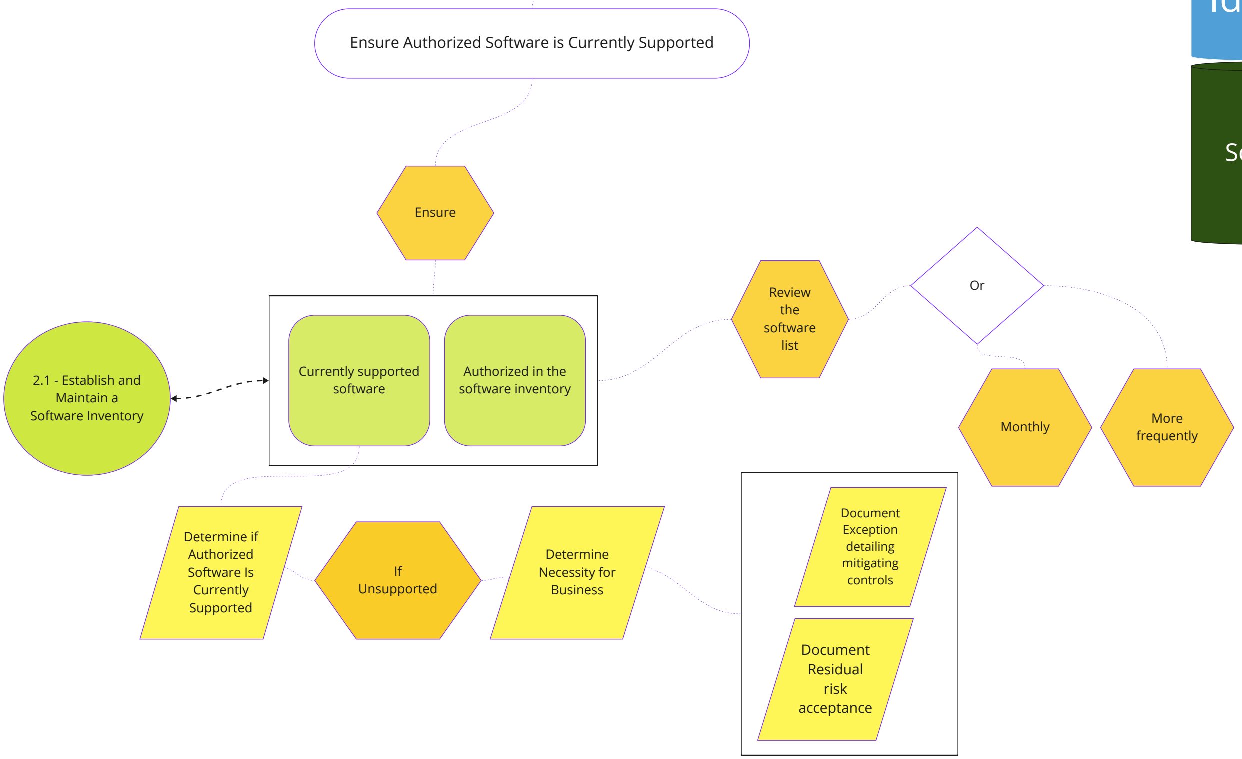
IG1

Asset Management

Identify

Enterprise and Software Asset Management Tool

Software



Ensure Authorized Software is Currently Supported

Ensure

2.1 - Establish and Maintain a Software Inventory

Currently supported software

Authorized in the software inventory

Review the software list

Or

Monthly

More frequently

Determine if Authorized Software Is Currently Supported

If Unsupported

Determine Necessity for Business

Document Exception detailing mitigating controls

Document Residual risk acceptance

Group Validated

2.3

Ensure that unauthorized software is either removed from use on enterprise assets or receives a documented exception. Review monthly, or more frequently.

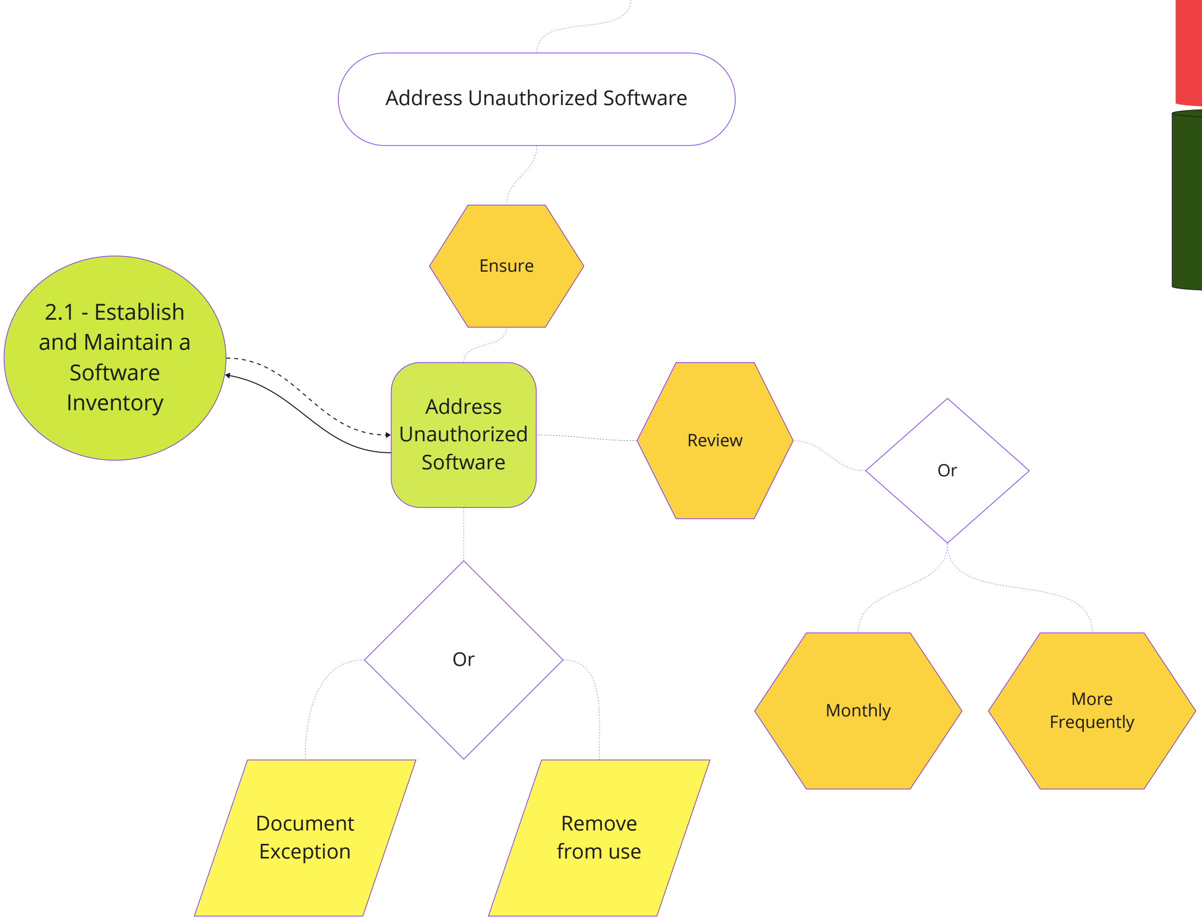
IG1

Asset Management

Respond

Software

Enterprise and Software Asset Management Tool



Address Unauthorized Software

Ensure

2.1 - Establish and Maintain a Software Inventory

Address Unauthorized Software

Review

Or

Or

Monthly

More Frequently

Document Exception

Remove from use

Group Validated

2.4

Utilize software inventory tools, when possible, throughout the enterprise to automate the discovery and documentation of installed software.

IG2

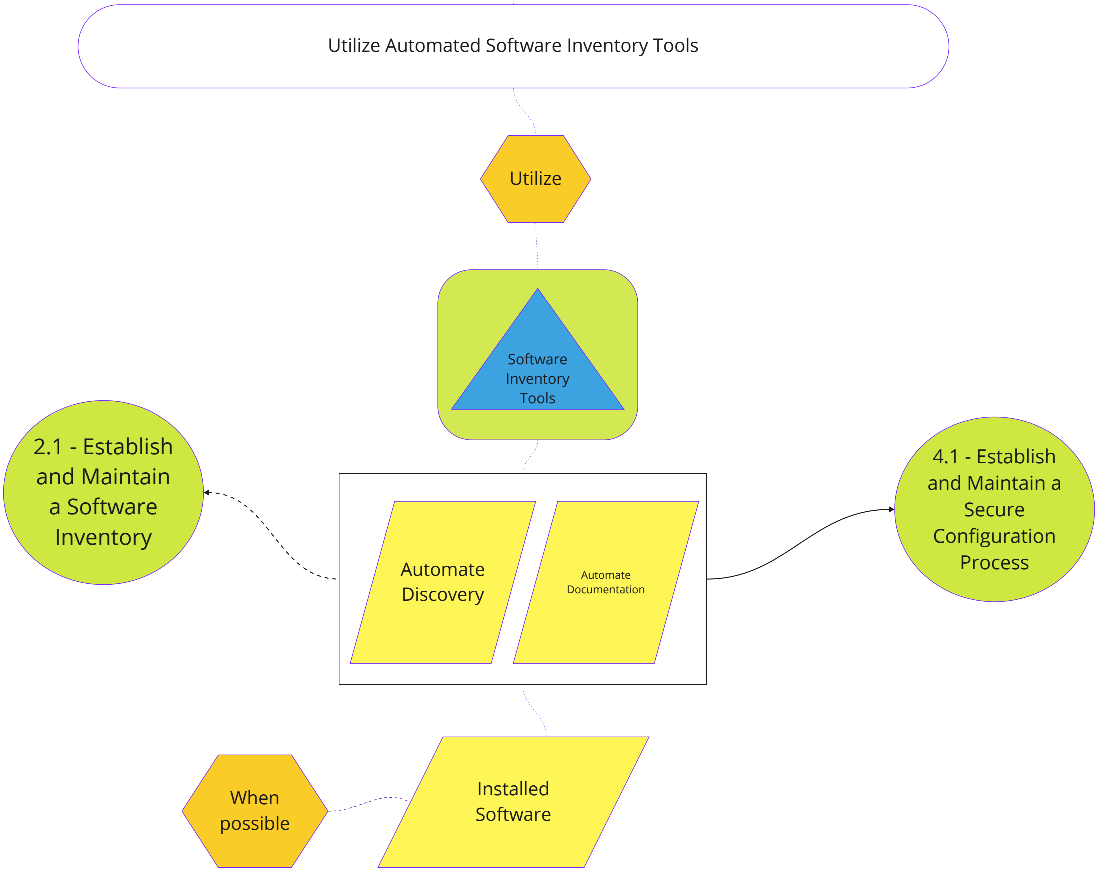
Asset Management

Detect

Software

Enterprise and Software Asset Management Tool

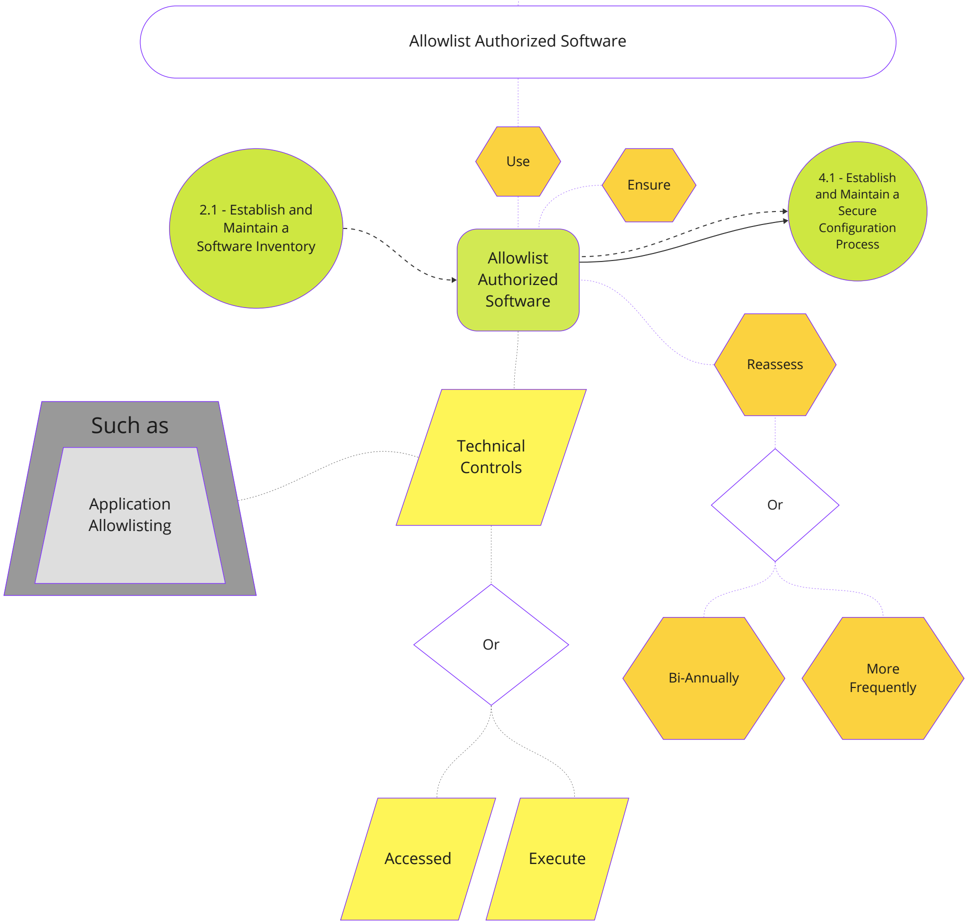
Software and Asset Discovery Tool


Utilize Automated Software Inventory Tools
Utilize
Software Inventory Tools
2.1 - Establish and Maintain a Software Inventory
Automate Discovery
Automate Documentation
4.1 - Establish and Maintain a Secure Configuration Process
When possible
Installed Software

Group Validated

2.5

Use technical controls, such as application allowlisting, to ensure that only authorized software can execute or be accessed. Reassess bi-annually, or more frequently.



Allowlist Authorized Software

Use

Ensure

2.1 - Establish and Maintain a Software Inventory

Allowlist Authorized Software

4.1 - Establish and Maintain a Secure Configuration Process

Reassess

Such as

Application Allowlisting

Technical Controls

Or

Or

Bi-Annually

More Frequently

Accessed

Execute

IG2

Protect

Asset Management

Application Control and Allowlisting Tool

Software

OS Dependent

Group Validated

2.6

Use technical controls to ensure that only authorized software libraries, such as specific .dll, .ocx, .so. files are allowed to load into a system process. Block unauthorized libraries from loading into a system process. Reassess bi-annually, or more frequently.

IG2

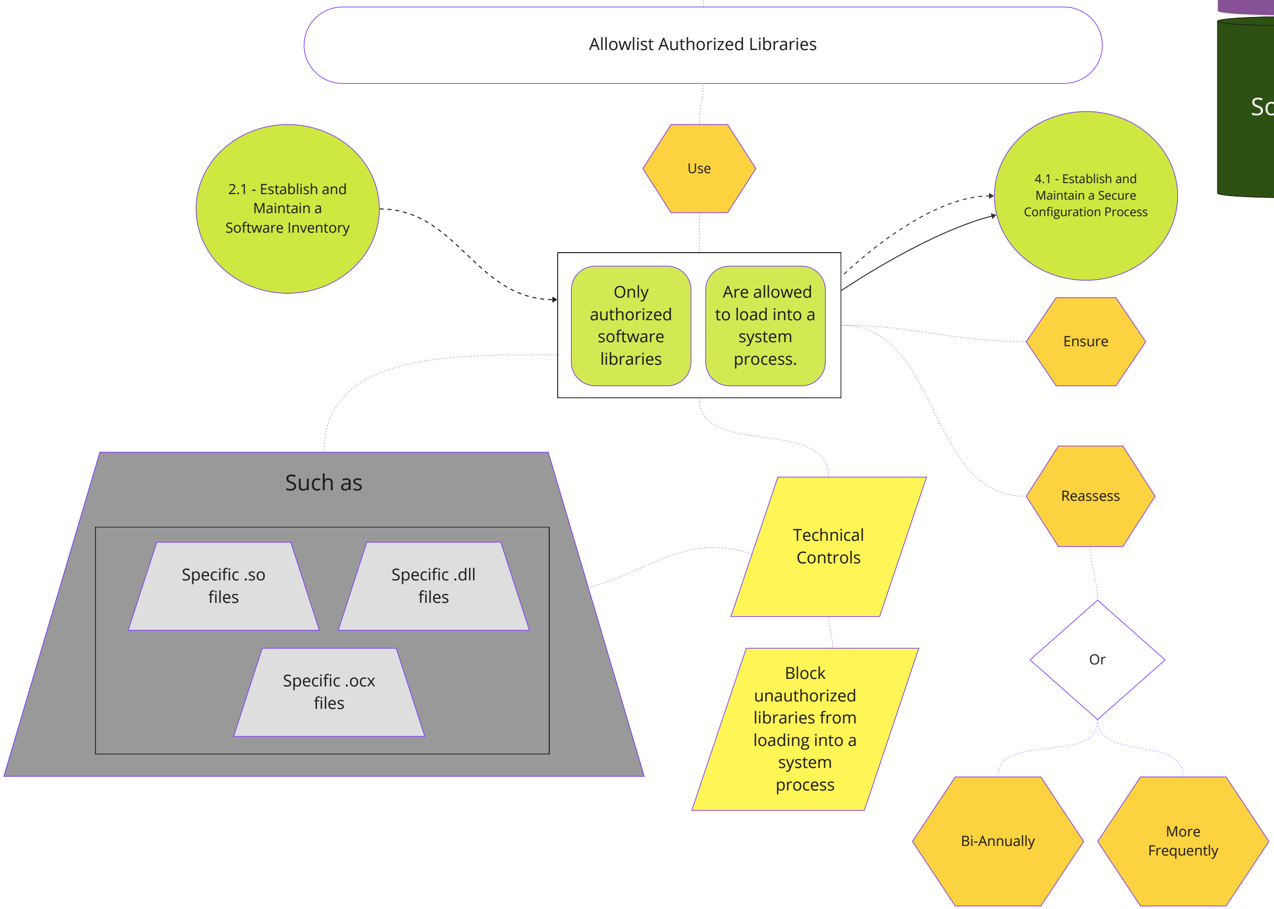
Asset management

Protect

Software

Application Control and Allowlisting Tool

OS Dependent



Allowlist Authorized Libraries

Use

2.1 - Establish and Maintain a Software Inventory

Only authorized software libraries

Are allowed to load into a system process.

4.1 - Establish and Maintain a Secure Configuration Process

Ensure

Such as

Specific .so files

Specific .dll files

Specific .ocx files

Technical Controls

Block unauthorized libraries from loading into a system process

Reassess

Or

Bi-Annually

More Frequently

Group Validated

2.7

IG3

Asset management

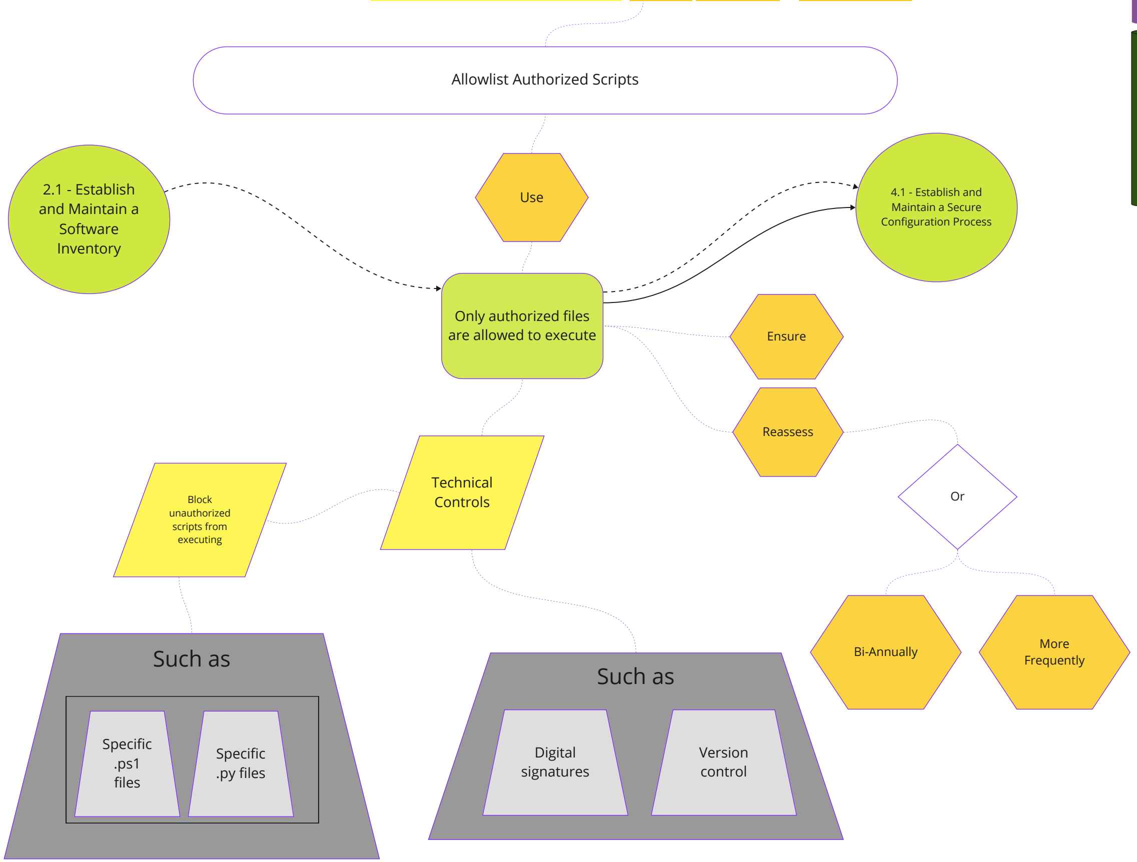
Protect

Script Control and Allowlisting Tool

Software

OS Dependent

Use technical controls, such as digital signatures and version control, to ensure that only authorized scripts, such as specific .ps1, .py, files are allowed to execute. Block unauthorized scripts from executing. Reassess bi-annually, or more frequently.



Allowlist Authorized Scripts

2.1 - Establish and Maintain a Software Inventory

Use

4.1 - Establish and Maintain a Secure Configuration Process

Only authorized files are allowed to execute

Ensure

Reassess

Or

Block unauthorized scripts from executing

Technical Controls

Bi-Annually

More Frequently

Such as

Specific .ps1 files

Specific .py files

Such as

Digital signatures

Version control

CONTROL 3

Data Protection

Safeguards: 14	IG1: 6/14	IG2: 12/14	IG3: 14/14

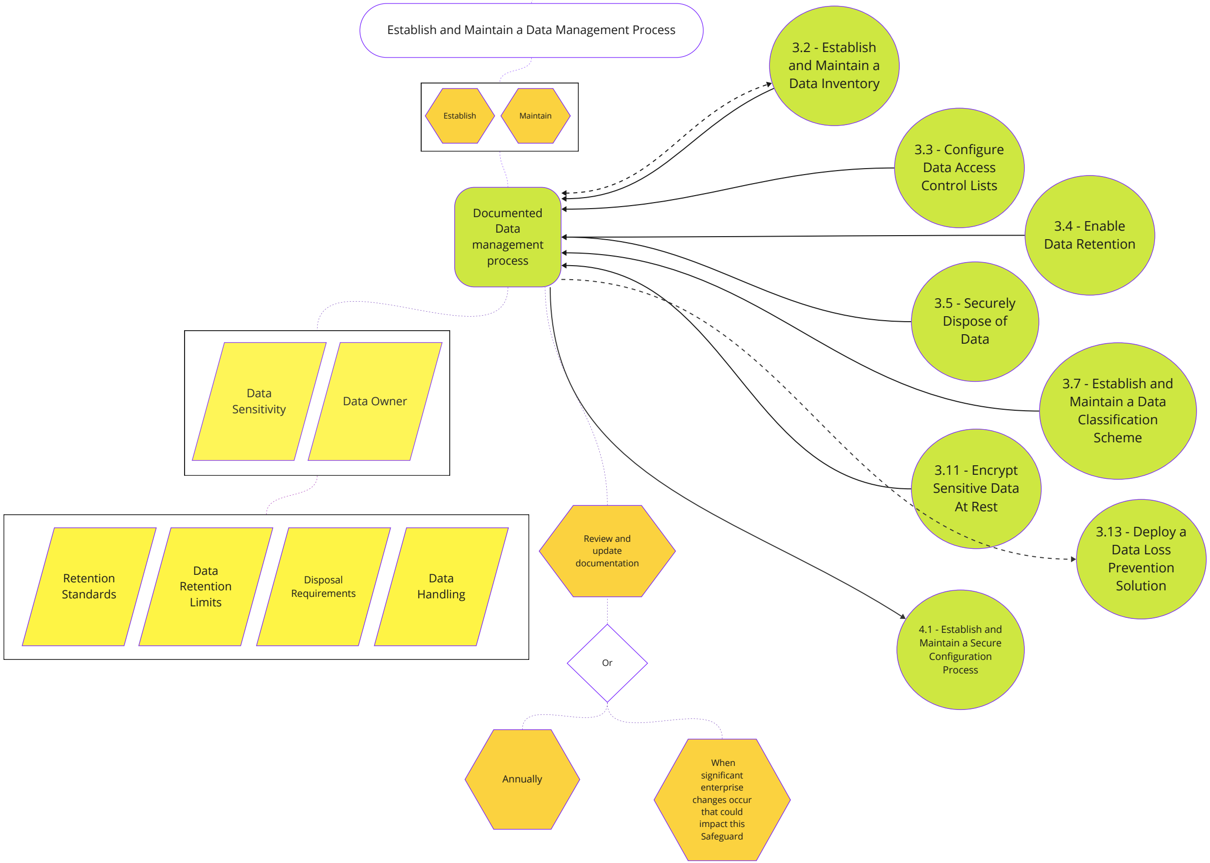
Overview

Develop processes and technical controls to identify, classify, securely handle, retain, and dispose of data.

Group Validated

3.1

Establish and maintain a documented data management process. In the process, address data sensitivity, data owner, handling of data, data retention limits, and disposal requirements, based on sensitivity and retention standards for the enterprise. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain a Data Management Process

Establish

Maintain

Documented Data management process

Data Sensitivity

Data Owner

Retention Standards

Data Retention Limits

Disposal Requirements

Data Handling

Review and update documentation

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

3.2 - Establish and Maintain a Data Inventory

3.3 - Configure Data Access Control Lists

3.4 - Enable Data Retention

3.5 - Securely Dispose of Data

3.7 - Establish and Maintain a Data Classification Scheme

3.11 - Encrypt Sensitive Data At Rest

3.13 - Deploy a Data Loss Prevention Solution

4.1 - Establish and Maintain a Secure Configuration Process

Process Oriented Safeguard

IG1

Data Management

Govern

Data Management Policy / Process

Data

Group Validated

3.2

Establish and maintain a data inventory based on the enterprise's data management process. Inventory sensitive data, at a minimum. Review and update inventory annually, at a minimum, with a priority on sensitive data.

Process Oriented Safeguard

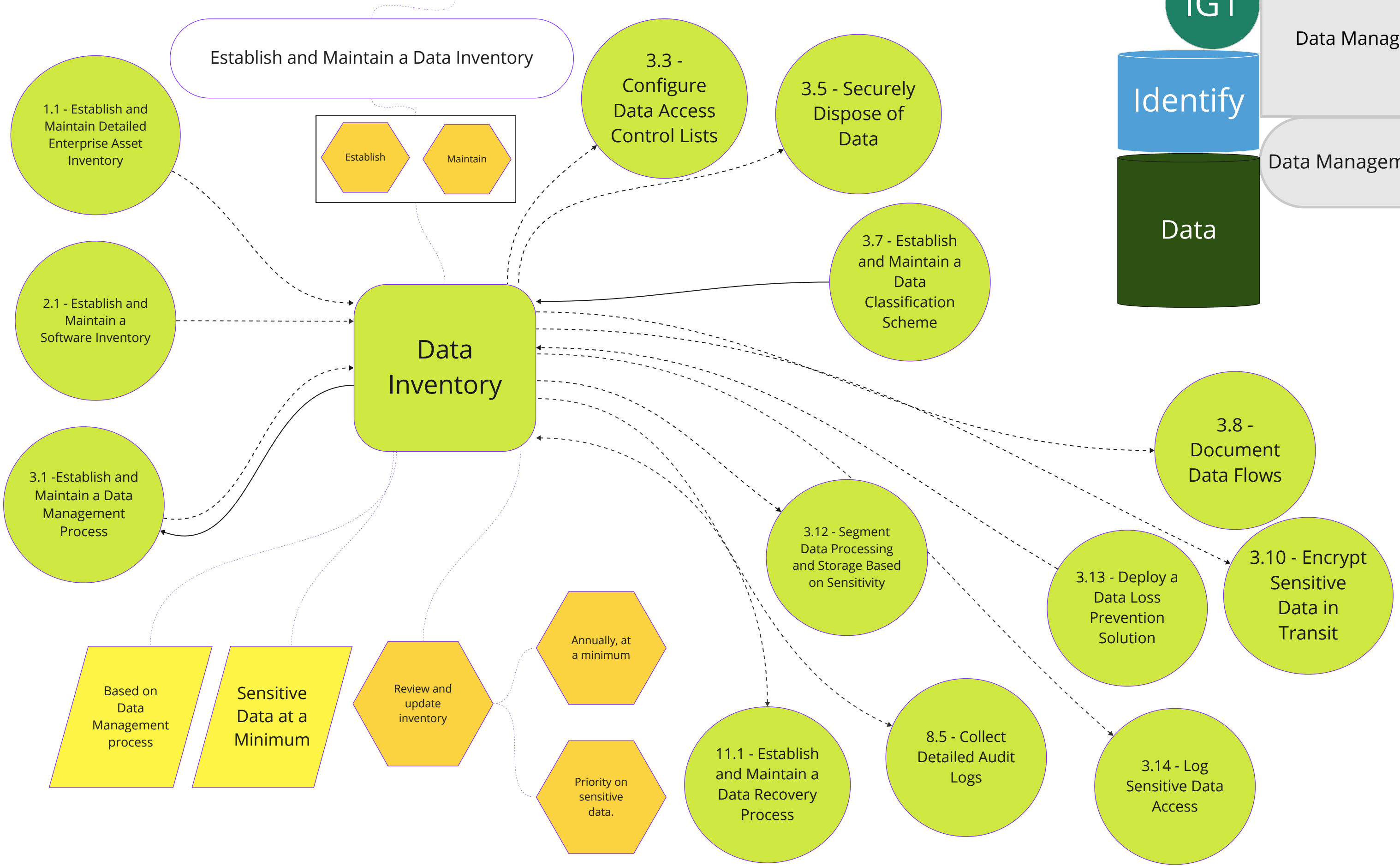
IG1

Identify

Data

Data Management

Data Management Tool



Establish and Maintain a Data Inventory

Establish

Maintain

Data Inventory

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

3.1 -Establish and Maintain a Data Management Process

3.3 - Configure Data Access Control Lists

3.5 - Securely Dispose of Data

3.7 - Establish and Maintain a Data Classification Scheme

3.8 - Document Data Flows

3.10 - Encrypt Sensitive Data in Transit

3.12 - Segment Data Processing and Storage Based on Sensitivity

3.13 - Deploy a Data Loss Prevention Solution

3.14 - Log Sensitive Data Access

8.5 - Collect Detailed Audit Logs

11.1 - Establish and Maintain a Data Recovery Process

Based on Data Management process

Sensitive Data at a Minimum

Review and update inventory

Annually, at a minimum

Priority on sensitive data.

Group Validated

3.3

IG1

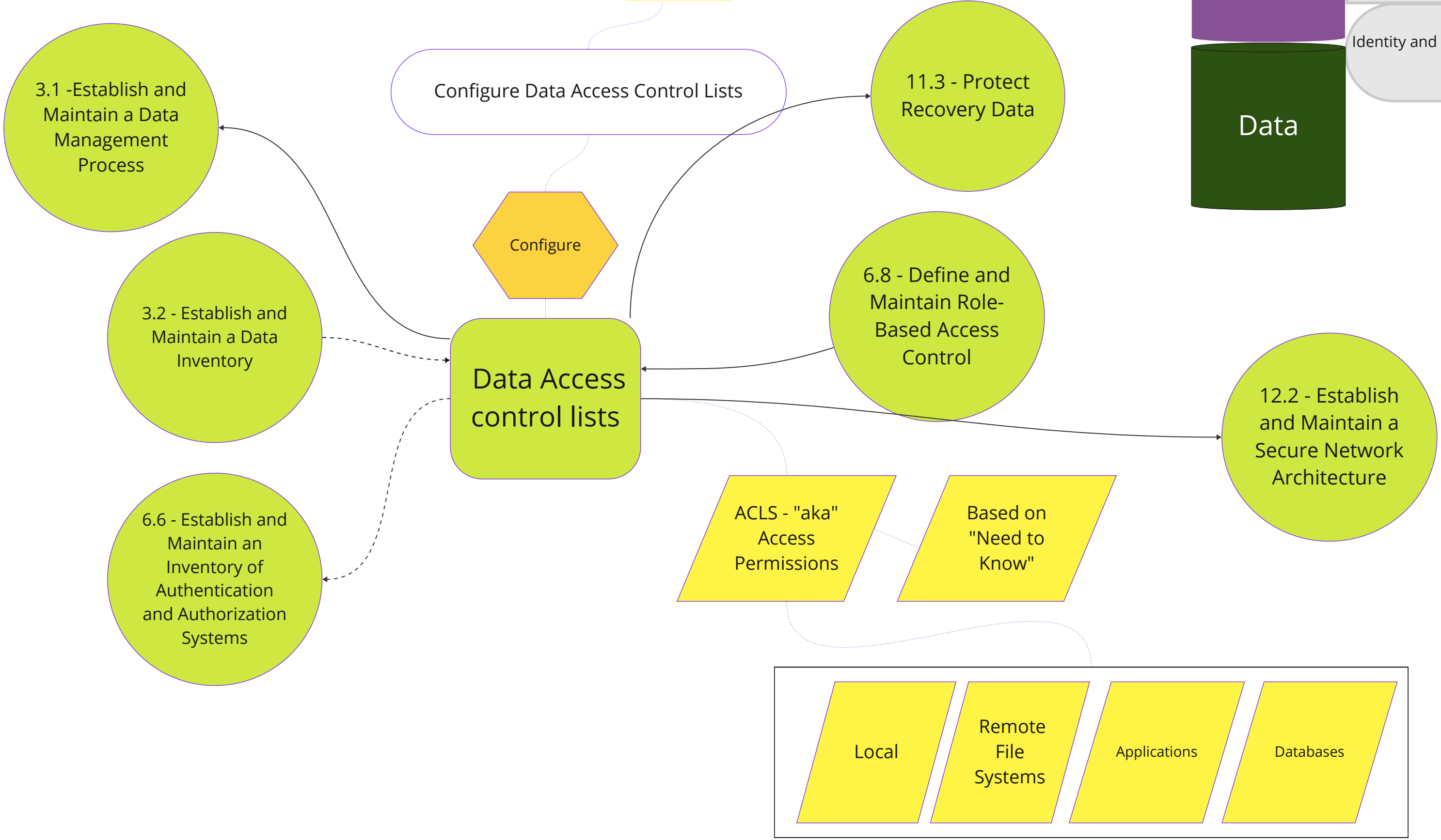
Protect

Data

Account and Access Control Management

Identity and Access Management Tool

Configure data access control lists based on a user’s need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.



Configure Data Access Control Lists

Configure

Data Access control lists

3.1 -Establish and Maintain a Data Management Process

3.2 - Establish and Maintain a Data Inventory

6.6 - Establish and Maintain an Inventory of Authentication and Authorization Systems

11.3 - Protect Recovery Data

6.8 - Define and Maintain Role-Based Access Control

12.2 - Establish and Maintain a Secure Network Architecture

ACLS - "aka" Access Permissions

Based on "Need to Know"

Local

Remote File Systems

Applications

Databases

Group Validated

3.4

Retain data according to the enterprise’s documented data management process. Data retention must include both minimum and maximum timelines.

IG1

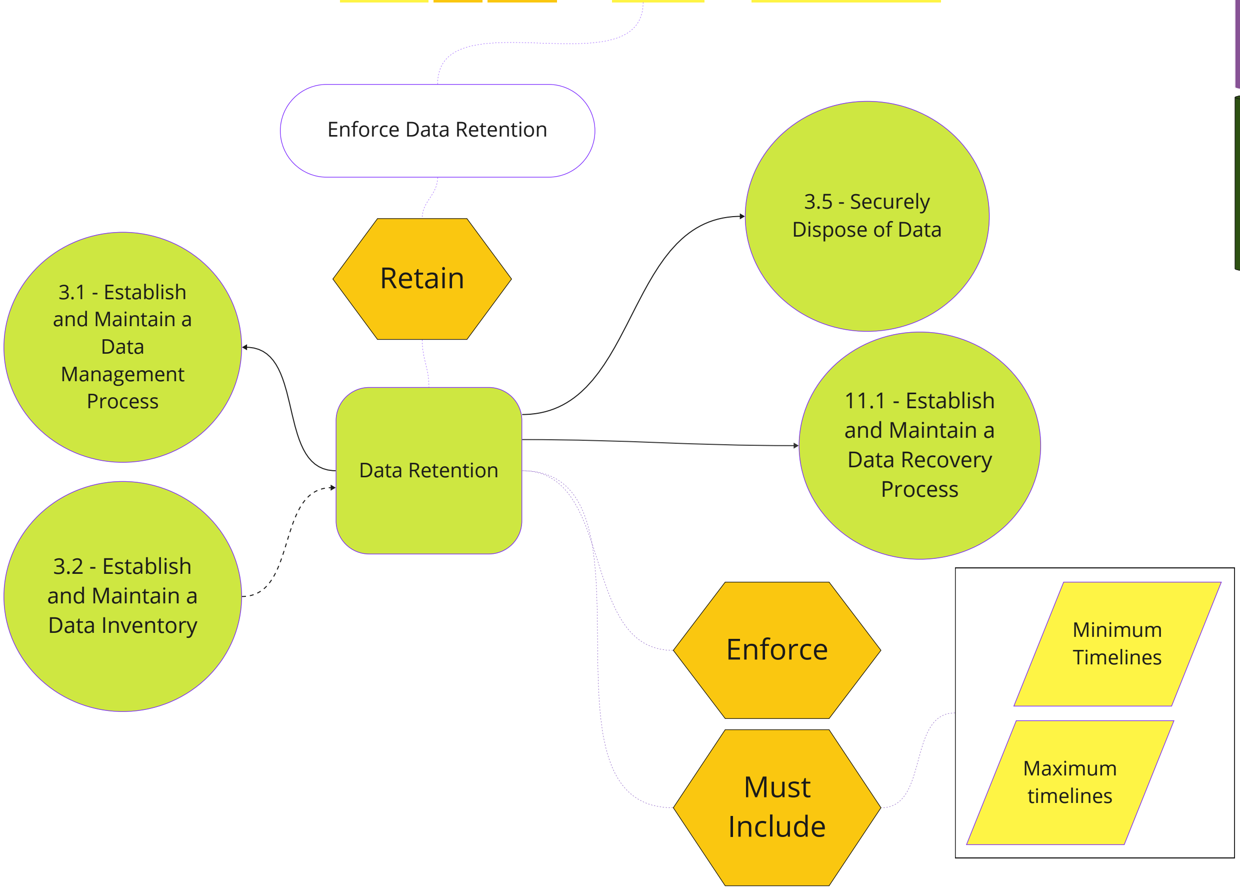
Protect

Data

Account and Access Control Management

Identity and Access Management Tool

Potentially OS Dependent



Enforce Data Retention

Retain

Data Retention

3.1 - Establish and Maintain a Data Management Process

3.2 - Establish and Maintain a Data Inventory

3.5 - Securely Dispose of Data

11.1 - Establish and Maintain a Data Recovery Process

Enforce

Must Include

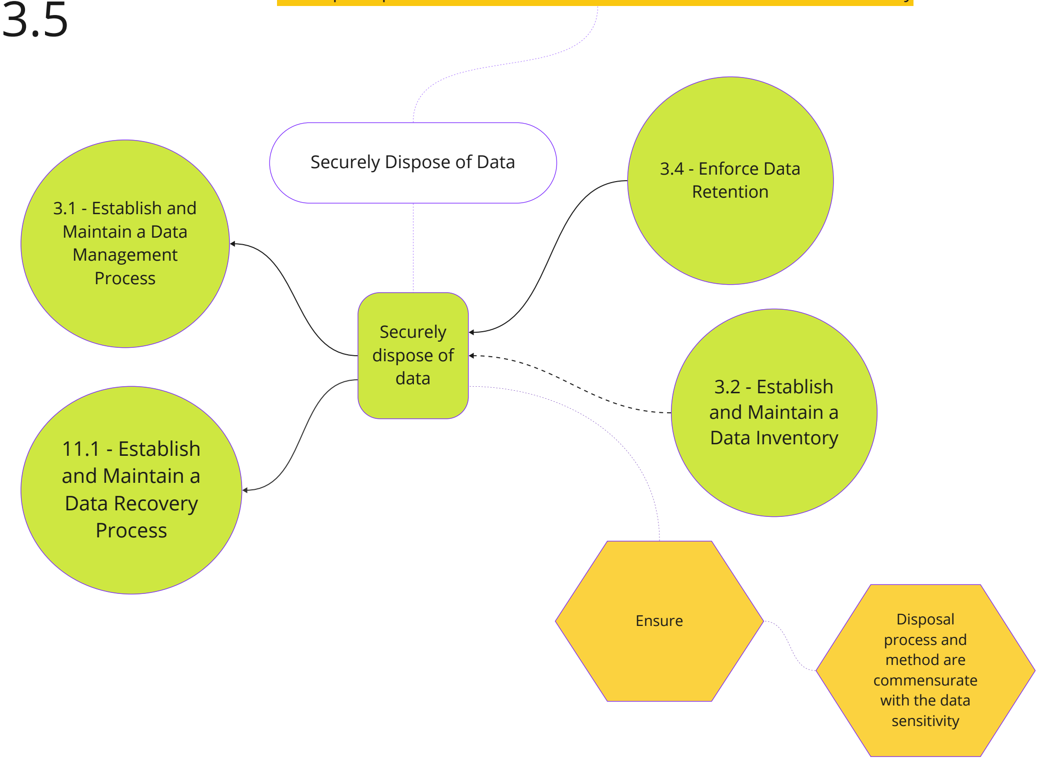
Minimum Timelines

Maximum timelines

Group Validated

3.5

Securely dispose of data as outlined in the enterprise’s data management process. Ensure the disposal process and method are commensurate with the data sensitivity.



Securely Dispose of Data

Securely dispose of data

3.1 - Establish and Maintain a Data Management Process

11.1 - Establish and Maintain a Data Recovery Process

3.4 - Enforce Data Retention

3.2 - Establish and Maintain a Data Inventory

Ensure

Disposal process and method are commensurate with the data sensitivity

IG1

Data Management

Protect

Data Disposal Tool

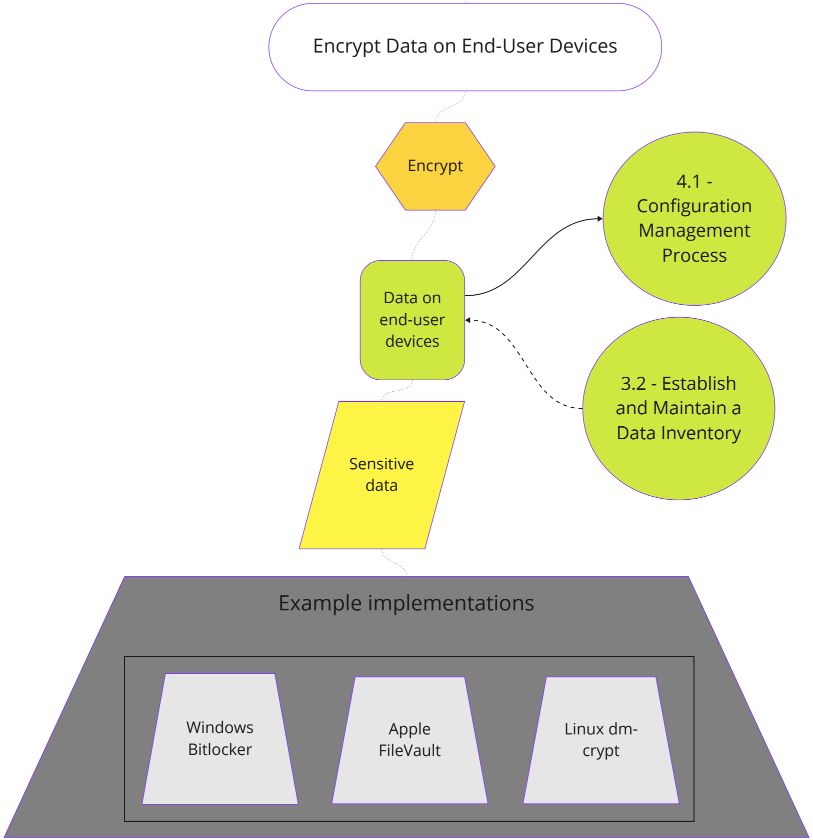
Data

Potentially OS Dependent

Group Validated

3.6

Encrypt data on end-user devices containing sensitive data. Example implementations can include: Windows BitLocker®, Apple FileVault®, Linux® dm-crypt.


Encrypt Data on End-User Devices
Encrypt
Data on end-user devices
4.1 - Configuration Management Process
3.2 - Establish and Maintain a Data Inventory
Sensitive data
Example implementations
Windows Bitlocker
Apple FileVault
Linux dm-crypt

IG1

Data Management

Protect

Data

Encryption Tool

Potentially OS Dependent

Group Validated

3.7

Process Oriented Safeguard

IG2

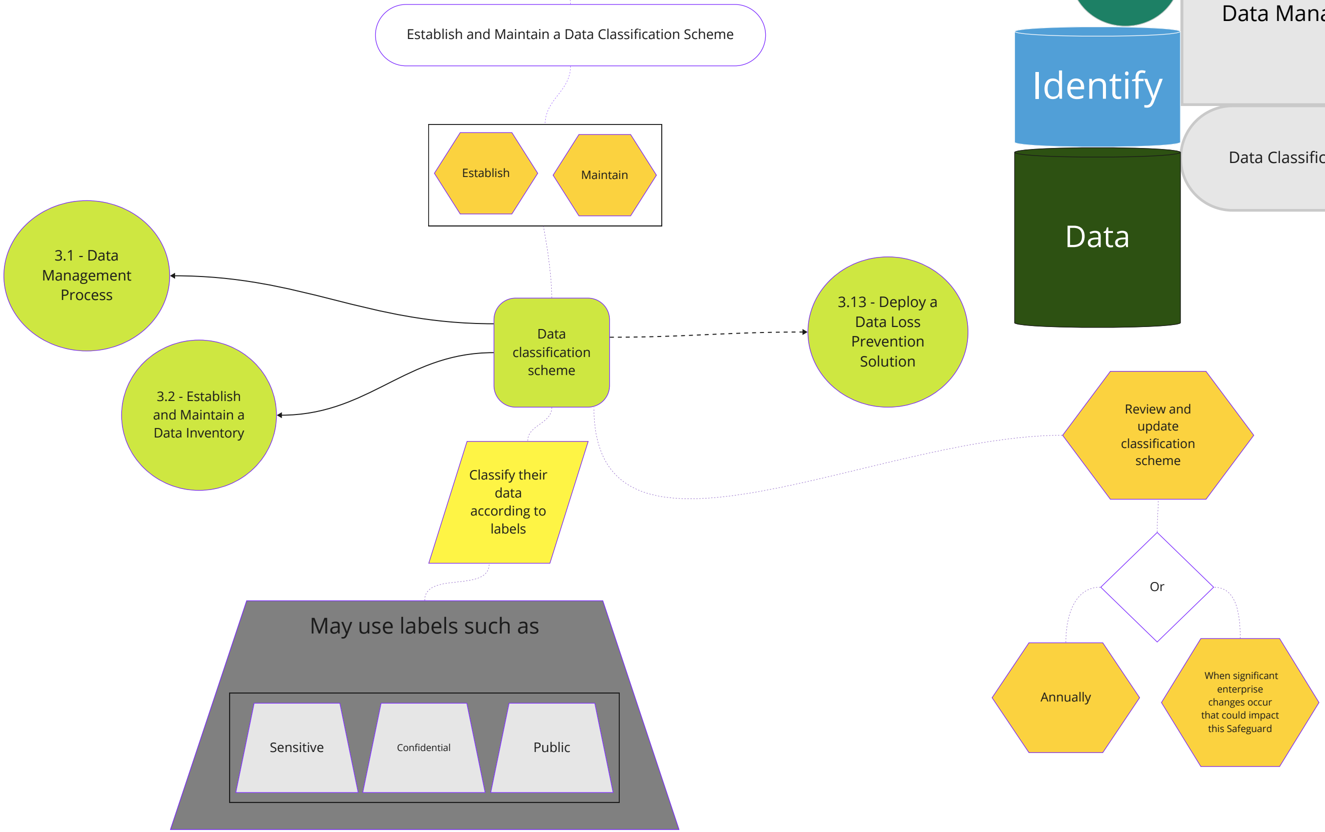
Identify

Data

Data Management

Data Classification Tool

Establish and maintain an overall data classification scheme for the enterprise. Enterprises may use labels, such as "Sensitive," "Confidential," and "Public," and classify their data according to those labels. Review and update the classification scheme annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain a Data Classification Scheme
Establish
Maintain
3.1 - Data Management Process
3.2 - Establish and Maintain a Data Inventory
Data classification scheme
3.13 - Deploy a Data Loss Prevention Solution
Classify their data according to labels
Review and update classification scheme
Or
Annually
When significant enterprise changes occur that could impact this Safeguard
May use labels such as
Sensitive
Confidential
Public

Group Validated

3.8

Document data flows. Data flow documentation includes service provider data flows and should be based on the enterprise's data management process. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

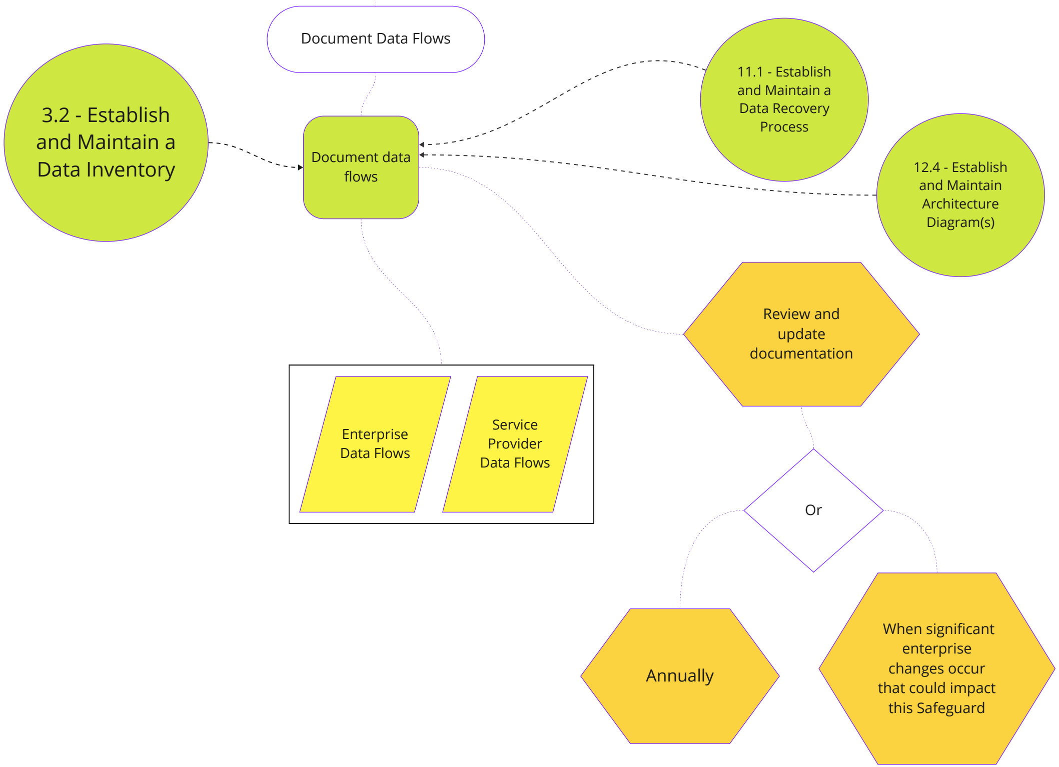
IG2

Identify

Data

Data Management

Data Flow Diagramming Tool



Document Data Flows

3.2 - Establish and Maintain a Data Inventory

Document data flows

11.1 - Establish and Maintain a Data Recovery Process

12.4 - Establish and Maintain Architecture Diagram(s)

Review and update documentation

Enterprise Data Flows

Service Provider Data Flows

Or

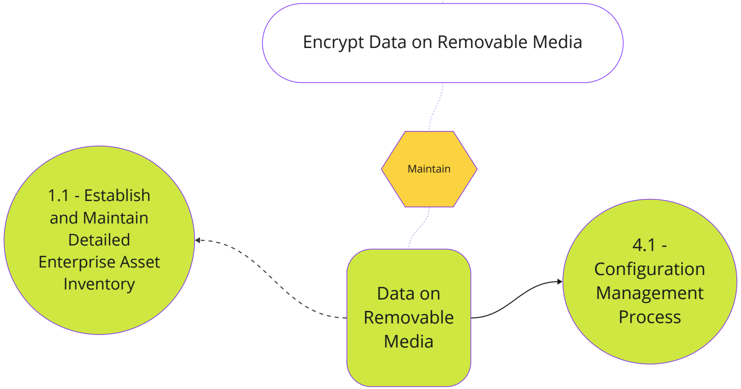
Annually

When significant enterprise changes occur that could impact this Safeguard

Group Validated

3.9

Encrypt Data on Removable Media



Encrypt Data on Removable Media

Maintain

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

Data on Removable Media

4.1 - Configuration Management Process

IG2

Data Management

Protect

Encryption Tool

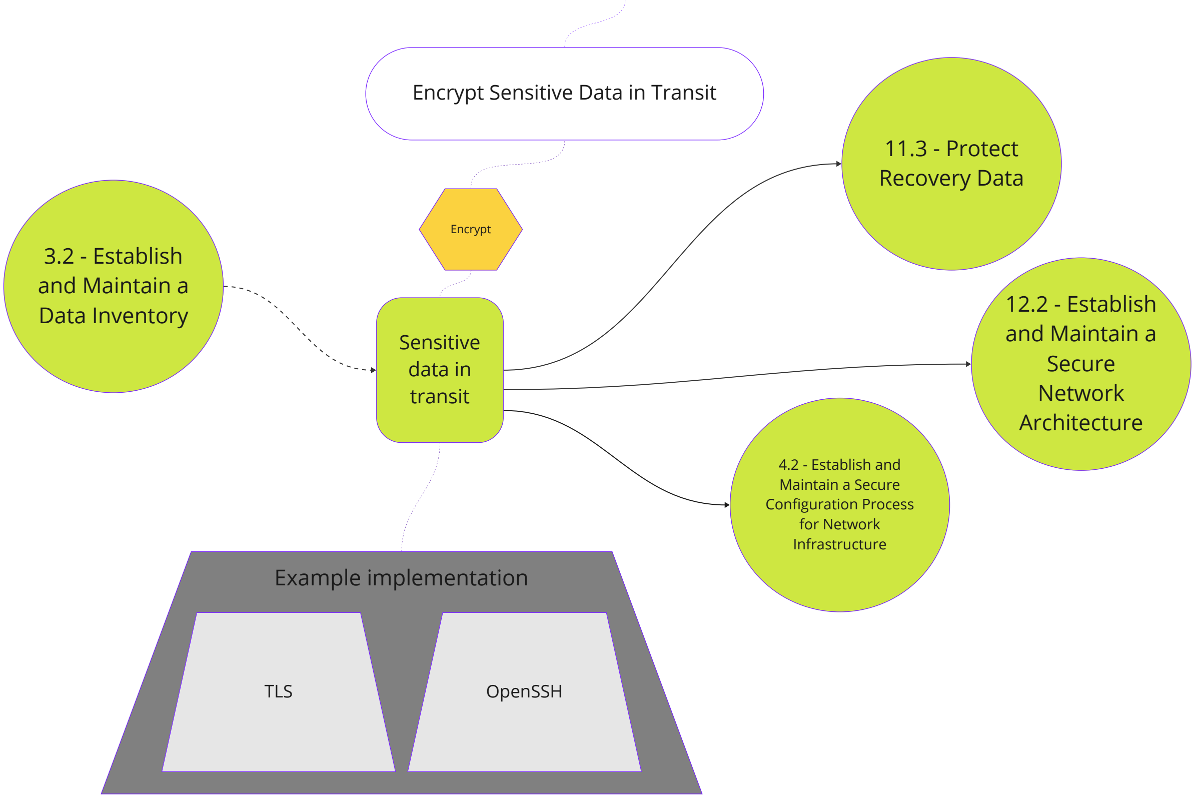
Data

Potentially OS Dependent

Group Validated

3.10

Encrypt sensitive data in transit. Example implementations can include: Transport Layer Security (TLS) and Open Secure Shell (OpenSSH).



Encrypt Sensitive Data in Transit

Encrypt

Sensitive data in transit

3.2 - Establish and Maintain a Data Inventory

11.3 - Protect Recovery Data

12.2 - Establish and Maintain a Secure Network Architecture

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

Example implementation

TLS

OpenSSH

IG2

Data Management

Protect

Data

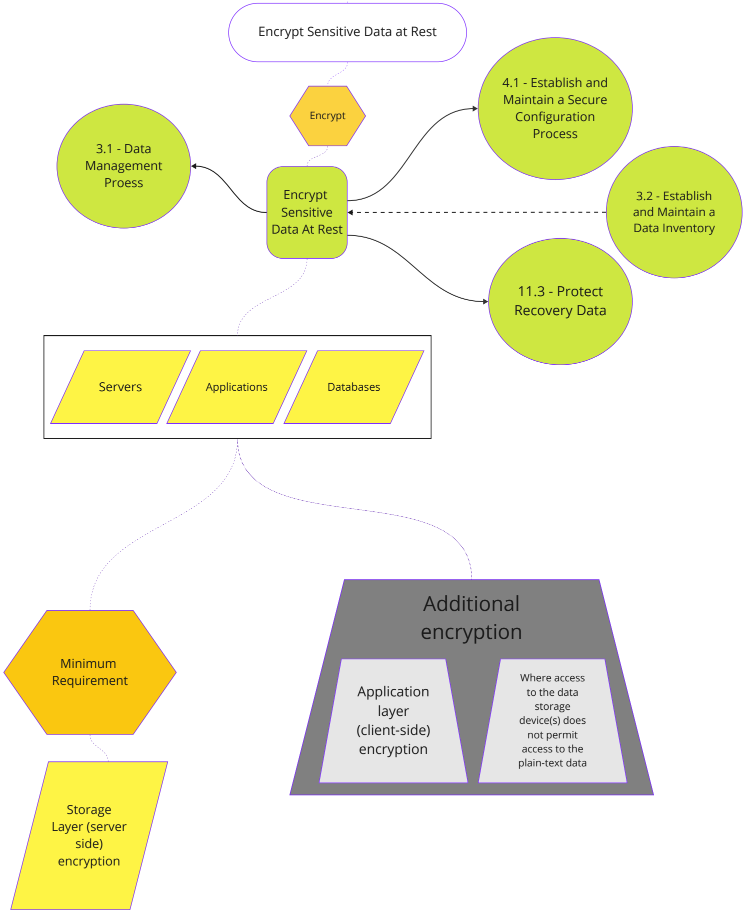
Encryption Tool

Potentially OS Dependent

Group Validated

3.11

Encrypt sensitive data at rest on servers, applications, and databases. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.


Encrypt Sensitive Data at Rest
Encrypt
4.1 - Establish and Maintain a Secure Configuration Process
3.1 - Data Management Proess
Encrypt Sensitive Data At Rest
3.2 - Establish and Maintain a Data Inventory
11.3 - Protect Recovery Data
Servers
Applications
Databases
Minimum Requirement
Storage Layer (server side) encryption
Additional encryption
Application layer (client-side) encryption
Where access to the data storage device(s) does not permit access to the plain-text data

IG2

Data Management

Protect

Encryption Tool

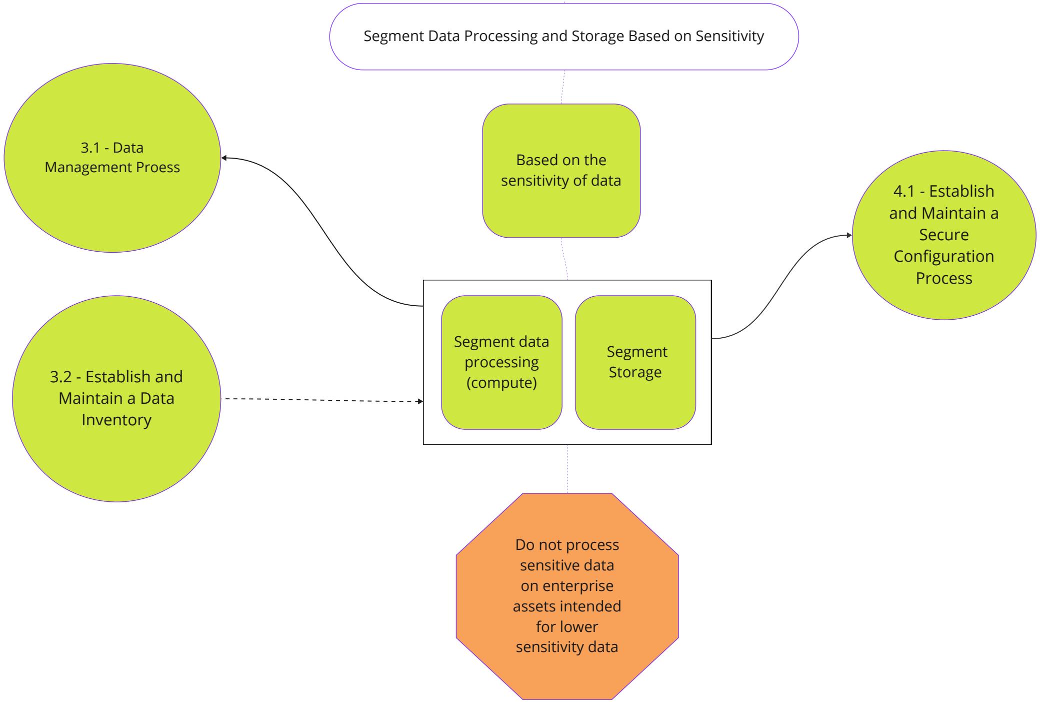
Data

Potentially OS Dependent

Group Validated

3.12

Segment data processing and storage based on the sensitivity of the data. Do not process sensitive data on enterprise assets intended for lower sensitivity data.



Segment Data Processing and Storage Based on Sensitivity

Based on the sensitivity of data

Segment data processing (compute)

Segment Storage

3.1 - Data Management Proess

3.2 - Establish and Maintain a Data Inventory

4.1 - Establish and Maintain a Secure Configuration Process

Do not process sensitive data on enterprise assets intended for lower sensitivity data

Process Oriented Safeguard

IG2

Secure Configurations

Protect

Secure Configuration Policy/Process

Network

Group Validated

3.13

Implement an automated tool, such as a host-based Data Loss Prevention (DLP) tool to identify all sensitive data stored, processed, or transmitted through enterprise assets, including those located onsite or at a remote service provider, and update the enterprise's data inventory.

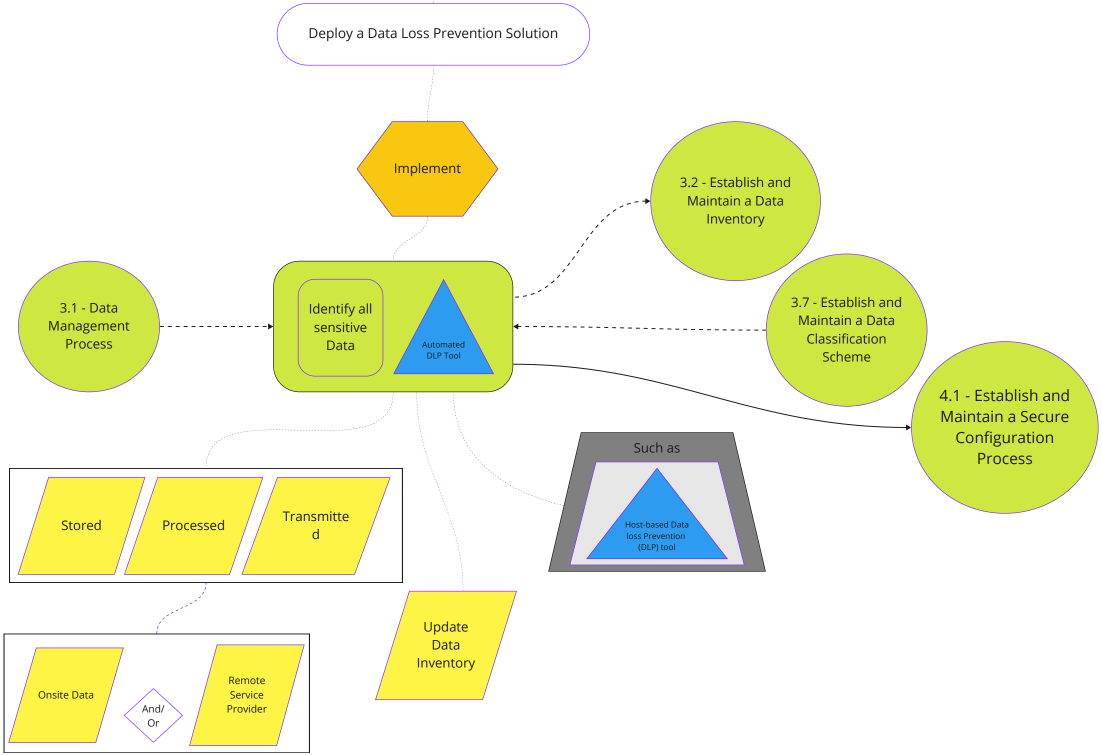
IG3

Data Management

Protect

Data

Data Loss Prevention Tool


Deploy a Data Loss Prevention Solution
Implement
3.2 - Establish and Maintain a Data Inventory
3.1 - Data Management Process
Identify all sensitive Data
Automated DLP Tool
3.7 - Establish and Maintain a Data Classification Scheme
4.1 - Establish and Maintain a Secure Configuration Process
Such as
Host-based Data loss Prevention (DLP) tool
Stored
Processed
Transmitte
d
Update Data Inventory
Onsite Data
And/
Or
Remote Service Provider

Group Validated

3.14

Log sensitive data access, including modification and disposal.

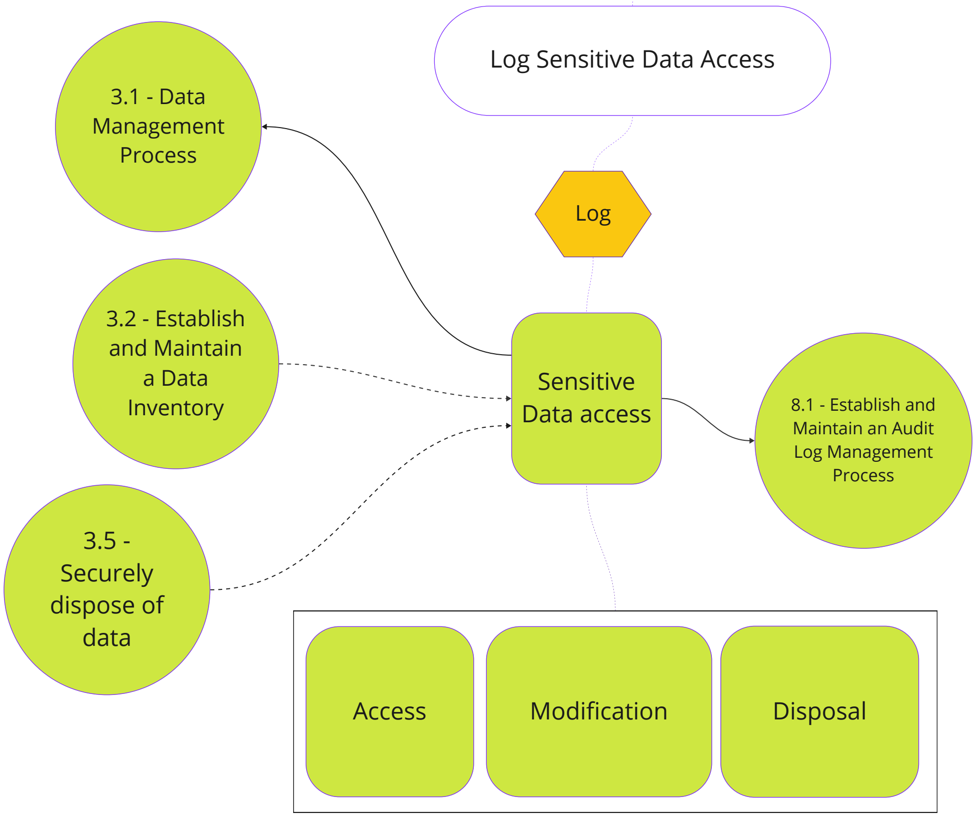
IG3

Log Management

Detect

Data

Log Management Policy/Process


Log Sensitive Data Access
Log
3.1 - Data Management Process
3.2 - Establish and Maintain a Data Inventory
3.5 - Securely dispose of data
Sensitive Data access
8.1 - Establish and Maintain an Audit Log Management Process
Access
Modification
Disposal

CONTROL 4

Secure Configuration of Enterprise Assets and Software

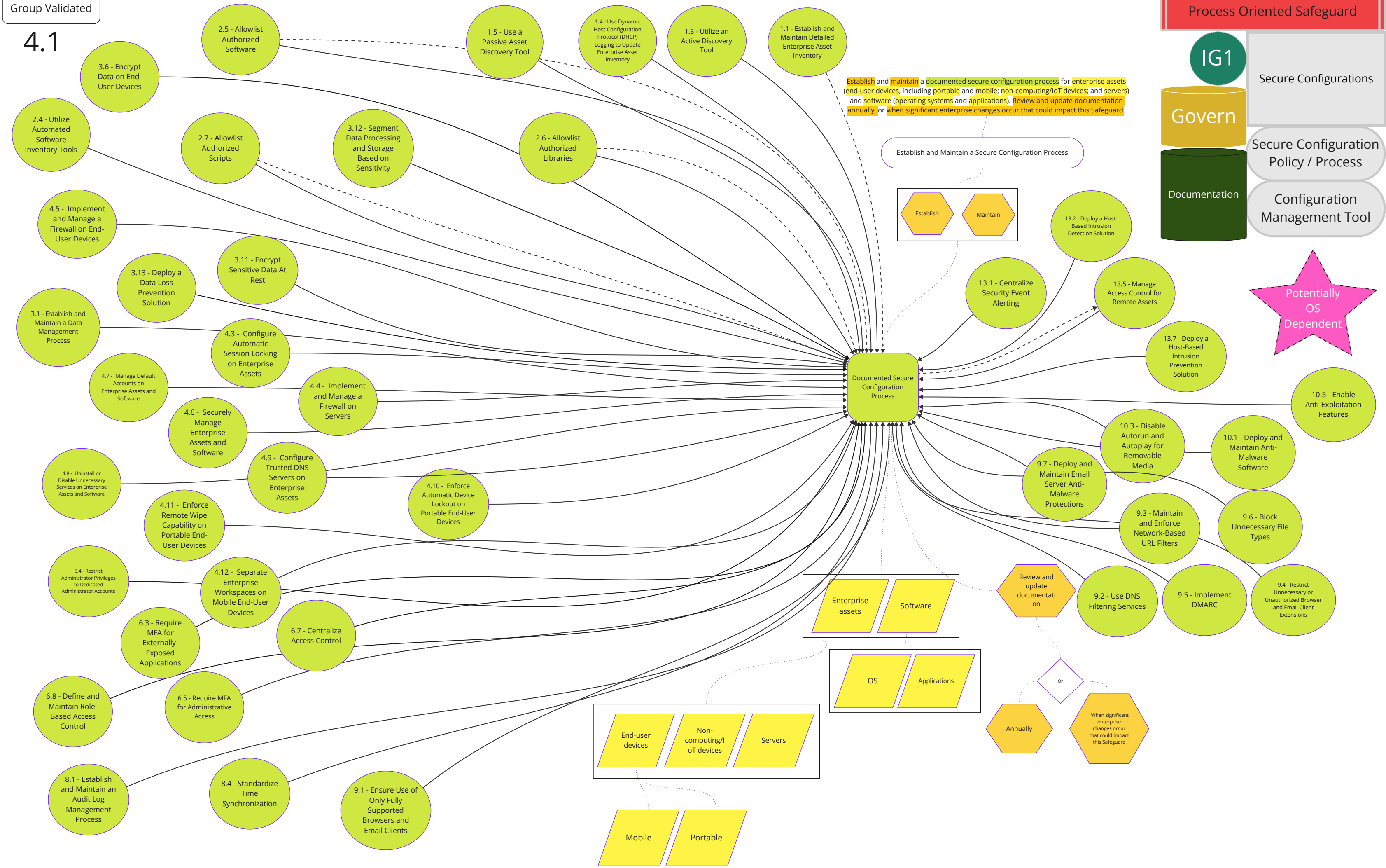
Safeguards: 12	IG1: 7/12	IG2: 11/12	IG3: 12/12

Overview

Establish and maintain the secure configuration of enterprise assets (end-user devices, including portable and mobile; network devices; non-computing/IoT devices; and servers) and software (operating systems and applications).

Group Validated

4.1



Establish and maintain a documented secure configuration process for enterprise assets (end-user devices, including portable and mobile; non-computing/IoT devices; and servers) and software (operating systems and applications). Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard
IG1
Secure Configurations
Govern
Documentation
Secure Configuration Policy / Process
Configuration Management Tool
Potentially OS Dependent
Establish and Maintain a Secure Configuration Process
Establish
Maintain
Documented Secure Configuration Process
Enterprise assets
Software
OS
Applications
End-user devices
Non-computing/IoT devices
Servers
Mobile
Portable
Review and update documentation
Or
Annually
When significant enterprise changes occur that could impact this Safeguard
1.1 - Establish and Maintain Detailed Enterprise Asset Inventory
1.3 - Utilize an Active Discovery Tool
1.4 - Use Dynamic Host Configuration Protocol (DHCP) Logging to Update Enterprise Asset Inventory
1.5 - Use a Passive Asset Discovery Tool
2.5 - Allowlist Authorized Software
3.6 - Encrypt Data on End-User Devices
2.4 - Utilize Automated Software Inventory Tools
2.7 - Allowlist Authorized Scripts
3.12 - Segment Data Processing and Storage Based on Sensitivity
2.6 - Allowlist Authorized Libraries
4.5 - Implement and Manage a Firewall on End-User Devices
3.11 - Encrypt Sensitive Data At Rest
3.13 - Deploy a Data Loss Prevention Solution
3.1 - Establish and Maintain a Data Management Process
4.3 - Configure Automatic Session Locking on Enterprise Assets
4.7 - Manage Default Accounts on Enterprise Assets and Software
4.4 - Implement and Manage a Firewall on Servers
4.6 - Securely Manage Enterprise Assets and Software
4.8 - Uninstall or Disable Unnecessary Services on Enterprise Assets and Software
4.9 - Configure Trusted DNS Servers on Enterprise Assets
4.10 - Enforce Automatic Device Lockout on Portable End-User Devices
4.11 - Enforce Remote Wipe Capability on Portable End-User Devices
5.4 - Restrict Administrator Privileges to Dedicated Administrator Accounts
4.12 - Separate Enterprise Workspaces on Mobile End-User Devices
6.3 - Require MFA for Externally-Exposed Applications
6.7 - Centralize Access Control
6.8 - Define and Maintain Role-Based Access Control
6.5 - Require MFA for Administrative Access
8.1 - Establish and Maintain an Audit Log Management Process
8.4 - Standardize Time Synchronization
9.1 - Ensure Use of Only Fully Supported Browsers and Email Clients
13.2 - Deploy a Host-Based Intrusion Detection Solution
13.1 - Centralize Security Event Alerting
13.5 - Manage Access Control for Remote Assets
13.7 - Deploy a Host-Based Intrusion Prevention Solution
10.5 - Enable Anti-Exploitation Features
10.3 - Disable Autorun and Autoplay for Removable Media
10.1 - Deploy and Maintain Anti-Malware Software
9.7 - Deploy and Maintain Email Server Anti-Malware Protections
9.3 - Maintain and Enforce Network-Based URL Filters
9.6 - Block Unnecessary File Types
9.2 - Use DNS Filtering Services
9.5 - Implement DMARC
9.4 - Restrict Unnecessary or Unauthorized Browser and Email Client Extensions

Group Validated

4.2

Process Oriented Safeguard

IG1

Secure Configurations

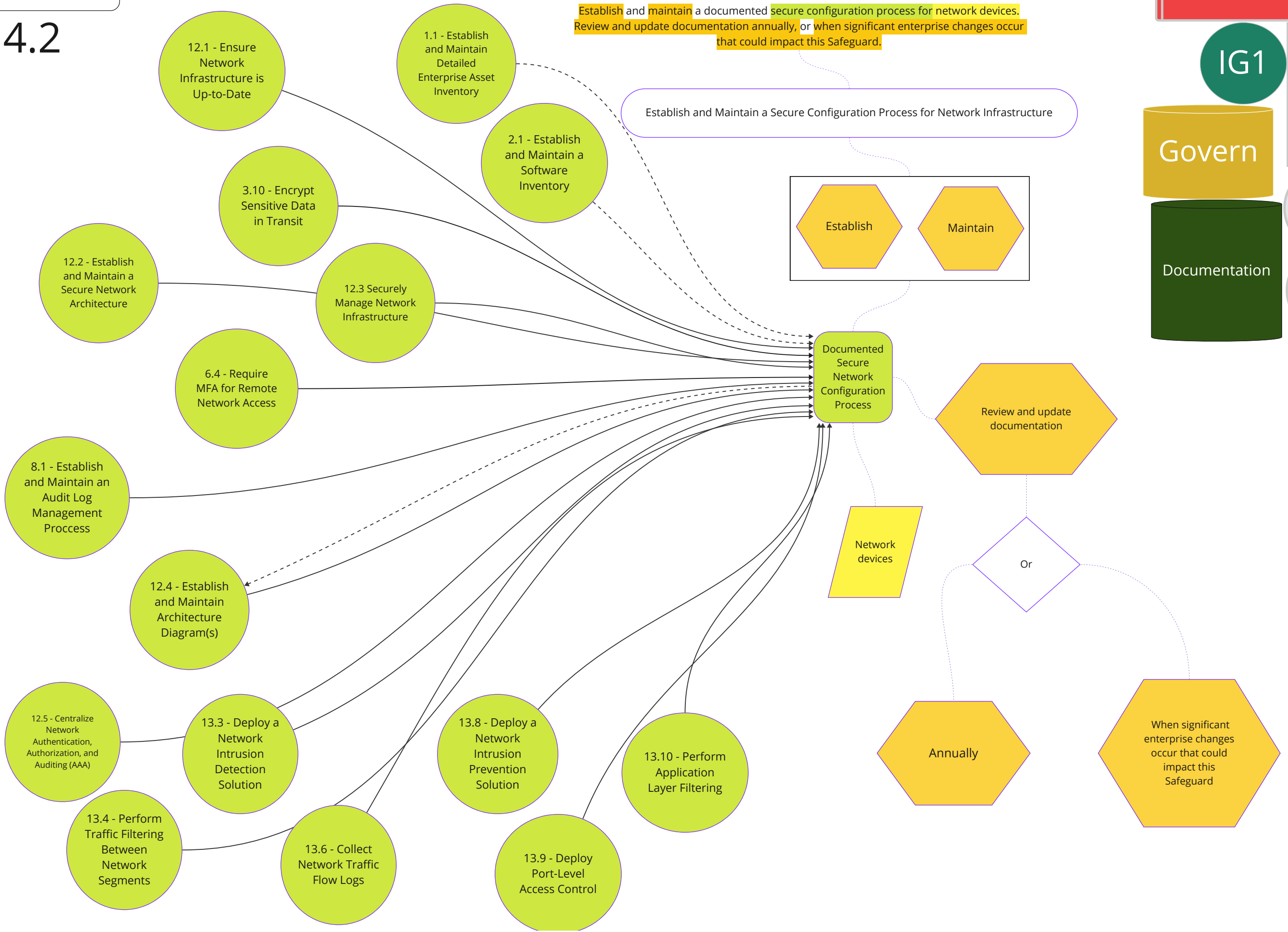
Govern

Documentation

Secure Configuration Policy / Process

Configuration Management Tool

Establish and maintain a documented secure configuration process for network devices. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain a Secure Configuration Process for Network Infrastructure

Establish

Maintain

Documented Secure Network Configuration Process

Review and update documentation

Network devices

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

12.1 - Ensure Network Infrastructure is Up-to-Date

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

3.10 - Encrypt Sensitive Data in Transit

12.2 - Establish and Maintain a Secure Network Architecture

12.3 Securely Manage Network Infrastructure

6.4 - Require MFA for Remote Network Access

8.1 - Establish and Maintain an Audit Log Management Proccess

12.4 - Establish and Maintain Architecture Diagram(s)

12.5 - Centralize Network Authentication, Authorization, and Auditing (AAA)

13.3 - Deploy a Network Intrusion Detection Solution

13.8 - Deploy a Network Intrusion Prevention Solution

13.10 - Perform Application Layer Filtering

13.4 - Perform Traffic Filtering Between Network Segments

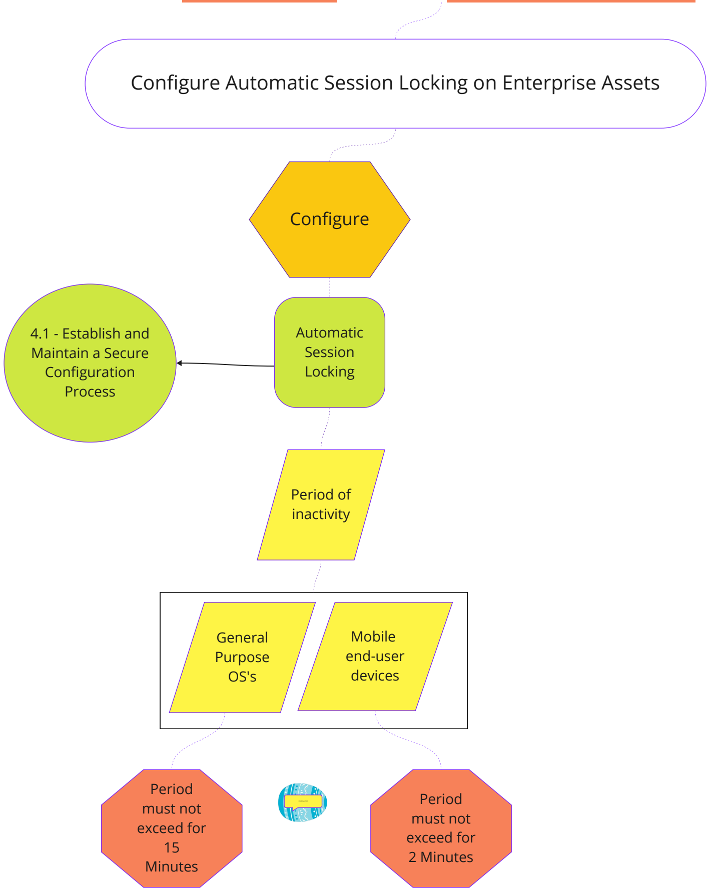
13.6 - Collect Network Traffic Flow Logs

13.9 - Deploy Port-Level Access Control

Group Validated

4.3

Configure automatic session locking on enterprise assets after a defined period of inactivity. For general purpose operating systems, the period Must Not Exceed 15 minutes. For mobile end-user devices, the period must not exceed 2 minutes.



Configure Automatic Session Locking on Enterprise Assets

Configure

Automatic Session Locking

4.1 - Establish and Maintain a Secure Configuration Process

Period of inactivity

General Purpose OS's

Mobile end-user devices

Period must not exceed for 15 Minutes

Period must not exceed for 2 Minutes

IG1

Secure Configurations

Protect

Configuration Management Tool

Devices

OS Dependent

Group Validated

4.4

IG1

Secure Configurations

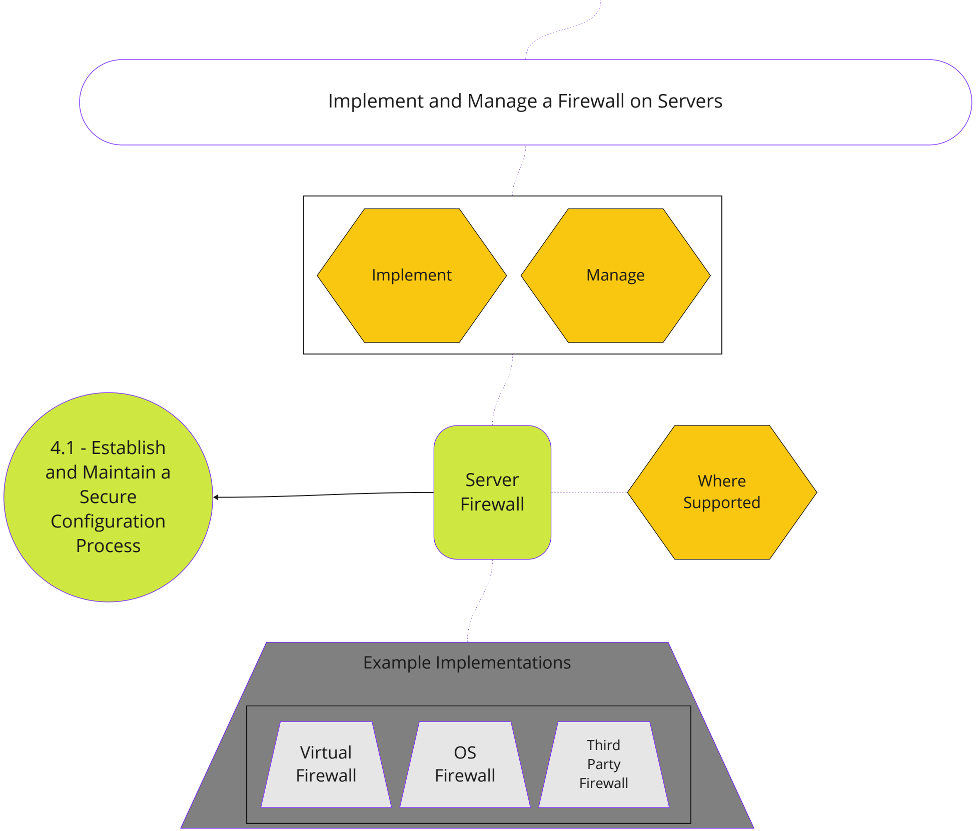
Protect

Firewall

Devices

Potentially OS Dependent

Implement and manage a firewall on servers, where supported. Example implementations include a virtual firewall, operating system firewall, or a third-party firewall agent.



Implement and Manage a Firewall on Servers

Implement

Manage

4.1 - Establish and Maintain a Secure Configuration Process

Server Firewall

Where Supported

Example Implementations

Virtual Firewall

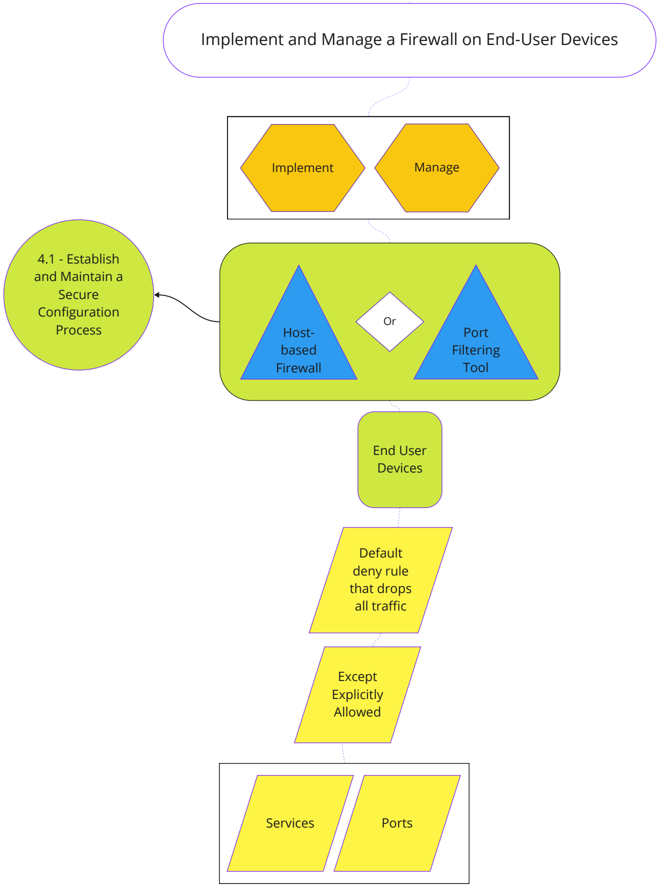
OS Firewall

Third Party Firewall

Group Validated

4.5

Implement and manage a host-based firewall or port-filtering tool on end-user devices, with a default-deny rule that drops all traffic except those services and ports that are explicitly allowed.



Implement and Manage a Firewall on End-User Devices

Implement

Manage

4.1 - Establish and Maintain a Secure Configuration Process

Host-based Firewall

Or

Port Filtering Tool

End User Devices

Default deny rule that drops all traffic

Except Explicitly Allowed

Services

Ports

IG1

Secure Configurations

Protect

Firewall

Devices

OS Dependent

Group Validated

4.6

IG1

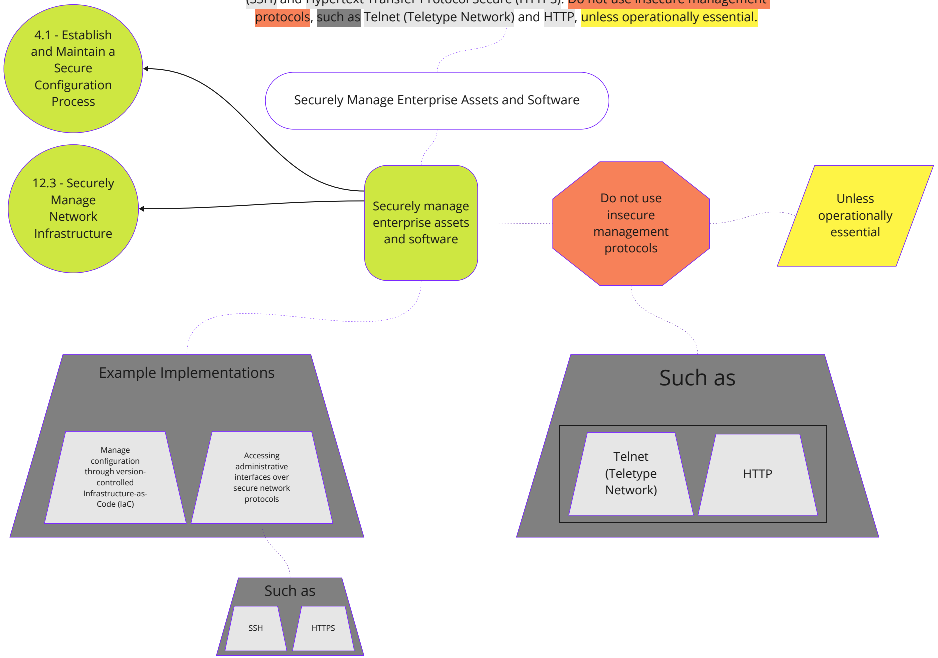
Secure Configurations

Protect

Configuration Management Tool

Devices

Securely manage enterprise assets and software. Example implementations include managing configuration through version-controlled- Infrastructure-as-Code (IaC) and accessing administrative interfaces over secure network protocols, such as Secure Shell (SSH) and Hypertext Transfer Protocol Secure (HTTPS). Do not use insecure management protocols, such as Telnet (Teletype Network) and HTTP, unless operationally essential.



Securely Manage Enterprise Assets and Software

4.1 - Establish and Maintain a Secure Configuration Process

12.3 - Securely Manage Network Infrastructure

Securely manage enterprise assets and software

Do not use insecure management protocols

Unless operationally essential

Example Implementations

Manage configuration through version-controlled Infrastructure-as-Code (IaC)

Accessing administrative interfaces over secure network protocols

Such as

SSH

HTTPS

Such as

Telnet (Teletype Network)

HTTP

Group Validated

4.7

Manage default accounts on enterprise assets and software, such as root, administrator, and other pre-configured vendor accounts. Example implementations can include: disabling default accounts or making them unusable.

IG1

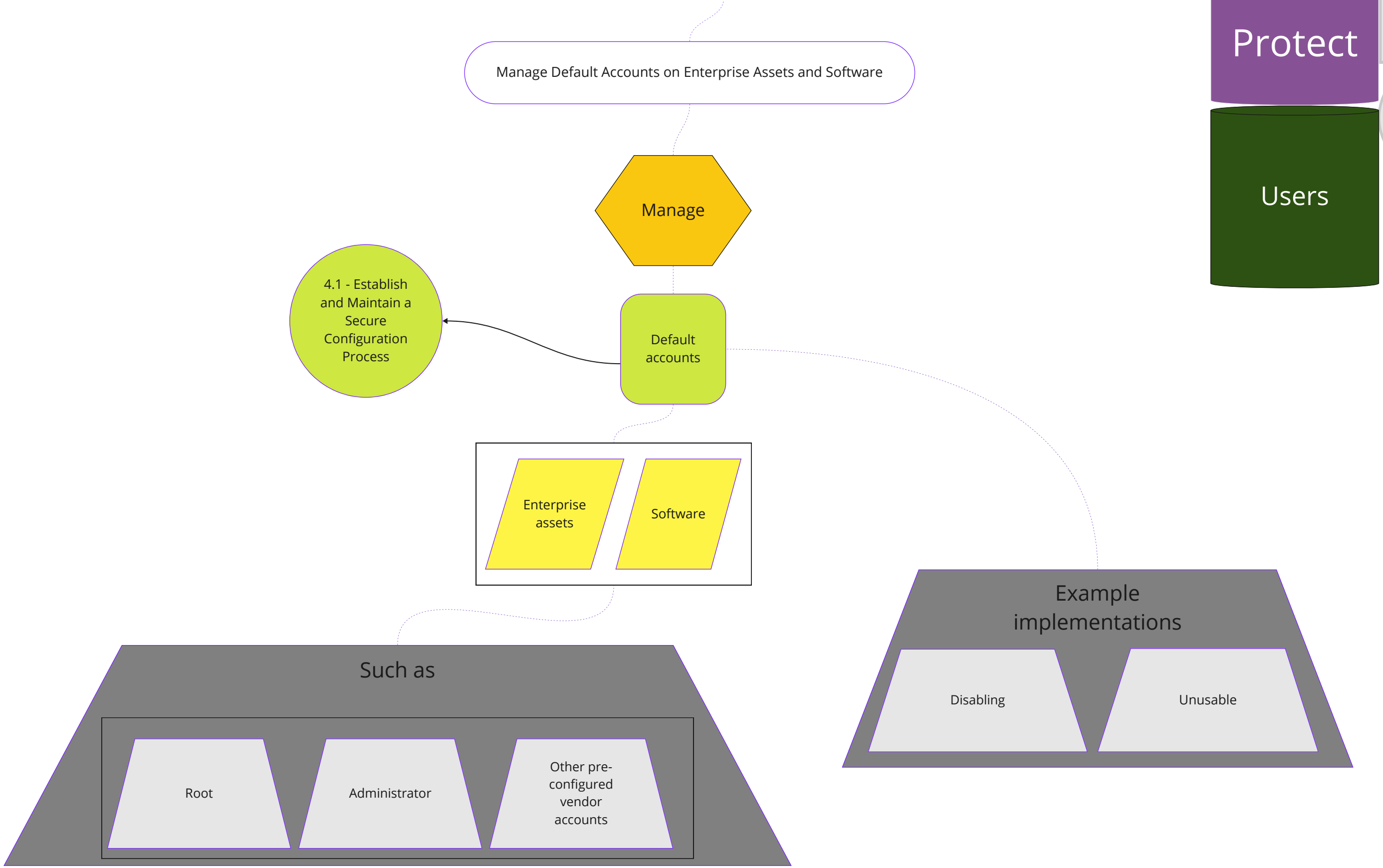
Secure Configurations

Protect

Configuration Management Tool

Users

OS Dependent



Manage Default Accounts on Enterprise Assets and Software

Manage

4.1 - Establish and Maintain a Secure Configuration Process

Default accounts

Enterprise assets

Software

Such as

Root

Administrator

Other pre-configured vendor accounts

Example implementations

Disabling

Unusable

Group Validated

4.8

Uninstall or disable unnecessary services on enterprise assets and software, such as an unused file sharing service, web application module, or service function.

IG2

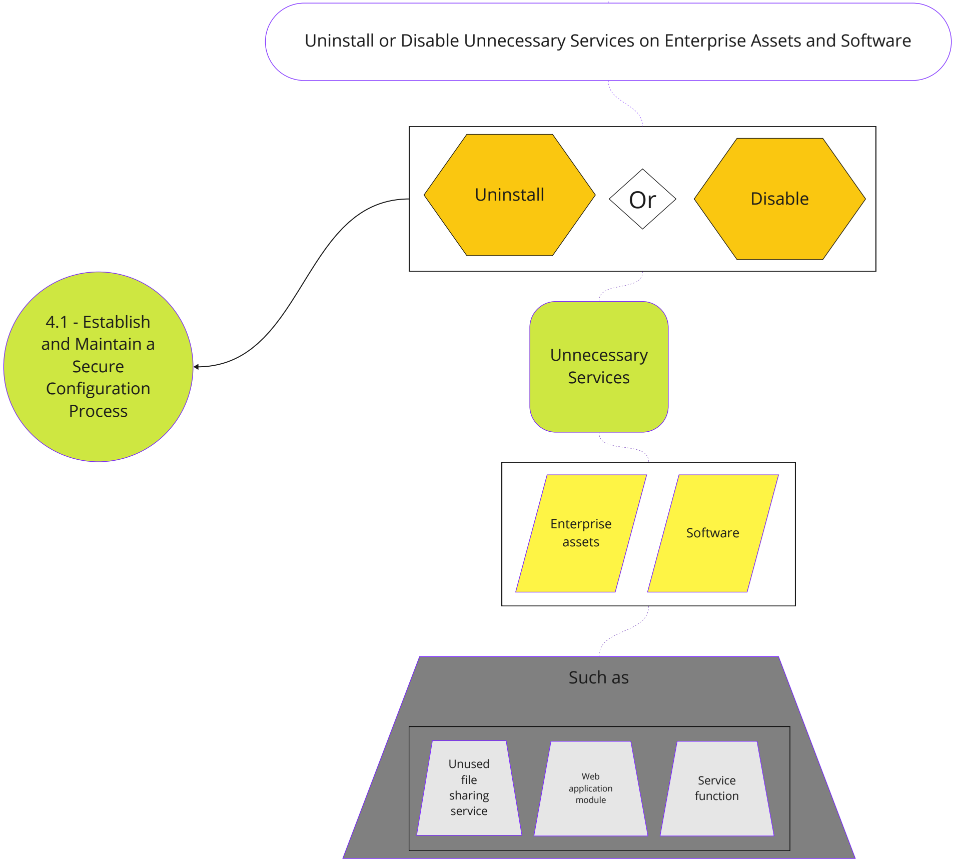
Secure Configurations

Protect

Devices

Configuration Management Tool

OS Dependent



Uninstall or Disable Unnecessary Services on Enterprise Assets and Software

Uninstall

Or

Disable

4.1 - Establish and Maintain a Secure Configuration Process

Unnecessary Services

Enterprise assets

Software

Such as

Unused file sharing service

Web application module

Service function

Group Validated

4.9

IG2

Protect

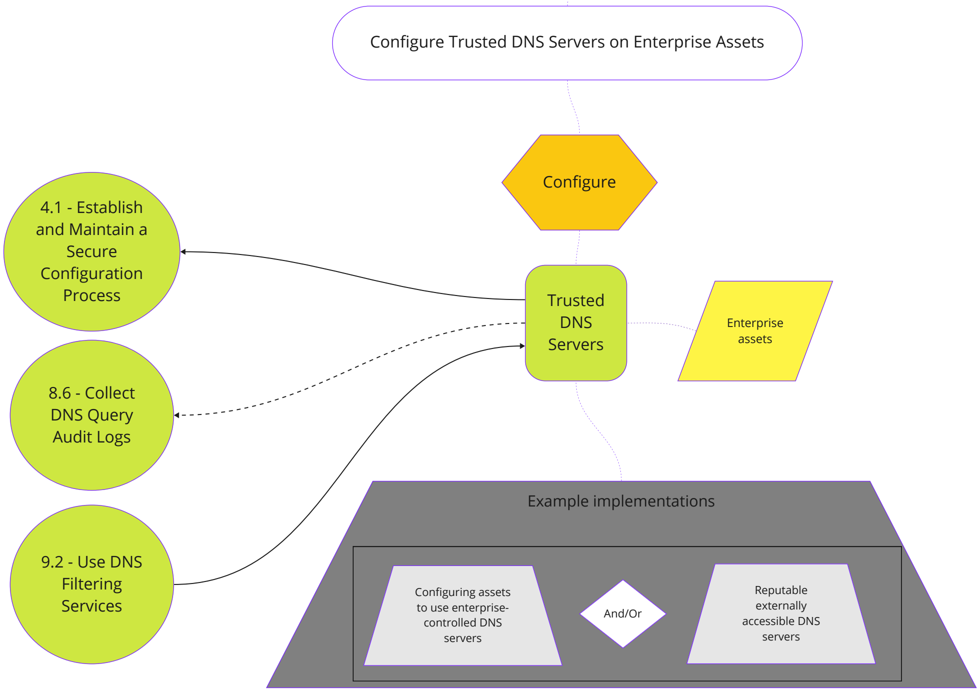
Devices

Secure Configurations

Configuration Management Tool

OS Dependent

Configure trusted DNS servers on enterprise assets. Example implementations include: configuring assets to use enterprise-controlled DNS servers and/or reputable externally accessible DNS servers.



Configure Trusted DNS Servers on Enterprise Assets

Configure

Trusted DNS Servers

Enterprise assets

4.1 - Establish and Maintain a Secure Configuration Process

8.6 - Collect DNS Query Audit Logs

9.2 - Use DNS Filtering Services

Example implementations

Configuring assets to use enterprise-controlled DNS servers

And/Or

Reputable externally accessible DNS servers

Group Validated

4.10

Enforce automatic device lockout following a predetermined threshold of local failed authentication attempts on portable end-user devices, where supported. For laptops, do not allow more than 20 failed authentication attempts; for tablets and smartphones, no more than 10 failed authentication attempts. Example implementations include Microsoft® InTune Device Lock and Apple® Configuration Profile maxFailedAttempts.

IG2

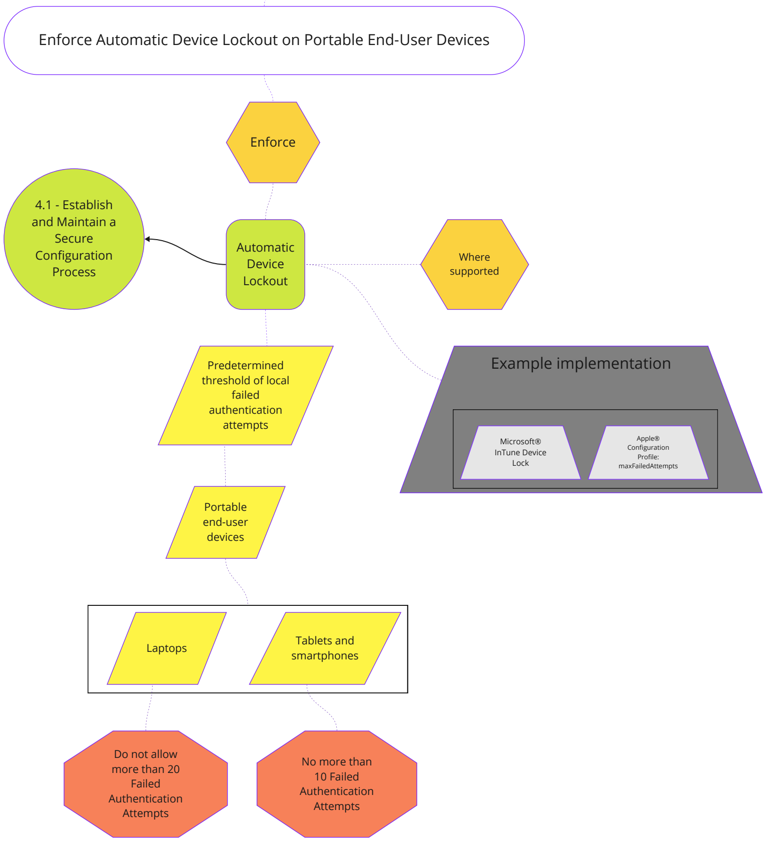
Protect

Secure Configurations

Devices

Configuration Management Tool

OS Dependent



Enforce Automatic Device Lockout on Portable End-User Devices

Enforce

4.1 - Establish and Maintain a Secure Configuration Process

Automatic Device Lockout

Where supported

Example implementation

Microsoft® InTune Device Lock

Apple® Configuration Profile: maxFailedAttempts

Predetermined threshold of local failed authentication attempts

Portable end-user devices

Laptops

Tablets and smartphones

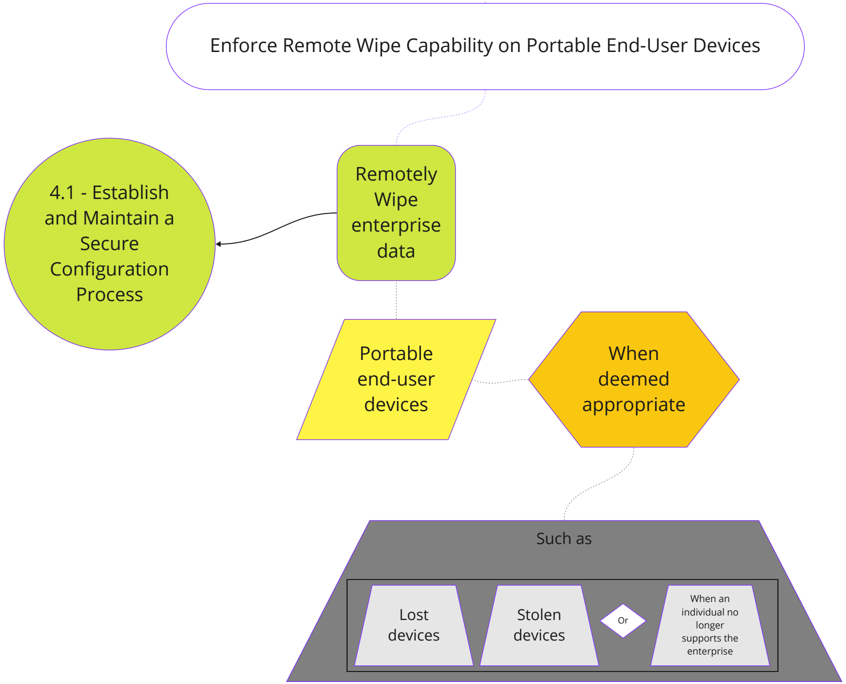
Do not allow more than 20 Failed Authentication Attempts

No more than 10 Failed Authentication Attempts

Group Validated

4.11

Remotely wipe enterprise data from enterprise-owned portable end-user devices when deemed appropriate such as lost or stolen devices, or when an individual no longer supports the enterprise.



Enforce Remote Wipe Capability on Portable End-User Devices

Remotely Wipe enterprise data

4.1 - Establish and Maintain a Secure Configuration Process

Portable end-user devices

When deemed appropriate

Such as

Lost devices

Stolen devices

Or

When an individual no longer supports the enterprise

IG2

Secure Configurations

Protect

Configuration Management Tool

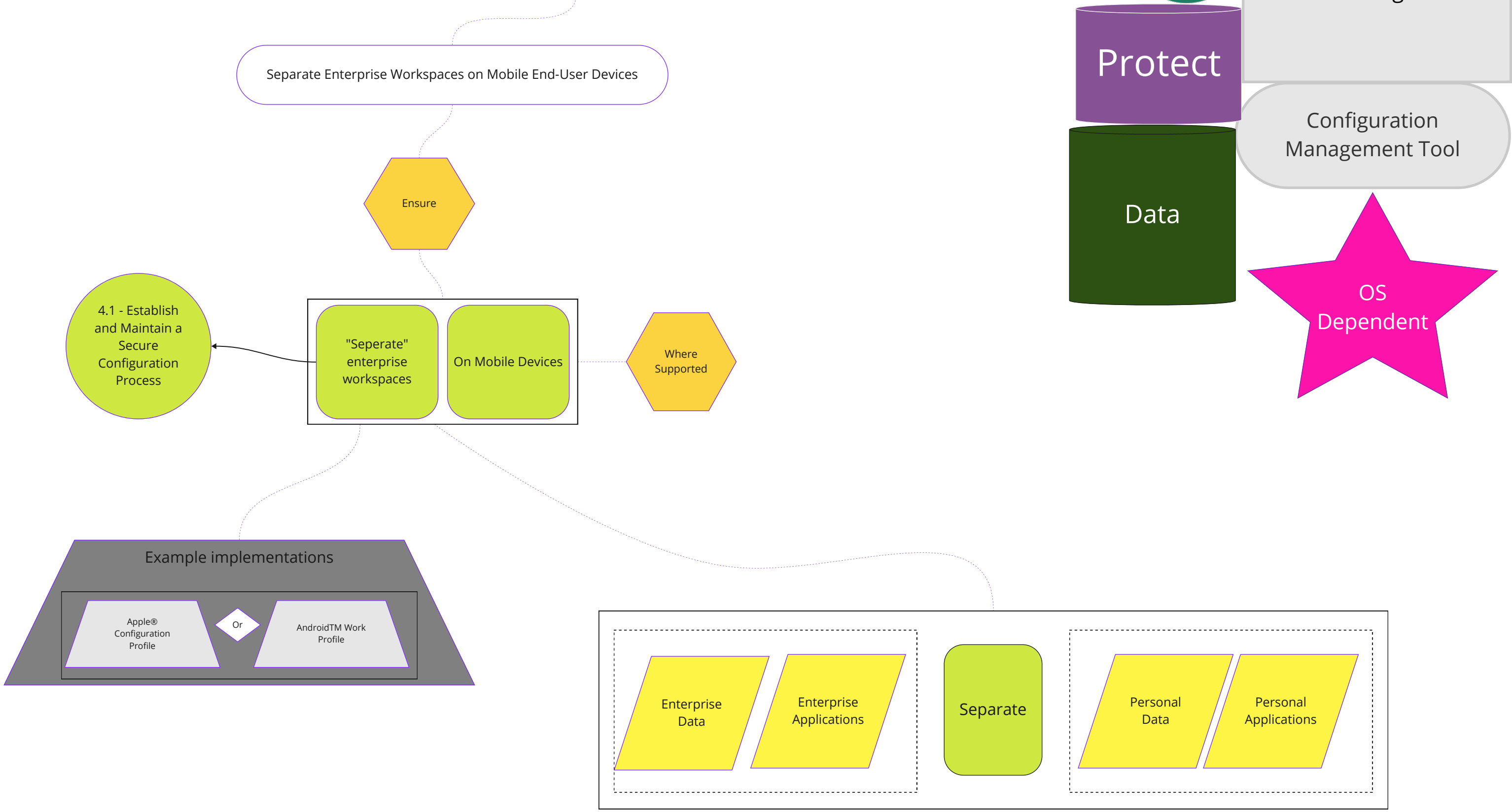
Data

OS Dependent

Group Validated

4.12

Ensure separate enterprise workspaces are used on mobile end-user devices, where supported. Example implementations include using an Apple® Configuration Profile or AndroidTM Work Profile to separate enterprise applications and data from personal applications and data.



IG3

Secure Configurations

Protect

Data

Configuration Management Tool

OS Dependent

Separate Enterprise Workspaces on Mobile End-User Devices

Ensure

"Seperate" enterprise workspaces

On Mobile Devices

Where Supported

4.1 - Establish and Maintain a Secure Configuration Process

Example implementations

Apple® Configuration Profile

Or

AndroidTM Work Profile

Enterprise Data

Enterprise Applications

Separate

Personal Data

Personal Applications

CONTROL 5

Account Management

Safeguards: 6		IG1: 4/6	IG2: 6/6	IG3: 6/6

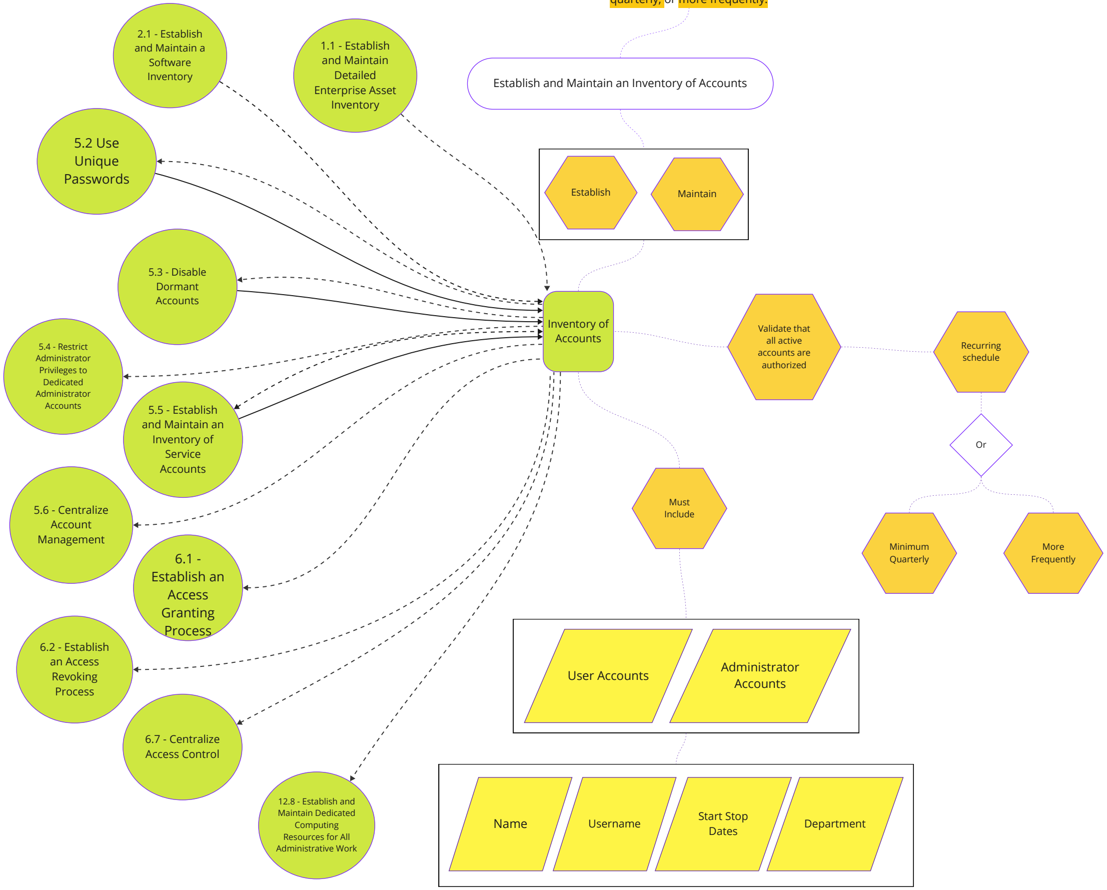
Overview

Use processes and tools to assign and manage authorization to credentials for user accounts, including administrator accounts, as well as service accounts, to enterprise assets and software.

Group Validated

5.1

Establish and maintain an inventory of all accounts managed in the enterprise. The inventory must include both user and administrator accounts. The inventory, at a minimum, should contain the person's name, username, start/stop dates, and department. Validate that all active accounts are authorized, on a recurring schedule at a minimum quarterly, or more frequently.



Establish and Maintain an Inventory of Accounts

Establish

Maintain

Inventory of Accounts

Validate that all active accounts are authorized

Recurring schedule

Or

Minimum Quarterly

More Frequently

Must Include

User Accounts

Administrator Accounts

Name

Username

Start Stop Dates

Department

2.1 - Establish and Maintain a Software Inventory

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

5.2 Use Unique Passwords

5.3 - Disable Dormant Accounts

5.4 - Restrict Administrator Privileges to Dedicated Administrator Accounts

5.5 - Establish and Maintain an Inventory of Service Accounts

5.6 - Centralize Account Management

6.1 - Establish an Access Granting Process

6.2 - Establish an Access Revoking Process

6.7 - Centralize Access Control

12.8 - Establish and Maintain Dedicated Computing Resources for All Administrative Work

Process Oriented Safeguard

IG1

Account and Access Control Management

Identify

Identity and Access Management Tool

Users

Group Validated

5.2

Use unique passwords for all enterprise assets. Best practice implementation includes, at a minimum, an 8-character password for accounts using Multi-Factor Authentication (MFA) and a 14-character password for accounts not using MFA.

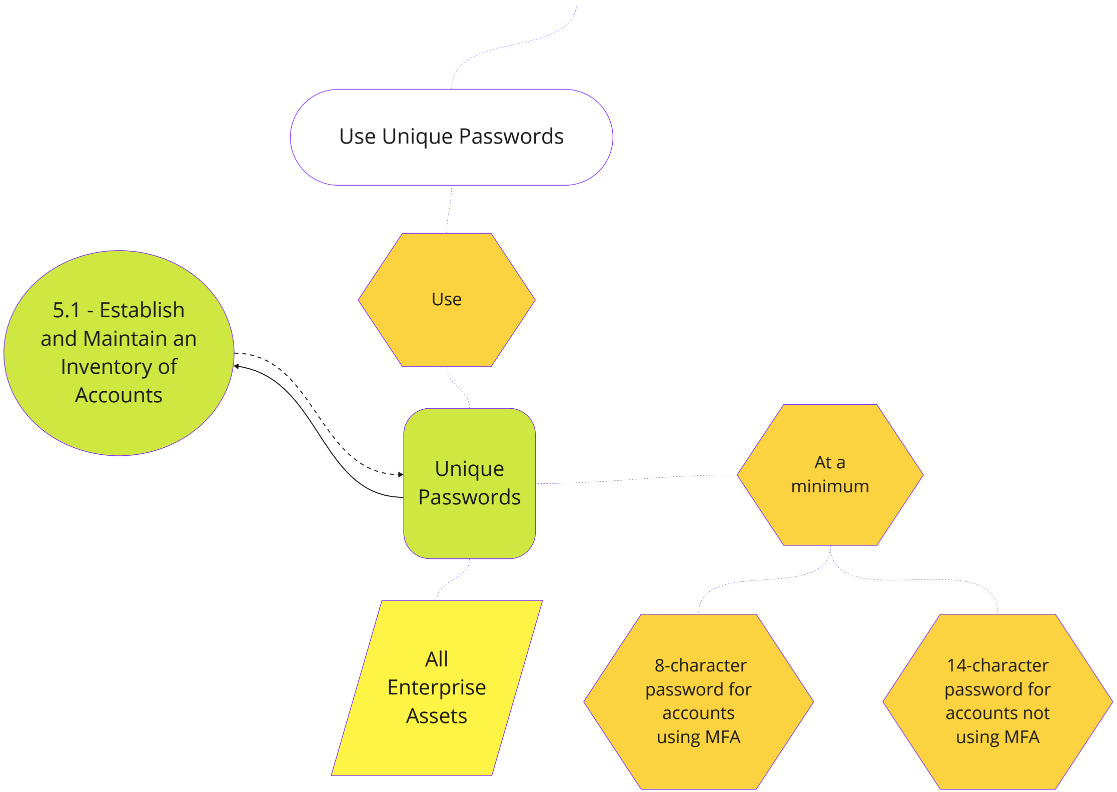
IG1

Account and Access Control Management

Protect

Password Management Tool

Users


Use Unique Passwords
Use
5.1 - Establish and Maintain an Inventory of Accounts
Unique Passwords
At a minimum
All Enterprise Assets
8-character password for accounts using MFA
14-character password for accounts not using MFA

Group Validated

5.3

Delete or disable any dormant accounts after a period of 45 days of inactivity, where supported.

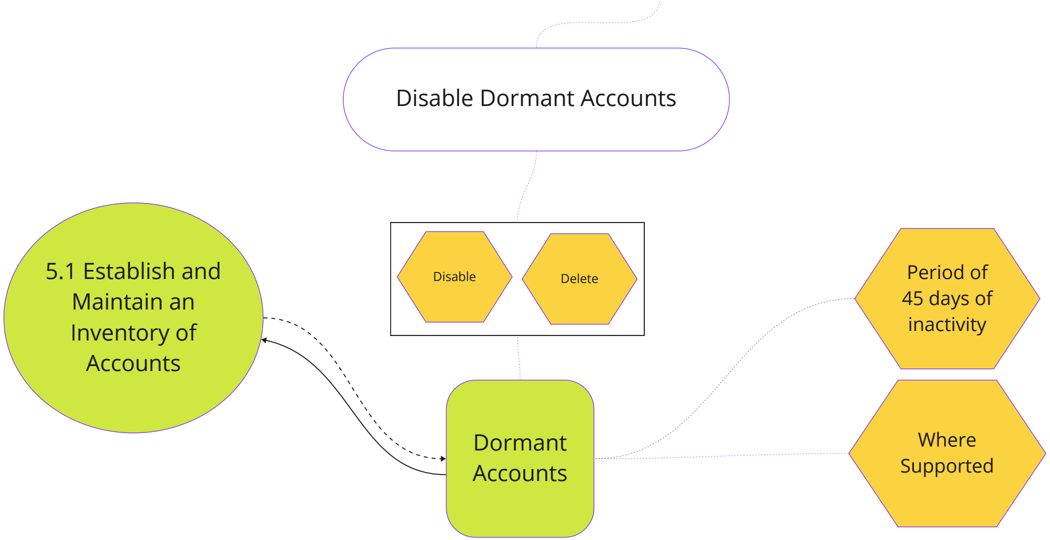
IG1

Protect

Users

Account and Access Control Management

Identity and Access Management Tool



Disable Dormant Accounts

Disable

Delete

5.1 Establish and Maintain an Inventory of Accounts

Dormant Accounts

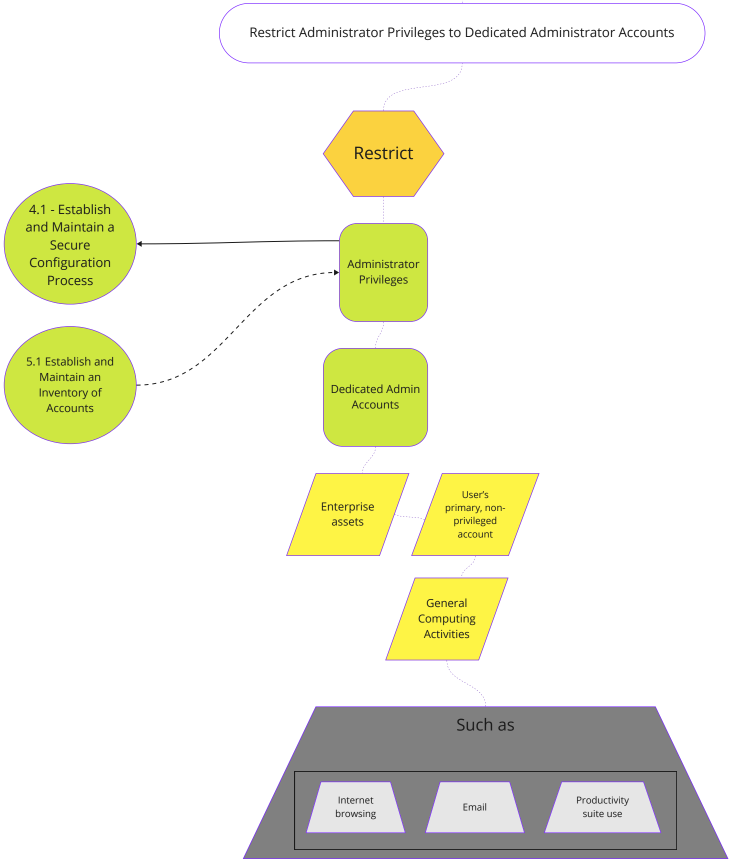
Period of 45 days of inactivity

Where Supported

Group Validated

5.4

Restrict administrator privileges to dedicated administrator accounts on enterprise assets. Conduct general computing activities, such as internet browsing, email, and productivity suite use, from the user’s primary, non-privileged account.


Restrict Administrator Privileges to Dedicated Administrator Accounts
Restrict
4.1 - Establish and Maintain a Secure Configuration Process
Administrator Privileges
5.1 Establish and Maintain an Inventory of Accounts
Dedicated Admin Accounts
Enterprise assets
User’s primary, non-privileged account
General Computing Activities
Such as
Internet browsing
Email
Productivity suite use

IG1

Account and Access Control Management

Protect

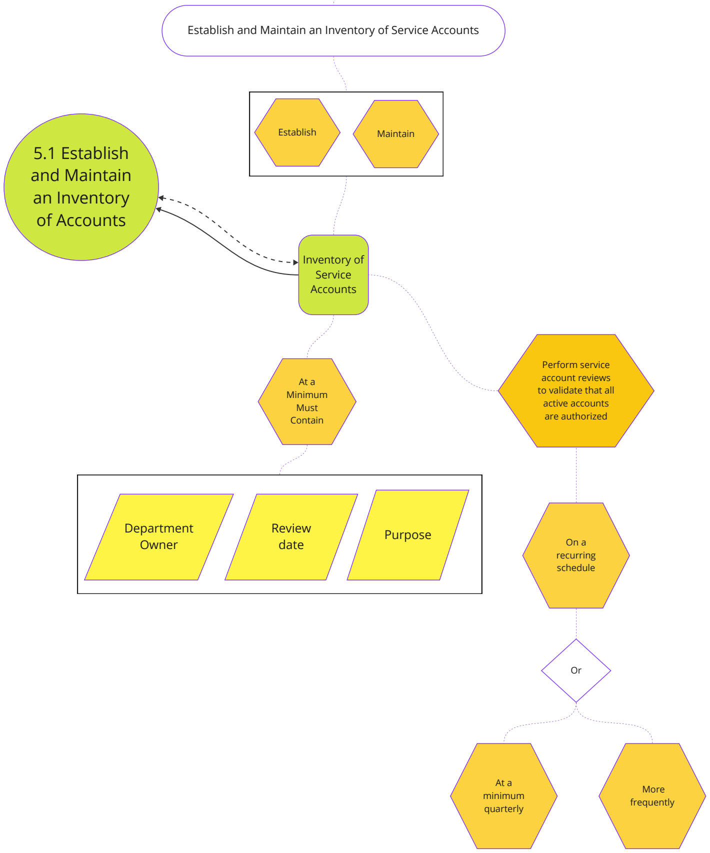
Identity and Access Management Tool

Users

Group Validated

5.5

Establish and maintain an inventory of service accounts. The inventory, at a minimum, must contain department owner, review date, and purpose. Perform service account reviews to validate that all active accounts are authorized, on a recurring schedule at a minimum quarterly, or more frequently.



Establish and Maintain an Inventory of Service Accounts

Establish

Maintain

5.1 Establish and Maintain an Inventory of Accounts

Inventory of Service Accounts

At a Minimum Must Contain

Department Owner

Review date

Purpose

Perform service account reviews to validate that all active accounts are authorized

On a recurring schedule

Or

At a minimum quarterly

More frequently

Process Oriented Safeguard

IG2

Account and Access Control Management

Identify

Identity and Access Management Tool

Users

Group Validated

5.6

Centralize account management through a directory or identity service.

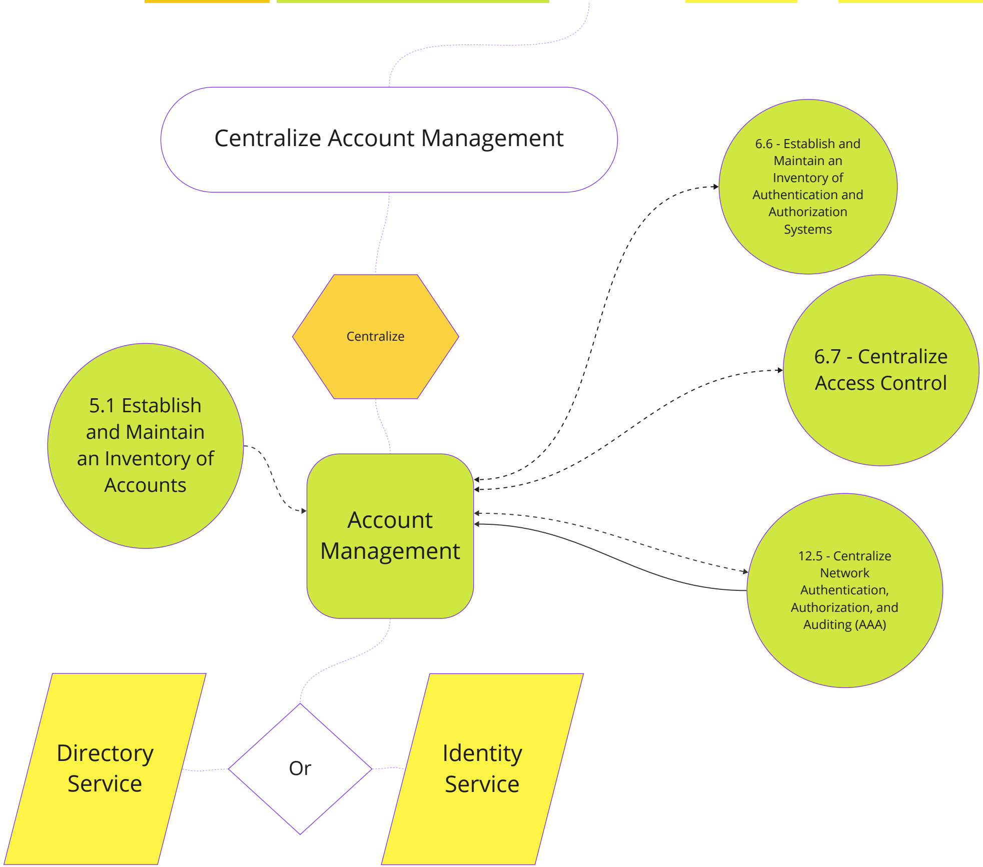
IG2

Govern

Users

Account and Access Control Management

Identity and Access Management Tool



Centralize Account Management

Centralize

Account Management

5.1 Establish and Maintain an Inventory of Accounts

6.6 - Establish and Maintain an Inventory of Authentication and Authorization Systems

6.7 - Centralize Access Control

12.5 - Centralize Network Authentication, Authorization, and Auditing (AAA)

Directory Service

Or

Identity Service

CONTROL 6

Access Control Management

Safeguards: 8	IG1: 5/8	IG2: 7/8	IG3: 8/8

Overview

Use processes and tools to create, assign, manage, and revoke access credentials and privileges for user, administrator, and service accounts for enterprise assets and software.

Group Validated

6.1

Establish and follow a documented process, preferably automated, for granting access to enterprise assets upon new hire or role change of a user.

Process Oriented Safeguard

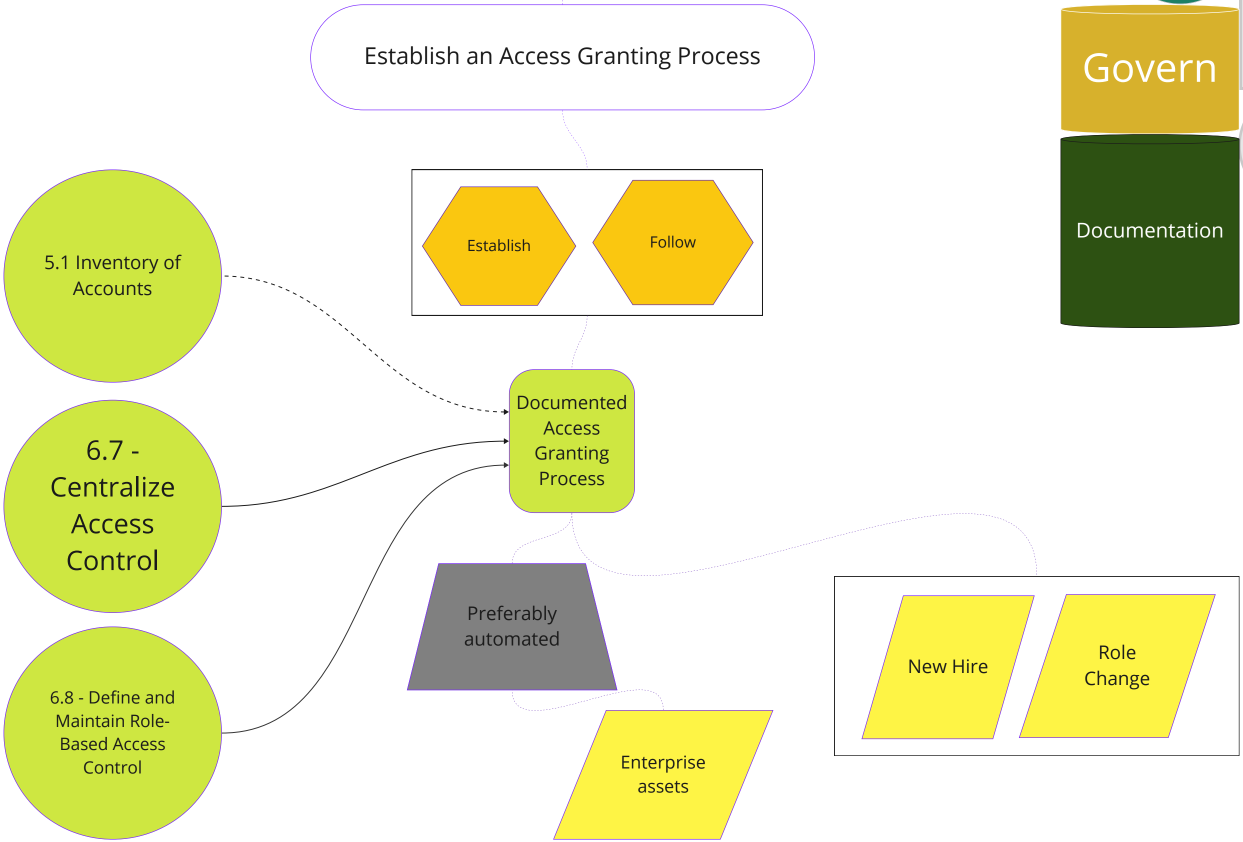
IG1

Account and Access Control Management

Govern

Documentation

Account and Credential Management Policy/Process



Establish an Access Granting Process

Establish

Follow

5.1 Inventory of Accounts

6.7 - Centralize Access Control

6.8 - Define and Maintain Role-Based Access Control

Documented Access Granting Process

Preferably automated

Enterprise assets

New Hire

Role Change

Group Validated

6.2

Establish and follow a process, preferably automated, for revoking access to enterprise assets, through disabling accounts immediately upon termination, rights revocation, or role change of a user. Disabling accounts, instead of deleting accounts, may be necessary to preserve audit trails.

Process Oriented Safeguard

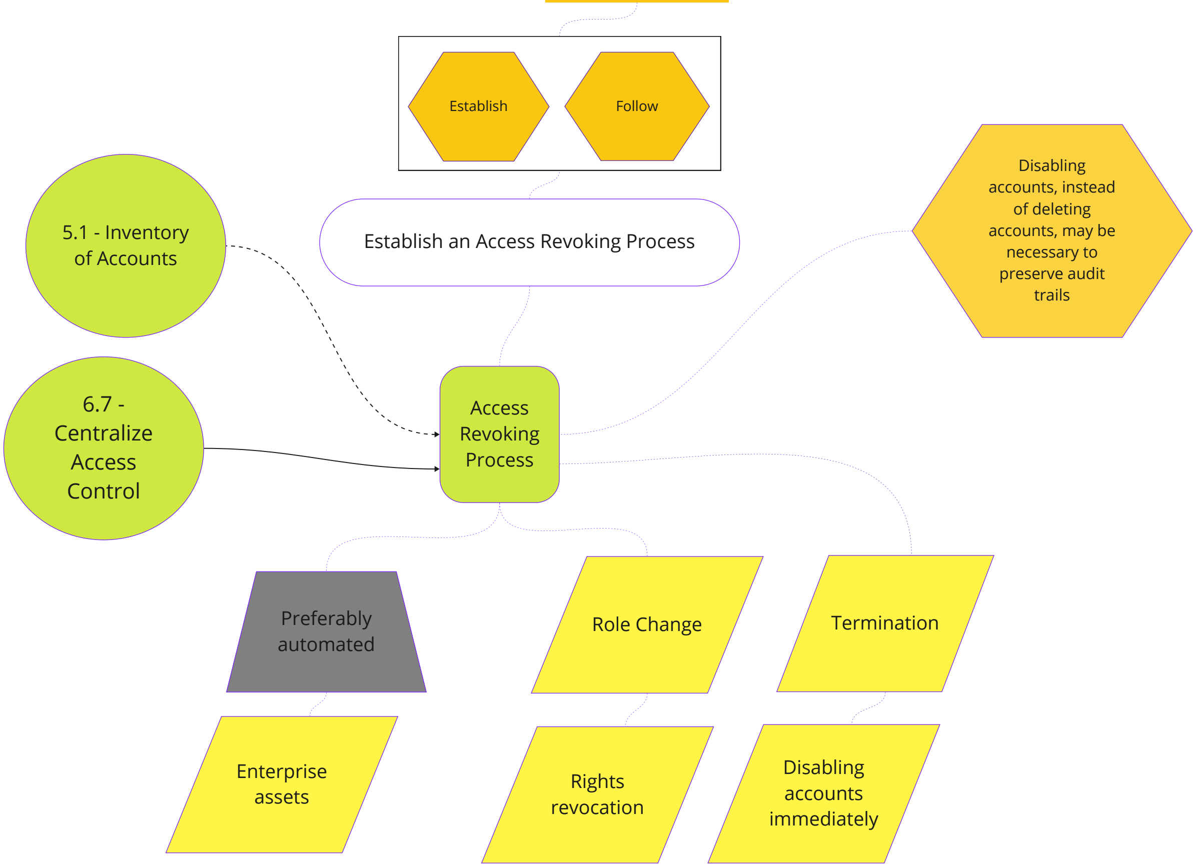
IG1

Account and Access Control Management

Govern

Account and Credential Management Policy/Process

Documentation



Establish

Follow

Establish an Access Revoking Process

5.1 - Inventory of Accounts

6.7 - Centralize Access Control

Access Revoking Process

Disabling accounts, instead of deleting accounts, may be necessary to preserve audit trails

Preferably automated

Role Change

Termination

Enterprise assets

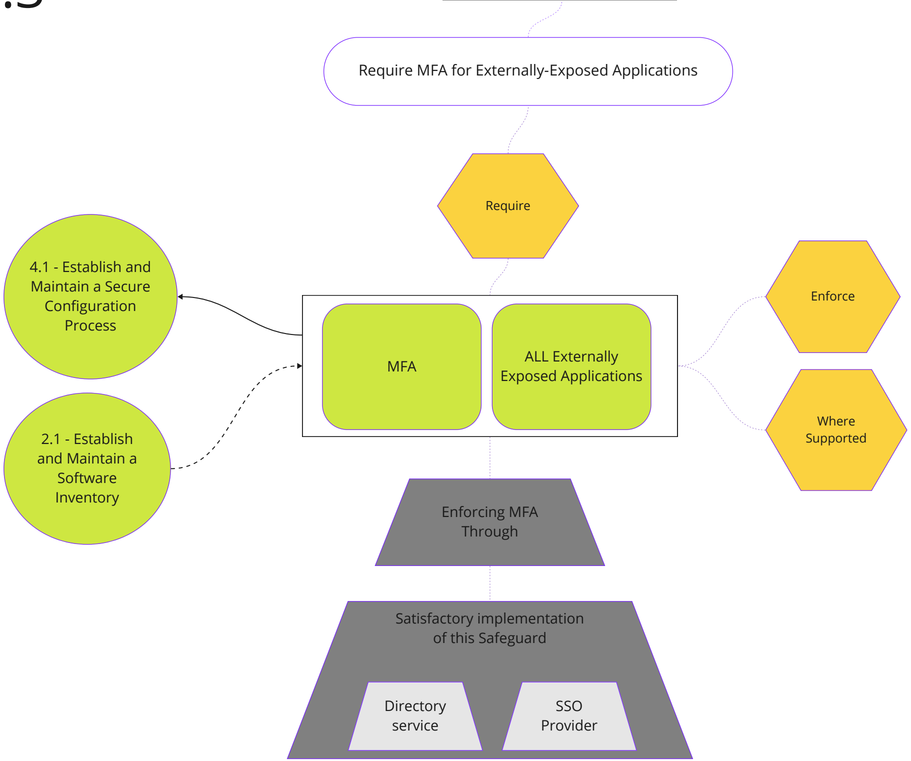
Rights revocation

Disabling accounts immediately

Group Validated

6.3

Require all externally-exposed enterprise or third-party applications to enforce MFA, where supported. Enforcing MFA through a directory service or SSO provider is a satisfactory implementation of this Safeguard.



Require MFA for Externally-Exposed Applications
Require
4.1 - Establish and Maintain a Secure Configuration Process
MFA
ALL Externally Exposed Applications
Enforce
Where Supported
2.1 - Establish and Maintain a Software Inventory
Enforcing MFA Through
Satisfactory implementation of this Safeguard
Directory service
SSO Provider

IG1

Account and Access Control Management

Protect

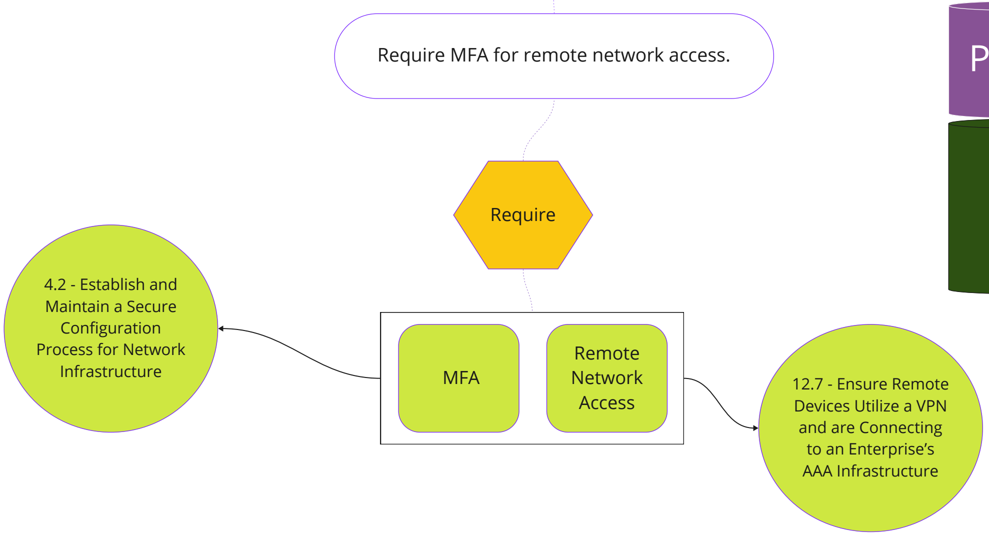
Multi-Factor Authentication Tool

Users

Group Validated

6.4

Require MFA for remote network access.



Require MFA for remote network access.

Require

MFA

Remote Network Access

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

12.7 - Ensure Remote Devices Utilize a VPN and are Connecting to an Enterprise's AAA Infrastructure

IG1

Account and Access Control Management

Protect

Multi-Factor Authentication Tool

Users

Group Validated

6.5

Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a service provider.

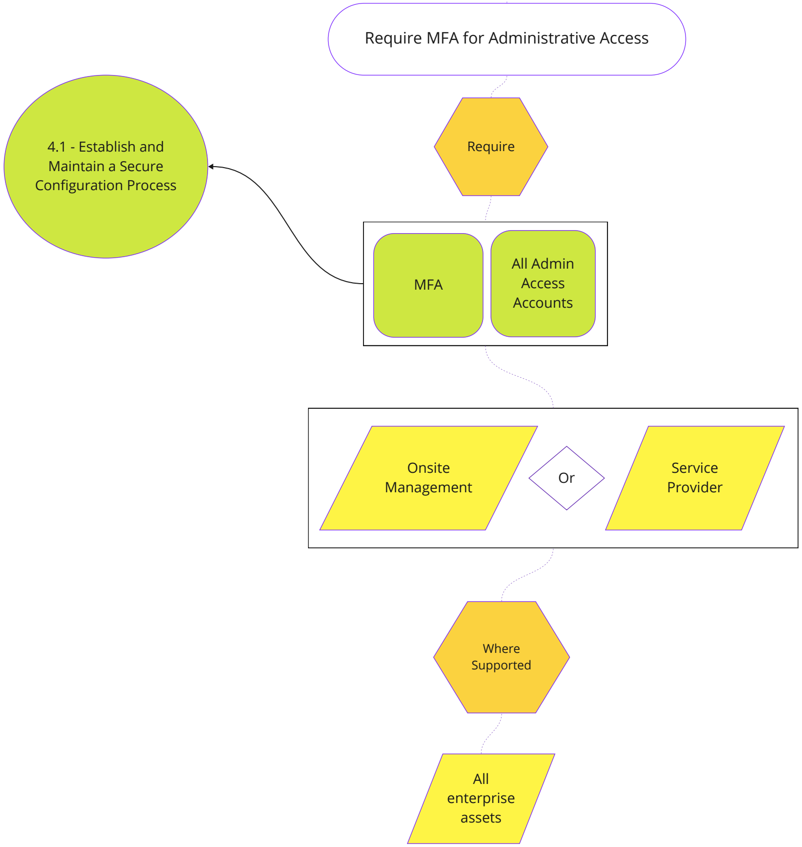
IG1

Protect

Users

Account and Access Control Management

Multi-Factor Authentication Tool



Require MFA for Administrative Access

Require

MFA

All Admin Access Accounts

4.1 - Establish and Maintain a Secure Configuration Process

Onsite Management

Or

Service Provider

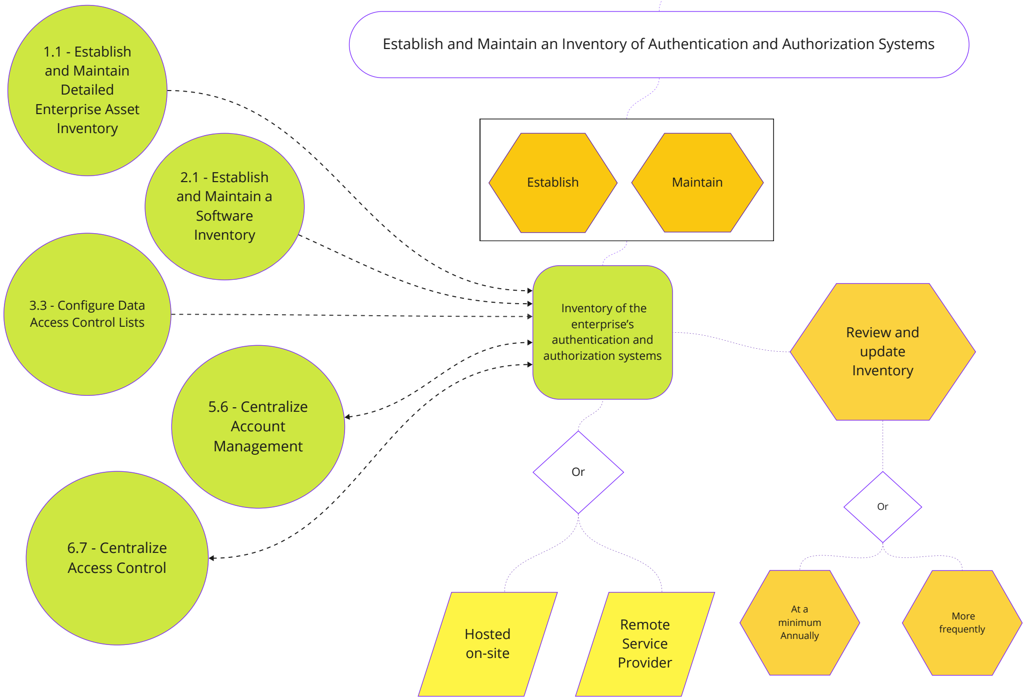
Where Supported

All enterprise assets

Group Validated

6.6

Establish and maintain an inventory of the enterprise's authentication and authorization systems, including those hosted on-site or at a remote service provider. Review and update the inventory, at a minimum, annually, or more frequently.



Establish and Maintain an Inventory of Authentication and Authorization Systems

Establish

Maintain

Inventory of the enterprise's authentication and authorization systems

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

3.3 - Configure Data Access Control Lists

5.6 - Centralize Account Management

6.7 - Centralize Access Control

Or

Hosted on-site

Remote Service Provider

Review and update Inventory

Or

At a minimum Annually

More frequently

Process Oriented Safeguard

IG2

Account and Access Control Management

Identify

Account and Credential Management Policy/Process

Software

Group Validated

6.7

Centralize access control for all enterprise assets through a directory service or SSO provider, where supported.

IG2

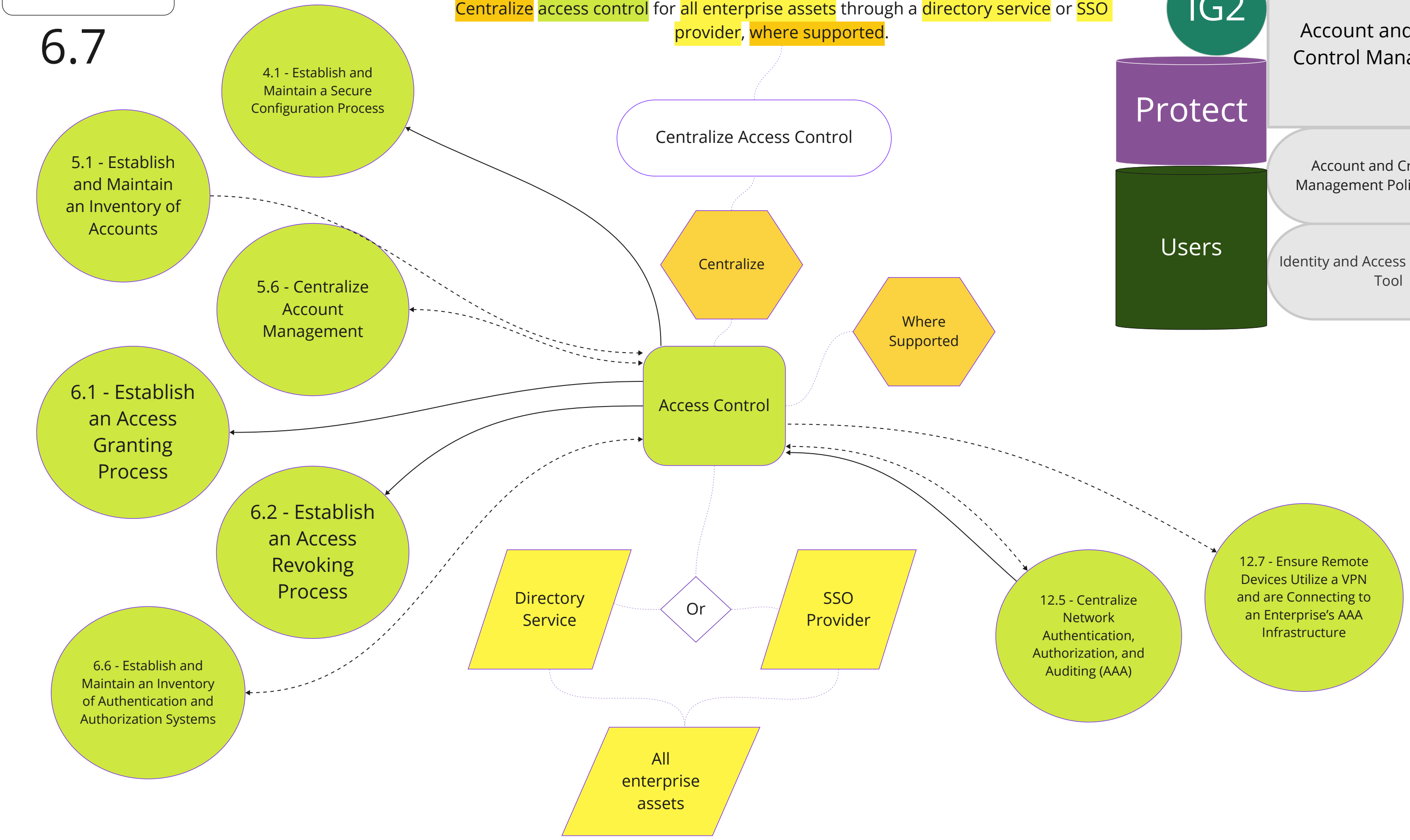
Protect

Users

Account and Access Control Management

Account and Credential Management Policy/Process

Identity and Access Management Tool



Centralize Access Control

Centralize

Where Supported

Access Control

Directory Service

Or

SSO Provider

All enterprise assets

4.1 - Establish and Maintain a Secure Configuration Process

5.1 - Establish and Maintain an Inventory of Accounts

5.6 - Centralize Account Management

6.1 - Establish an Access Granting Process

6.2 - Establish an Access Revoking Process

6.6 - Establish and Maintain an Inventory of Authentication and Authorization Systems

12.5 - Centralize Network Authentication, Authorization, and Auditing (AAA)

12.7 - Ensure Remote Devices Utilize a VPN and are Connecting to an Enterprise's AAA Infrastructure

Group Validated

6.8

Define and maintain role-based access control, through determining and documenting the access rights necessary for each role within the enterprise to successfully carry out its assigned duties. Perform access control reviews of enterprise assets to validate that all privileges are authorized, on a recurring schedule at a minimum annually, or more frequently.

Process Oriented Safeguard

IG3

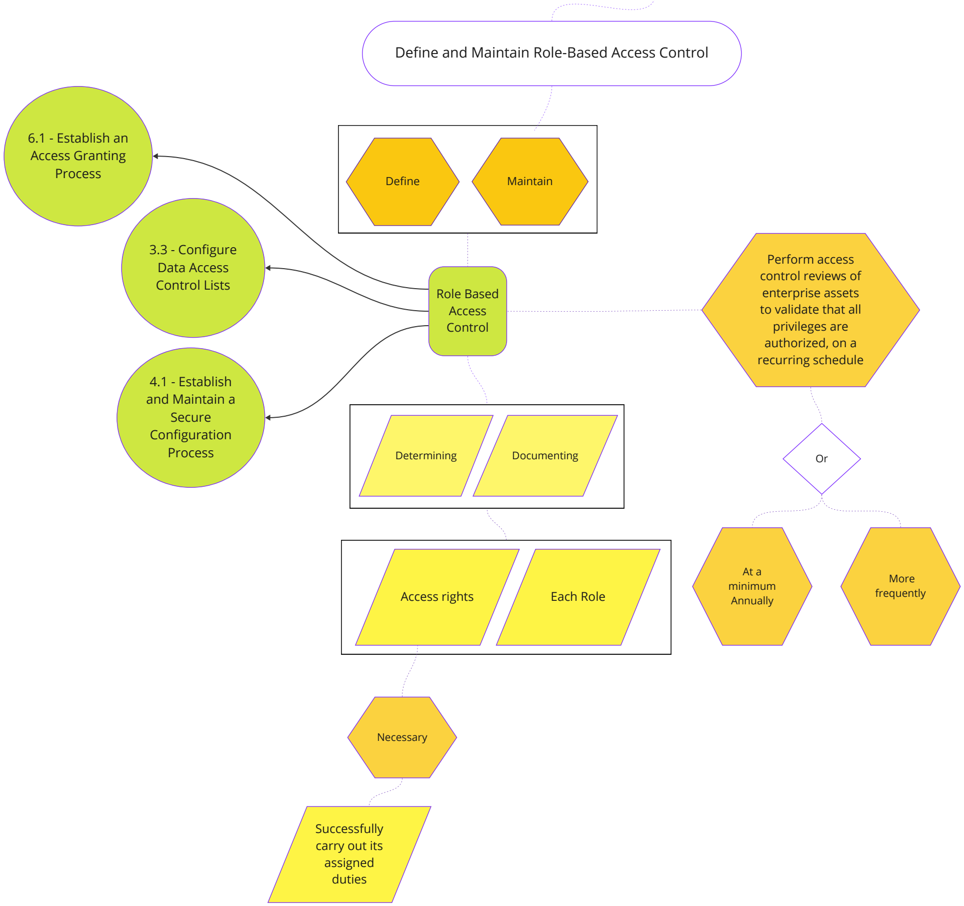
Account and Access Control Management

Govern

Users

Account and Credential Management Policy/Process

Identity and Access management Tool



Define and Maintain Role-Based Access Control

Define

Maintain

Role Based Access Control

6.1 - Establish an Access Granting Process

3.3 - Configure Data Access Control Lists

4.1 - Establish and Maintain a Secure Configuration Process

Determining

Documenting

Access rights

Each Role

Necessary

Successfully carry out its assigned duties

Perform access control reviews of enterprise assets to validate that all privileges are authorized, on a recurring schedule

Or

At a minimum Annually

More frequently

CONTROL 7

Continuous Vulnerability Management

Safeguards: 7	IG1: 4/7	IG2: 7/7	IG3: 7/7

Overview

Develop a plan to continuously assess and track vulnerabilities on all enterprise assets within the enterprise's infrastructure, in order to remediate, and minimize, the window of opportunity for attackers. Monitor public and private industry sources for new threat and vulnerability information.

Group Validated

7.1

Establish and maintain a documented vulnerability management process for enterprise assets. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

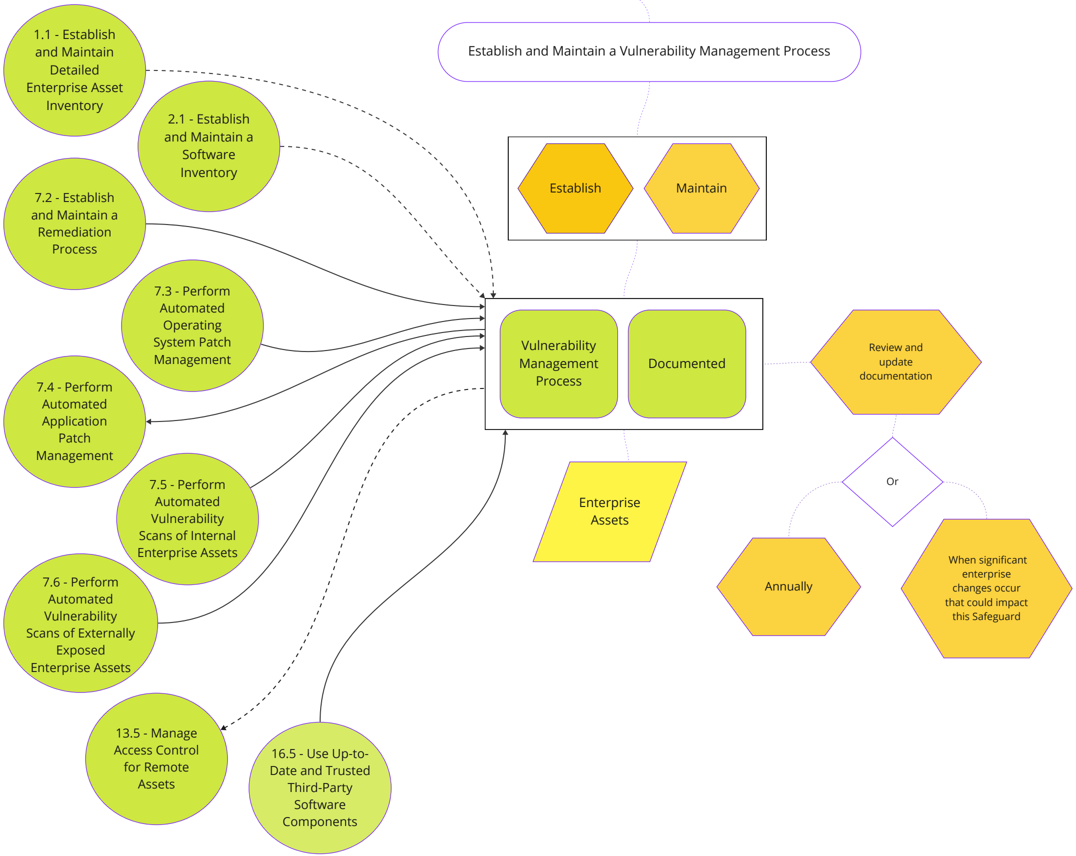
IG1

Govern

Documentation

Vulnerability Management

Vulnerability/Patch Management Policy/Process



Establish and Maintain a Vulnerability Management Process

Establish

Maintain

Vulnerability Management Process

Documented

Enterprise Assets

Review and update documentation

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

7.2 - Establish and Maintain a Remediation Process

7.3 - Perform Automated Operating System Patch Management

7.4 - Perform Automated Application Patch Management

7.5 - Perform Automated Vulnerability Scans of Internal Enterprise Assets

7.6 - Perform Automated Vulnerability Scans of Externally Exposed Enterprise Assets

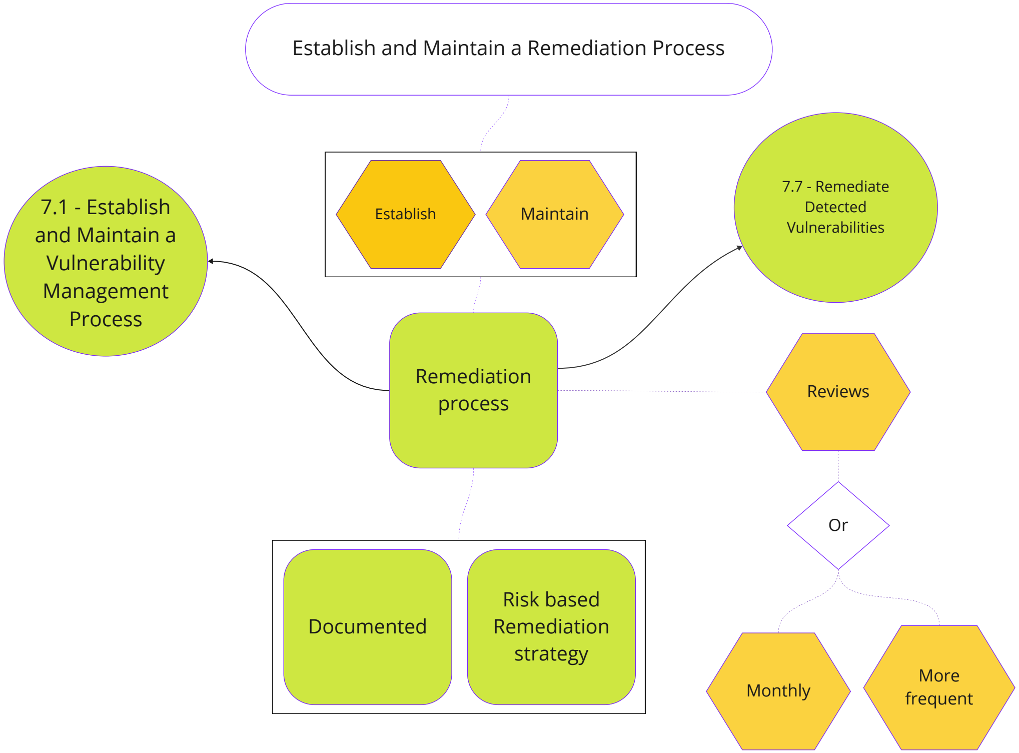
13.5 - Manage Access Control for Remote Assets

16.5 - Use Up-to-Date and Trusted Third-Party Software Components

Group Validated

7.2

Establish and maintain a risk-based remediation strategy documented in a remediation process, with monthly, or more frequent, reviews.



Establish and Maintain a Remediation Process

Establish

Maintain

7.1 - Establish and Maintain a Vulnerability Management Process

Remediation process

7.7 - Remediate Detected Vulnerabilities

Reviews

Or

Monthly

More frequent

Documented

Risk based Remediation strategy

Process Oriented Safeguard

IG1

Vulnerability Management

Govern

Vulnerability/Patch Management Tool

Documentation

Group Validated

7.3

Perform operating system updates on enterprise assets through automated patch management on a monthly, or more frequent, basis.

IG1

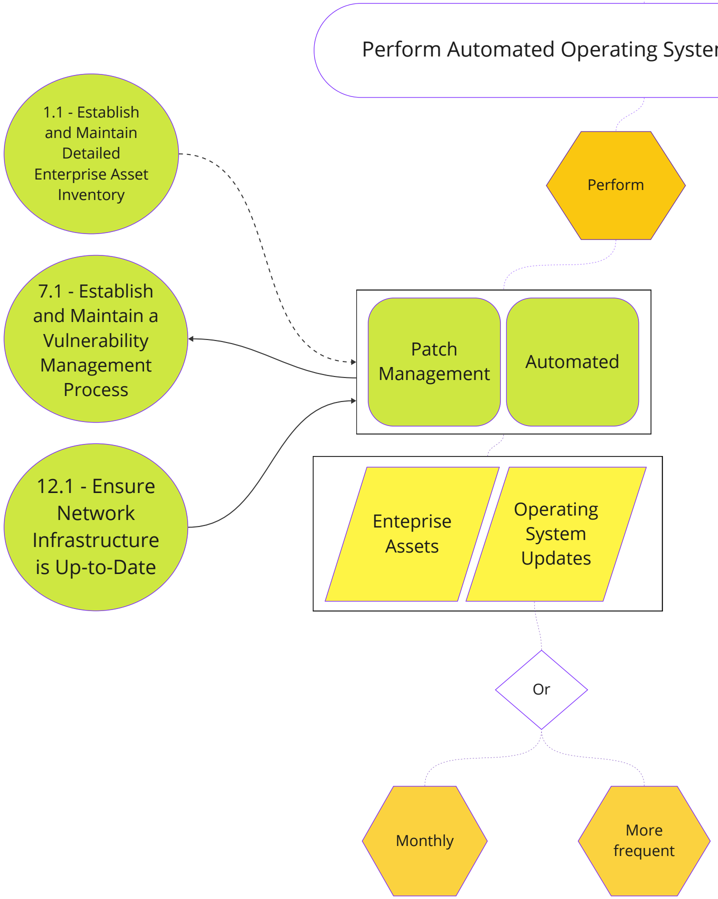
Vulnerability Management

Protect

Vulnerability/Patch Management Tool

Software

OS Dependent



Perform Automated Operating System Patch Management

Perform

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

7.1 - Establish and Maintain a Vulnerability Management Process

12.1 - Ensure Network Infrastructure is Up-to-Date

Patch Management

Automated

Enteprise Assets

Operating System Updates

Or

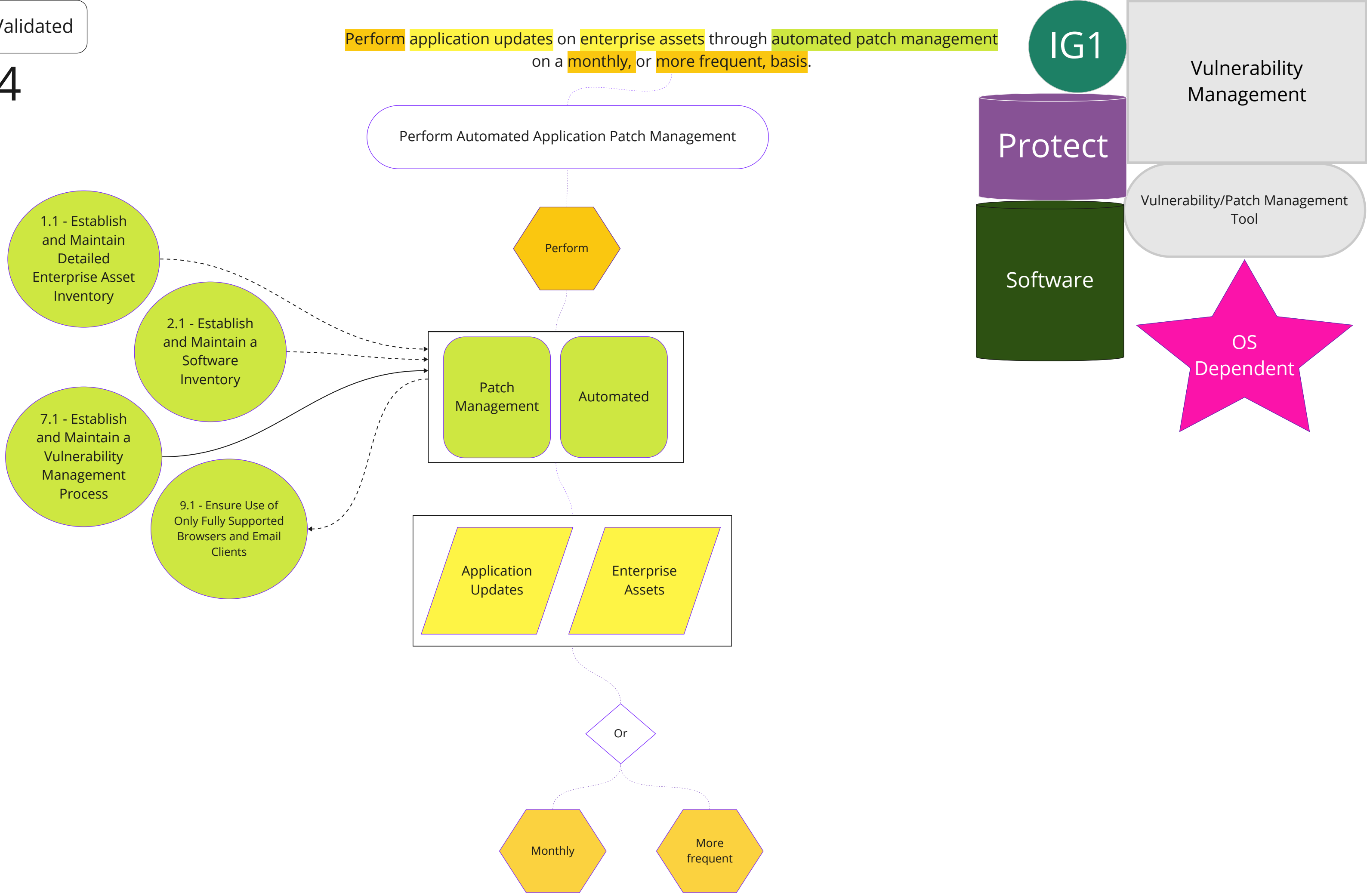
Monthly

More frequent

Group Validated

7.4

Perform application updates on enterprise assets through automated patch management on a monthly, or more frequent, basis.



IG1

Vulnerability Management

Protect

Vulnerability/Patch Management Tool

Software

OS Dependent

Perform Automated Application Patch Management

Perform

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

7.1 - Establish and Maintain a Vulnerability Management Process

9.1 - Ensure Use of Only Fully Supported Browsers and Email Clients

Patch Management

Automated

Application Updates

Enterprise Assets

Or

Monthly

More frequent

Group Validated

7.5

Perform automated vulnerability scans of internal enterprise assets on a quarterly, or more frequent, basis. Conduct both authenticated and unauthenticated scans.

IG2

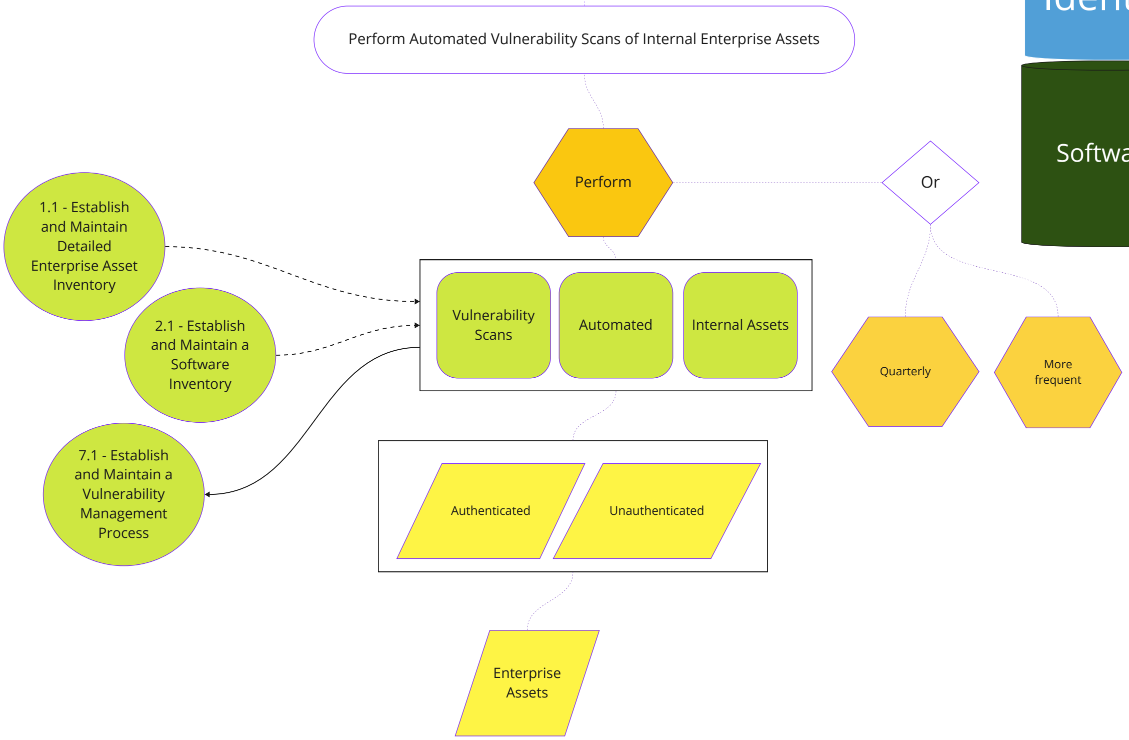
Identify

Software

Vulnerability Management

Vulnerability Scanning Tool

OS Dependent



Perform Automated Vulnerability Scans of Internal Enterprise Assets

Perform

Or

Vulnerability Scans

Automated

Internal Assets

Quarterly

More frequent

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

7.1 - Establish and Maintain a Vulnerability Management Process

Authenticated

Unauthenticated

Enterprise Assets

Group Validated

7.6

IG2

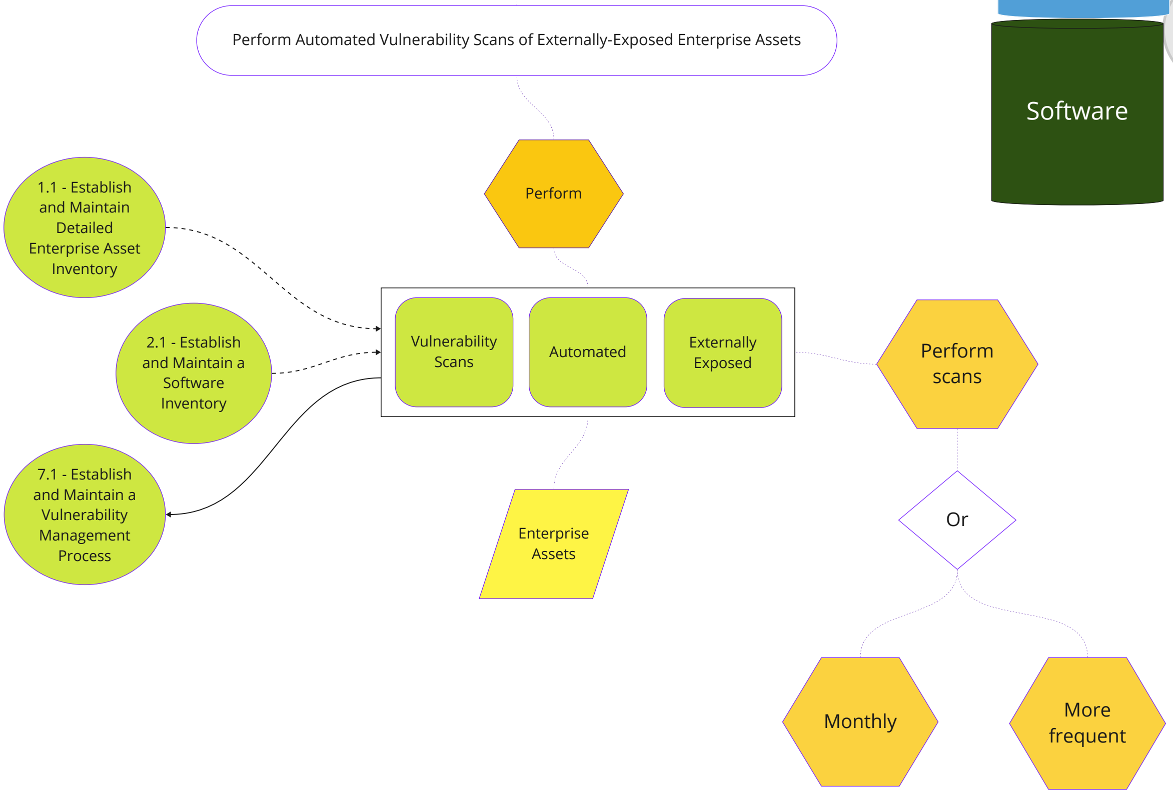
Identify

Software

Vulnerability Management

Vulnerability Scanning Tool

Perform automated vulnerability scans of externally-exposed enterprise assets. Perform scans on a monthly, or more frequent, basis.



Perform Automated Vulnerability Scans of Externally-Exposed Enterprise Assets

Perform

Vulnerability Scans

Automated

Externally Exposed

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

7.1 - Establish and Maintain a Vulnerability Management Process

Enterprise Assets

Perform scans

Or

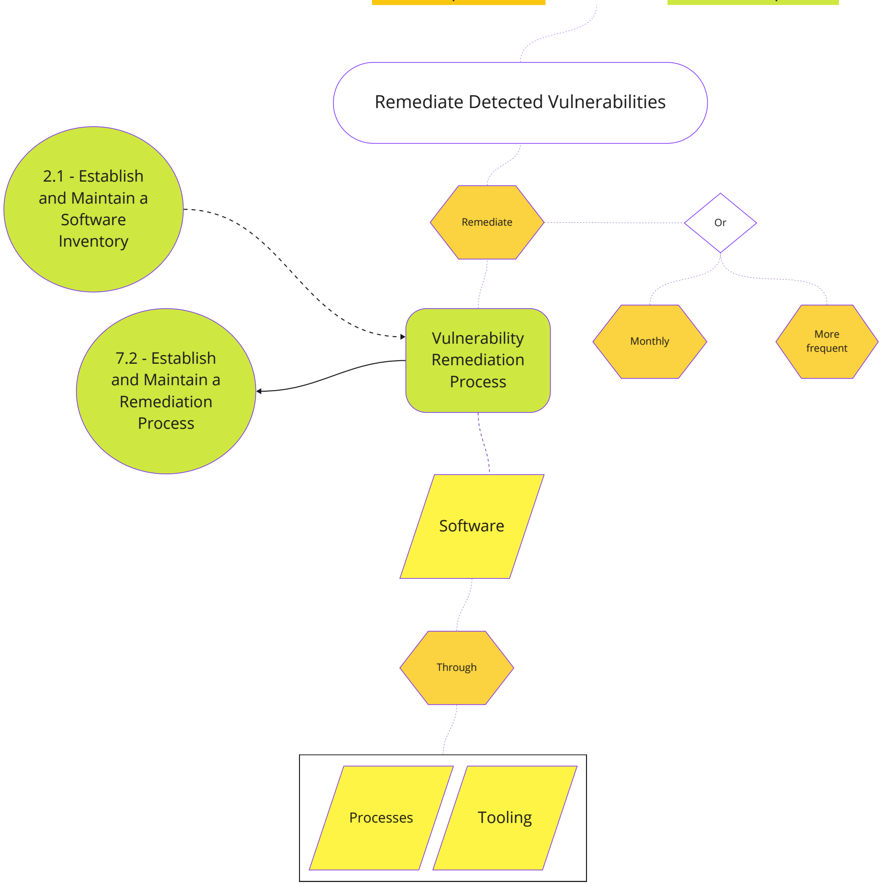
Monthly

More frequent

Group Validated

7.7

Remediate detected vulnerabilities in software through processes and tooling on a monthly, or more frequent, basis, based on the remediation process.



Remediate Detected Vulnerabilities

Remediate

Or

Monthly

More frequent

2.1 - Establish and Maintain a Software Inventory

Vulnerability Remediation Process

7.2 - Establish and Maintain a Remediation Process

Software

Through

Processes

Tooling

Process Oriented Safeguard

IG2

Vulnerability Management

Respond

Vulnerability/Patch Management Policy/Process

Software

CONTROL 8

Audit Log Management

Safeguards: 12	IG1: 3/12	IG2: 11/12	IG3: 12/12

Overview

Collect, alert, review, and retain audit logs of events that could help detect, understand, or recover from an attack.

Group Validated

8.1

Process Oriented Safeguard

Establish and maintain a documented audit log management process that defines the enterprise’s logging requirements. At a minimum, address the collection, review, and retention of audit logs for enterprise assets. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.

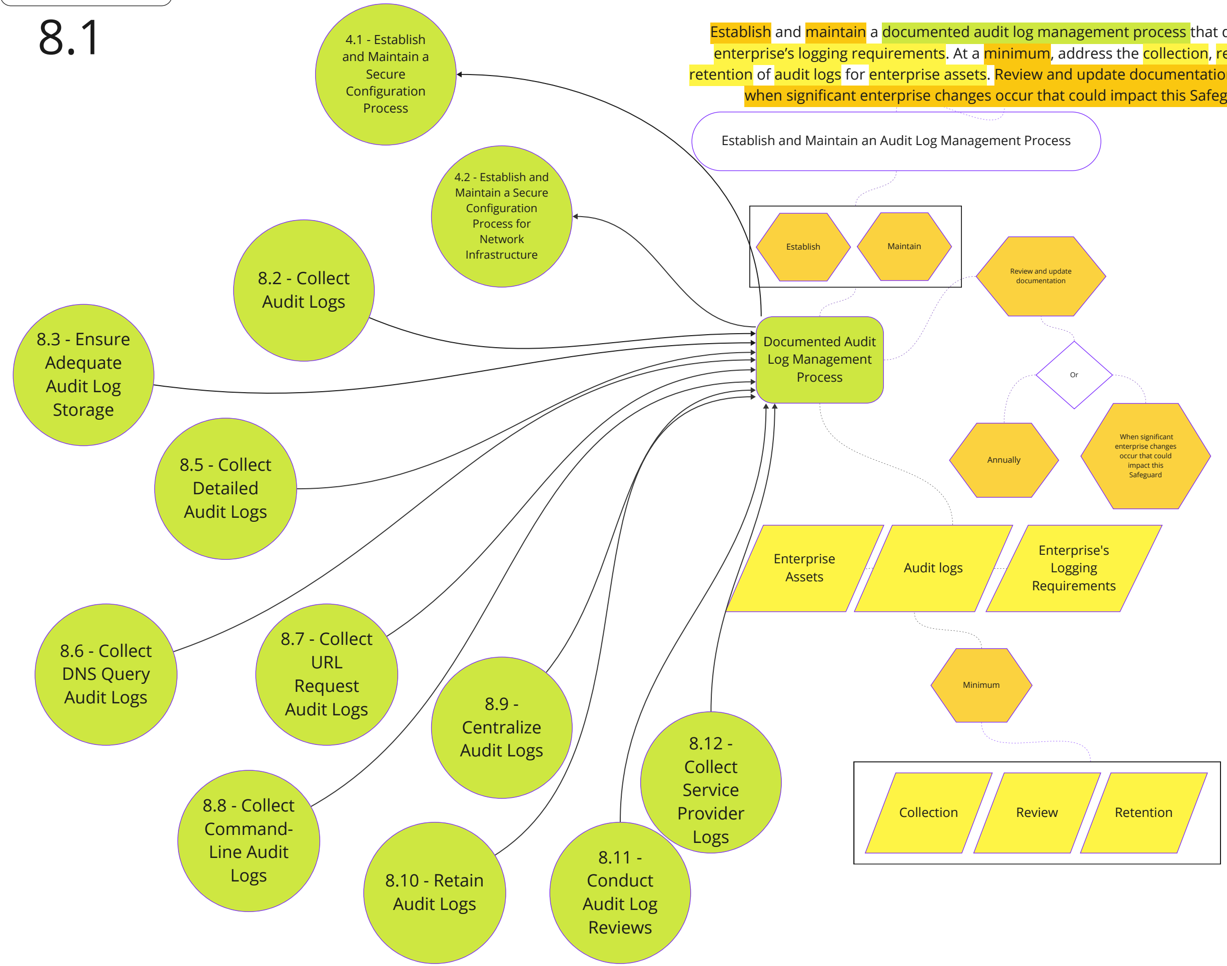
IG1

Log Management

Govern

Documentation

Log Management Policy/Process



Establish and Maintain an Audit Log Management Process

Establish

Maintain

Review and update documentation

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

Documented Audit Log Management Process

Enterprise Assets

Audit logs

Enterprise's Logging Requirements

Minimum

Collection

Review

Retention

4.1 - Establish and Maintain a Secure Configuration Process

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

8.2 - Collect Audit Logs

8.3 - Ensure Adequate Audit Log Storage

8.5 - Collect Detailed Audit Logs

8.6 - Collect DNS Query Audit Logs

8.7 - Collect URL Request Audit Logs

8.8 - Collect Command-Line Audit Logs

8.9 - Centralize Audit Logs

8.10 - Retain Audit Logs

8.11 - Conduct Audit Log Reviews

8.12 - Collect Service Provider Logs

Group Validated

8.2

Collect audit logs. Ensure that logging, per the enterprise’s audit log management process, has been enabled across enterprise assets.

IG1

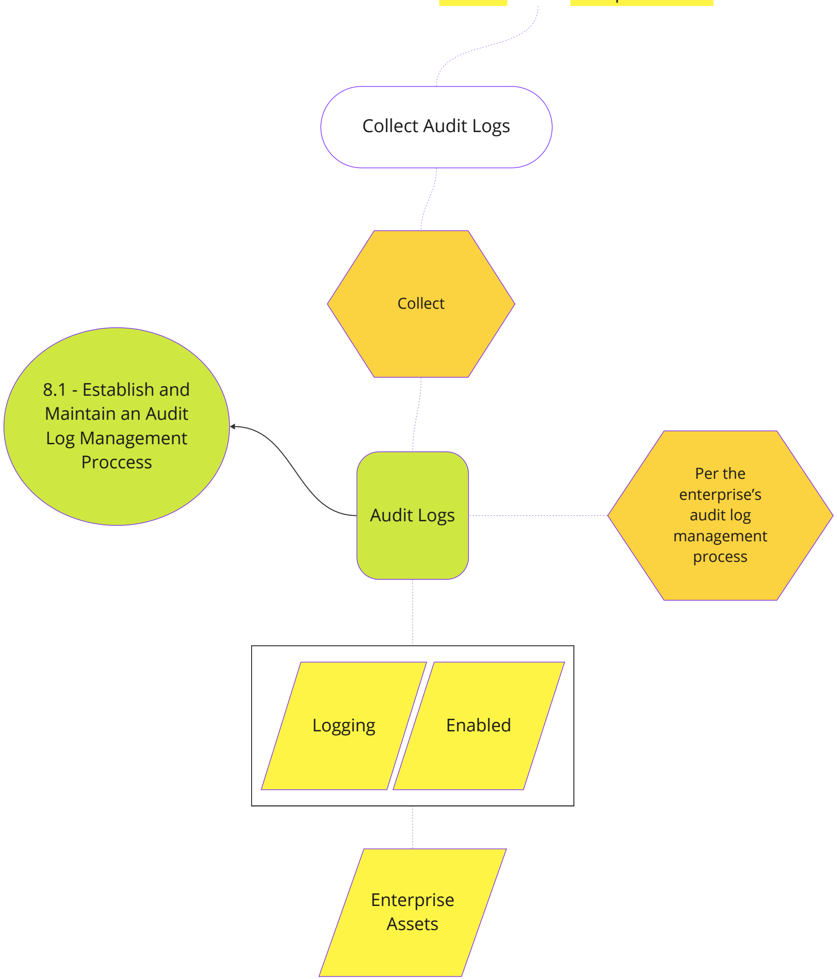
Log Management

Detect

Data

Log Management Tool

OS Dependent


Collect Audit Logs
Collect
8.1 - Establish and Maintain an Audit Log Management Proccess
Audit Logs
Per the enterprise’s audit log management process
Logging
Enabled
Enterprise Assets

Group Validated

8.3

Ensure that logging destinations maintain adequate storage to comply with the enterprise’s audit log management process.

IG1

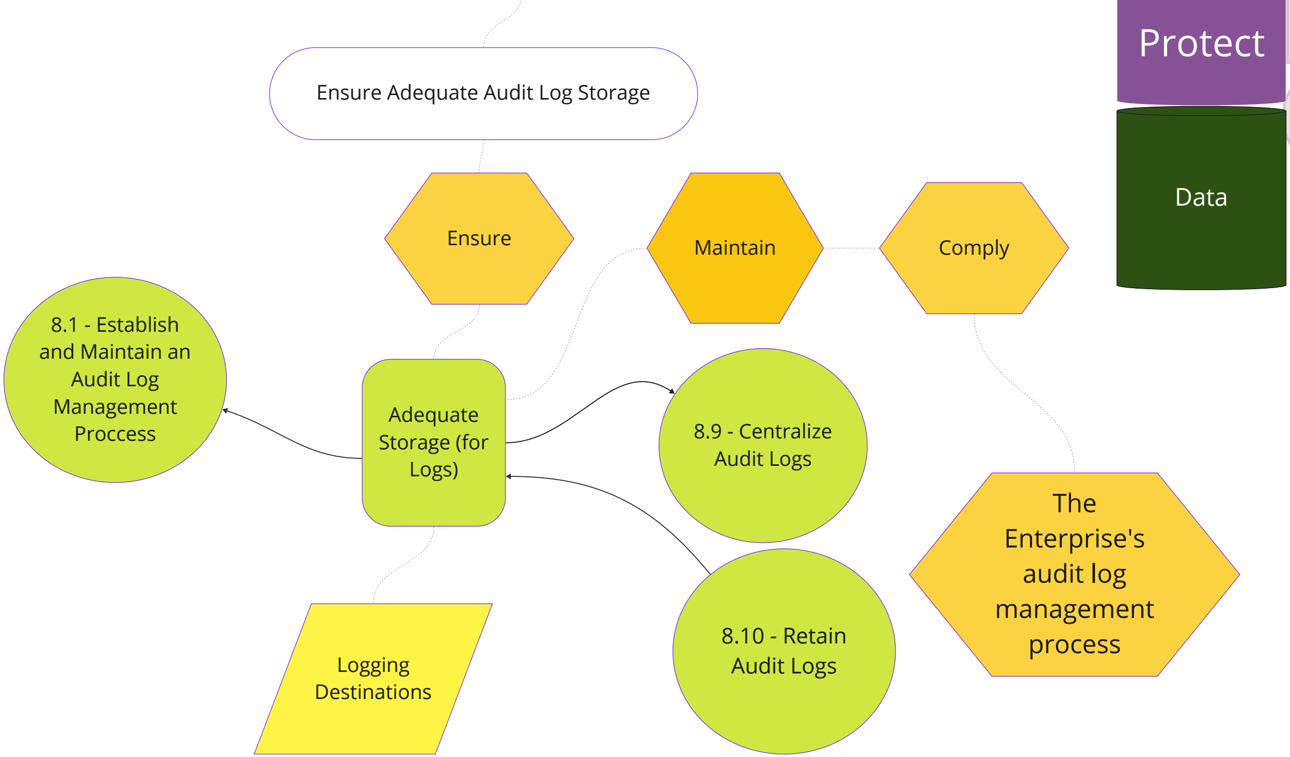
Protect

Data

Log Management

Log Management Tool

Potentially OS Dependent



Ensure Adequate Audit Log Storage

Ensure

Maintain

Comply

8.1 - Establish and Maintain an Audit Log Management Proccess

Adequate Storage (for Logs)

8.9 - Centralize Audit Logs

8.10 - Retain Audit Logs

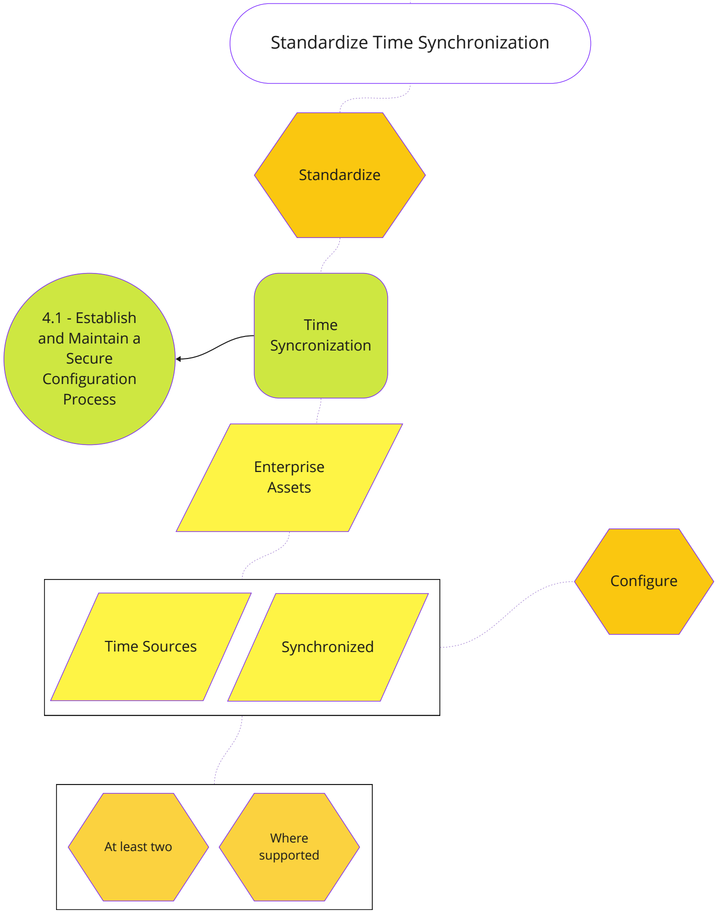
The Enterprise's audit log management process

Logging Destinations

Group Validated

8.4

Standardize time synchronization. Configure at least two synchronized time sources across enterprise assets, where supported.



IG2

Secure Configurations

Protect

Secure Configuration Policy/Process

Data

Potentially OS Dependent

Group Validated

8.5

Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.

IG2

Log Management

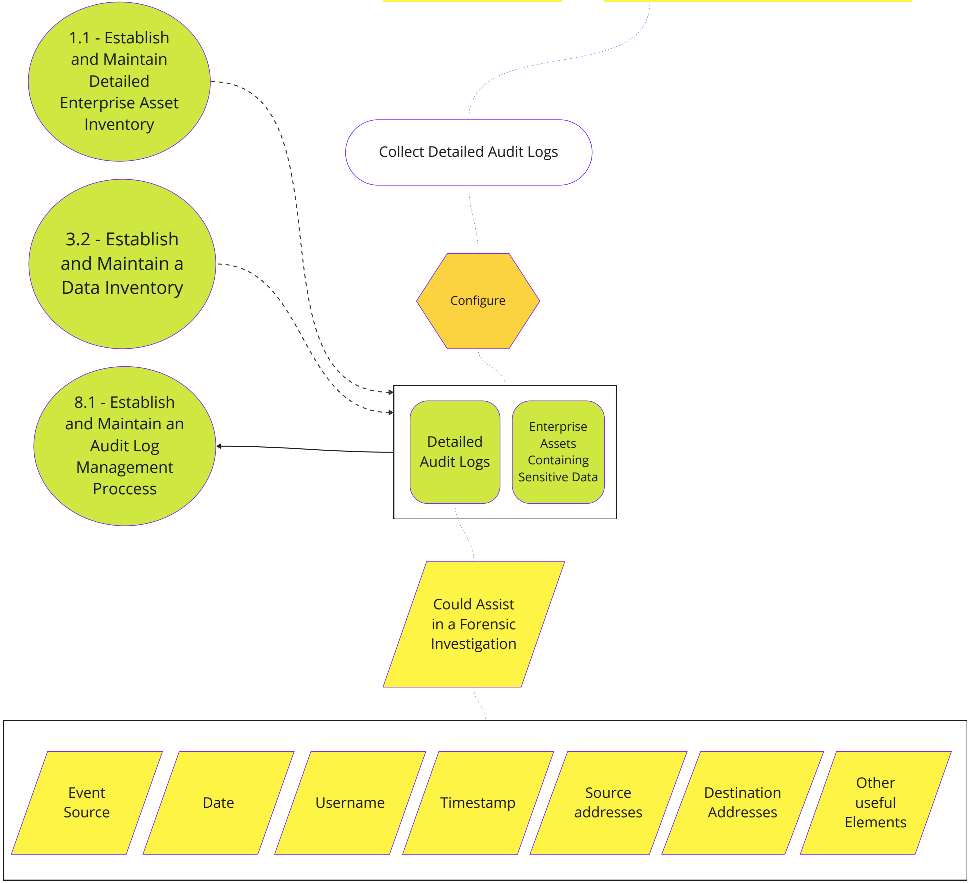
Detect

Log Management Policy/Process

Data

Log Management Tool

Potentially OS Dependent



1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

3.2 - Establish and Maintain a Data Inventory

8.1 - Establish and Maintain an Audit Log Management Proccess

Collect Detailed Audit Logs

Configure

Detailed Audit Logs

Enterprise Assets Containing Sensitive Data

Could Assist in a Forensic Investigation

Event Source

Date

Username

Timestamp

Source addresses

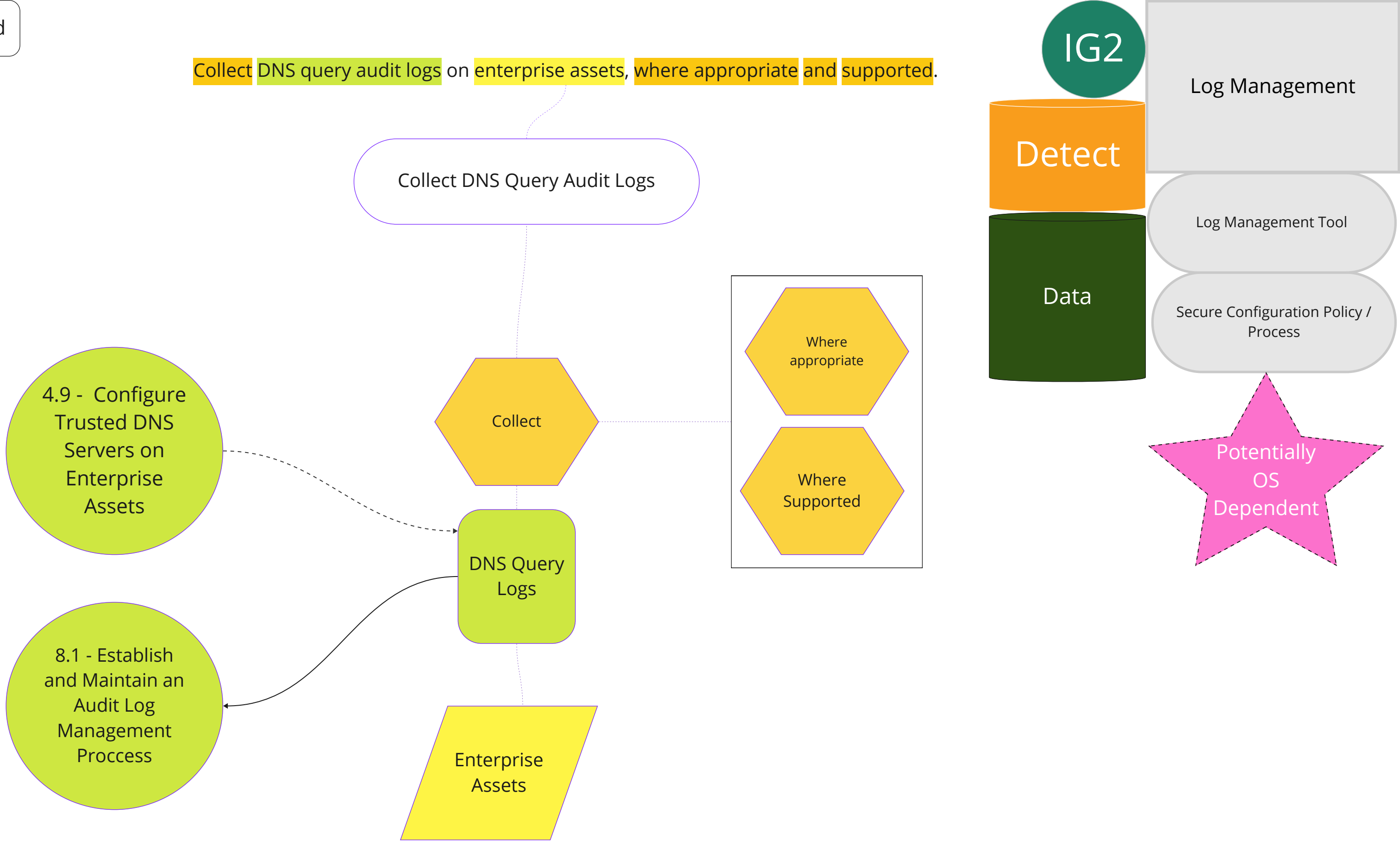
Destination Addresses

Other useful Elements

Group Validated

8.6

Collect DNS query audit logs on enterprise assets, where appropriate and supported.



IG2

Log Management

Detect

Data

Log Management Tool

Secure Configuration Policy / Process

Potentially OS Dependent

Collect DNS Query Audit Logs

Collect

Where appropriate

Where Supported

4.9 - Configure Trusted DNS Servers on Enterprise Assets

DNS Query Logs

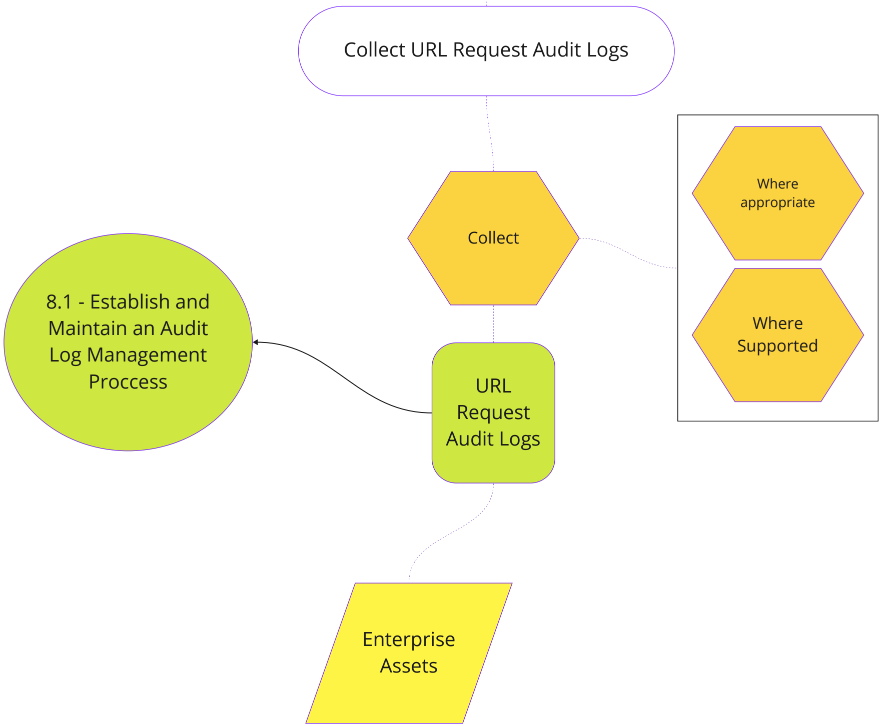
8.1 - Establish and Maintain an Audit Log Management Proccess

Enterprise Assets

Group Validated

8.7

Collect URL request audit logs on enterprise assets, where appropriate and supported.



Collect URL Request Audit Logs

Collect

Where appropriate

Where Supported

8.1 - Establish and Maintain an Audit Log Management Proccess

URL Request Audit Logs

Enterprise Assets

IG2

Log Management

Detect

Data

Log Management Tool

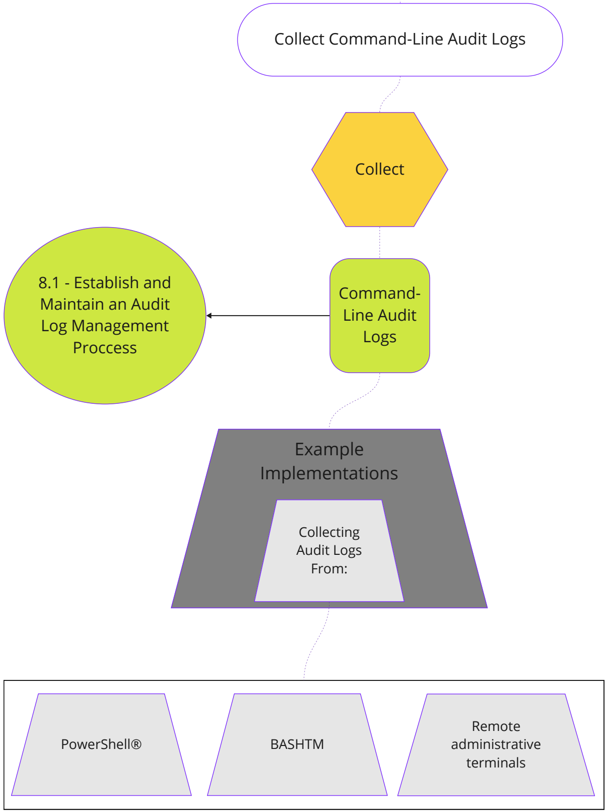
Secure Configuration Policy / Process

Potentially OS Dependent

Group Validated

8.8

Collect command-line audit logs. Example implementations include collecting audit logs from PowerShell®, BASHTM, and remote administrative terminals.



Collect Command-Line Audit Logs

Collect

Command-Line Audit Logs

8.1 - Establish and Maintain an Audit Log Management Proccess

Example Implementations

Collecting Audit Logs From:

PowerShell®

BASHTM

Remote administrative terminals

IG2

Detect

Data

Log Management

Log Management Tool

Secure Configuration Policy / Process

OS Dependent

Group Validated

8.9

IG2

Log Management

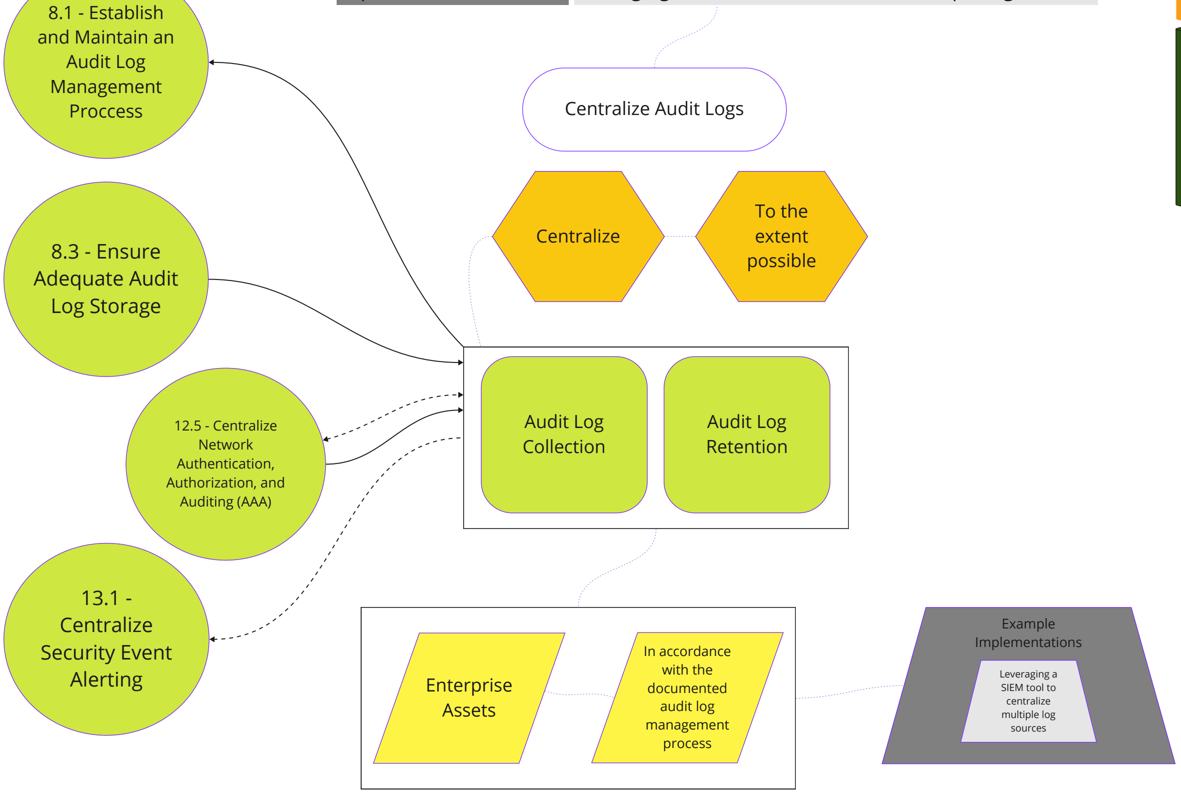
Detect

Data

Log Analytics and Centralization Tool

OS Dependent

Centralize, to the extent possible, audit log collection and retention across enterprise assets in accordance with the documented audit log management process. Example implementations include leveraging a SIEM tool to centralize multiple log sources.



Centralize Audit Logs

Centralize

To the extent possible

Audit Log Collection

Audit Log Retention

8.1 - Establish and Maintain an Audit Log Management Proccess

8.3 - Ensure Adequate Audit Log Storage

12.5 - Centralize Network Authentication, Authorization, and Auditing (AAA)

13.1 - Centralize Security Event Alerting

Enterprise Assets

In accordance with the documented audit log management process

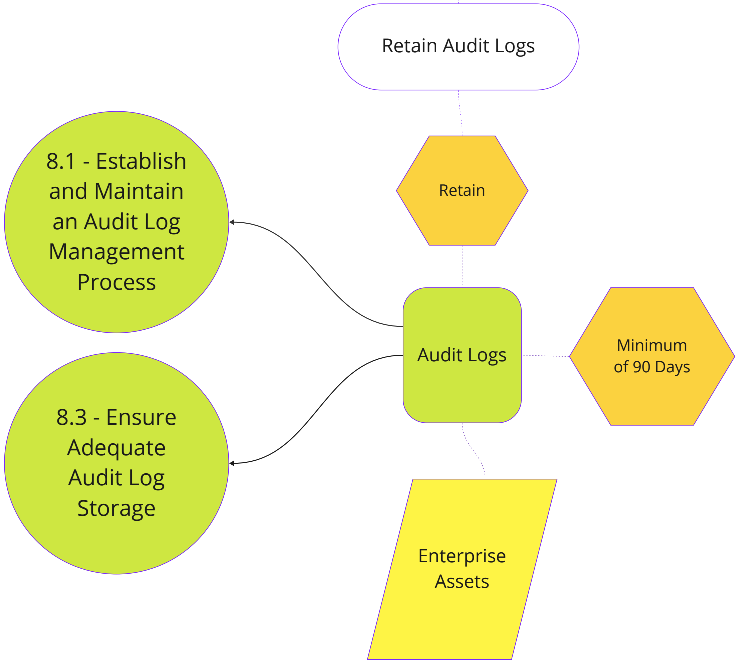
Example Implementations

Leveraging a SIEM tool to centralize multiple log sources

Group Validated

8.10

Retain audit logs across enterprise assets for a minimum of 90 days



Retain Audit Logs

Retain

Audit Logs

Minimum of 90 Days

Enterprise Assets

8.1 - Establish and Maintain an Audit Log Management Process

8.3 - Ensure Adequate Audit Log Storage

IG2

Protect

Data

Log Management

Log Analytics and Centralization Tool

Group Validated

8.11

Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.

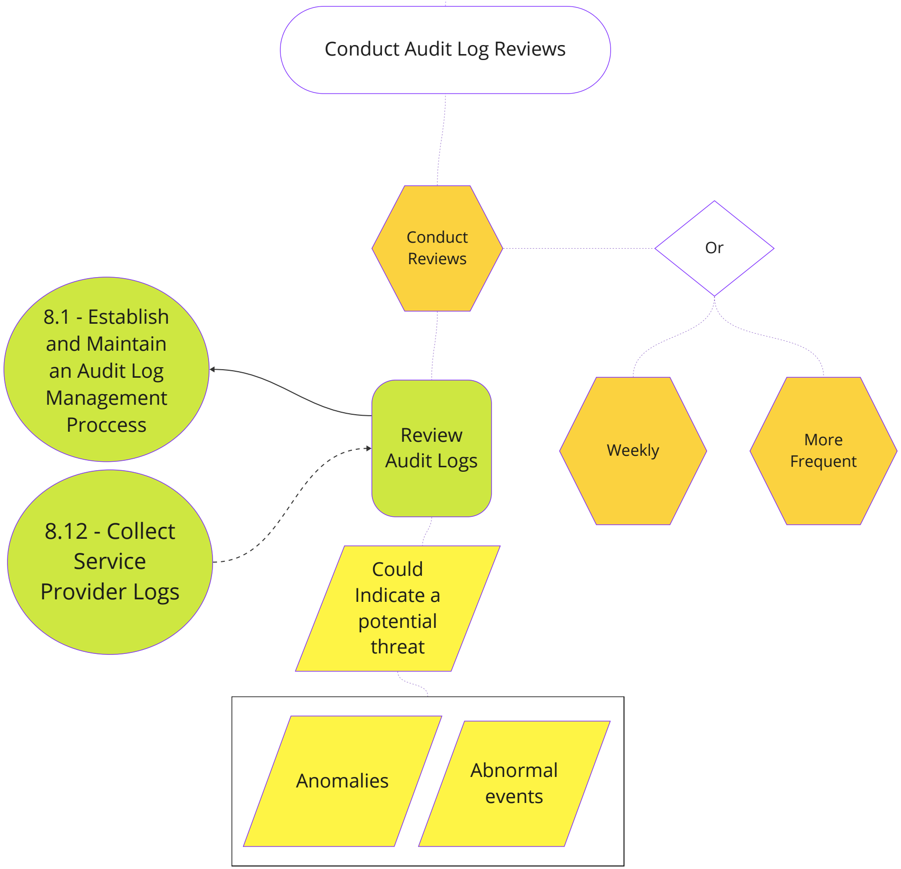
IG2

Log Management

Detect

Log Analytics and Centralization Tool

Data



Conduct Audit Log Reviews

Conduct Reviews

Or

Weekly

More Frequent

8.1 - Establish and Maintain an Audit Log Management Proccess

8.12 - Collect Service Provider Logs

Review Audit Logs

Could Indicate a potential threat

Anomalies

Abnormal events

Group Validated

8.12

Collect service provider logs, where supported. Example implementations include collecting authentication and authorization events, data creation and disposal events, and user management events.

IG3

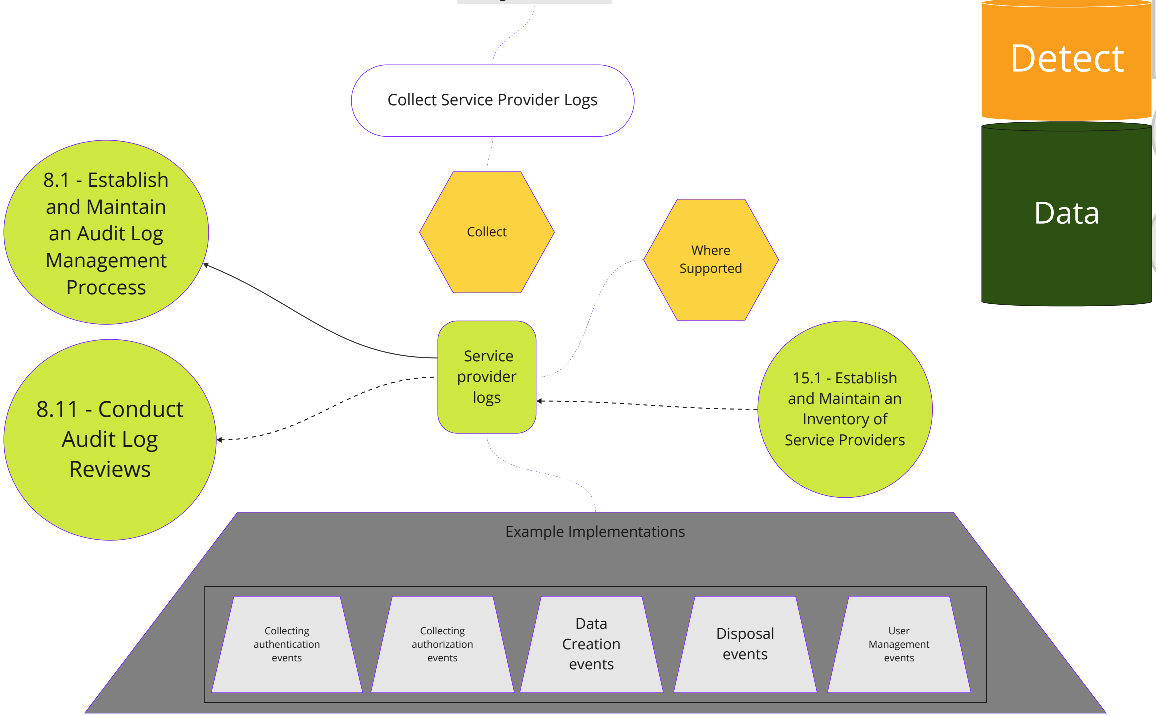
Detect

Data

Log Management

Log Analytics and Centralization Tool

Secure Configuration Policy / Process



Collect Service Provider Logs

Collect

Where Supported

Service provider logs

8.1 - Establish and Maintain an Audit Log Management Proccess

8.11 - Conduct Audit Log Reviews

15.1 - Establish and Maintain an Inventory of Service Providers

Example Implementations

Collecting authentication events

Collecting authorization events

Data Creation events

Disposal events

User Management events

CONTROL 9

Email and Web Browser Protections

Safeguards: 7	IG1: 2/7	IG2: 6/7	IG3: 7/7

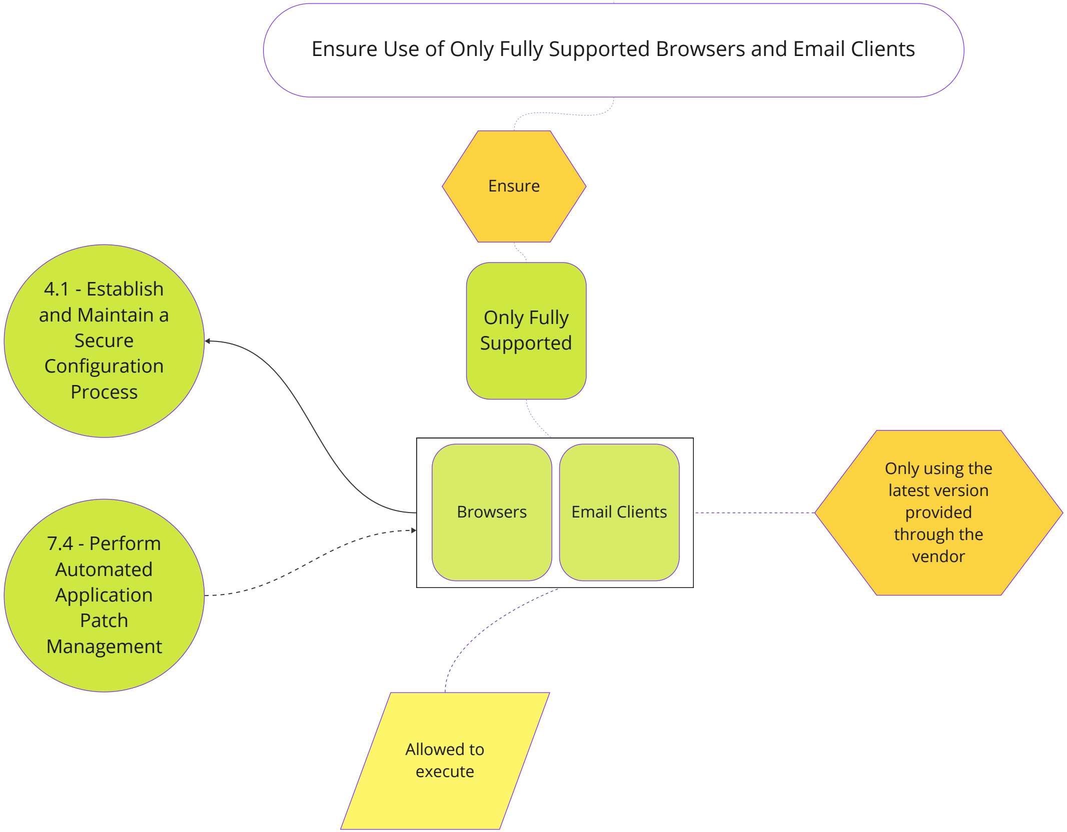
Overview

Improve protections and detections of threats from email and web vectors, as these are opportunities for attackers to manipulate human behavior through direct engagement.

Group Validated

9.1

Ensure only fully supported browsers and email clients are allowed to execute in the enterprise, only using the latest version of browsers and email clients provided through the vendor.



Ensure Use of Only Fully Supported Browsers and Email Clients

Ensure

Only Fully Supported

Browsers

Email Clients

Only using the latest version provided through the vendor

Allowed to execute

4.1 - Establish and Maintain a Secure Configuration Process

7.4 - Perform Automated Application Patch Management

IG1

Protect

Software

Asset Management

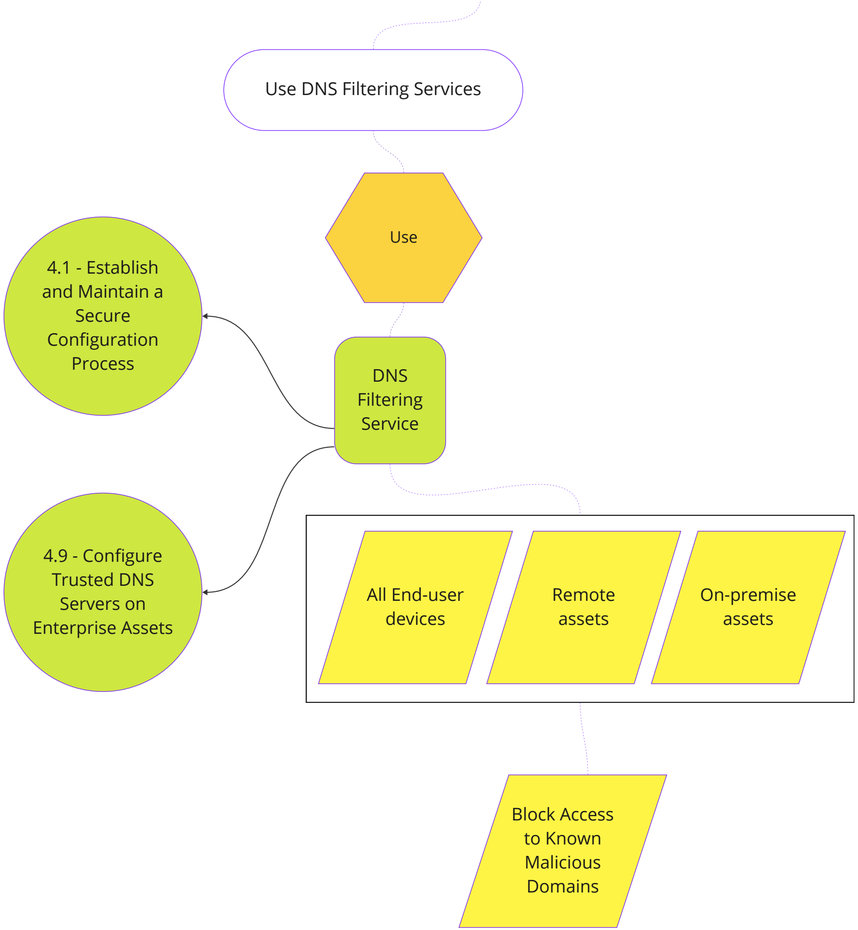
Enterprise and Software Asset Management Tool

Potentially OS Dependent

Group Validated

9.2

Use DNS filtering services on all end -user devices, including remote and on-premise assets, to block access to known malicious domains.



Use DNS Filtering Services

Use

DNS Filtering Service

4.1 - Establish and Maintain a Secure Configuration Process

4.9 - Configure Trusted DNS Servers on Enterprise Assets

All End-user devices

Remote assets

On-premise assets

Block Access to Known Malicious Domains

IG1

Malware Defense

Protect

DNS Service/Server

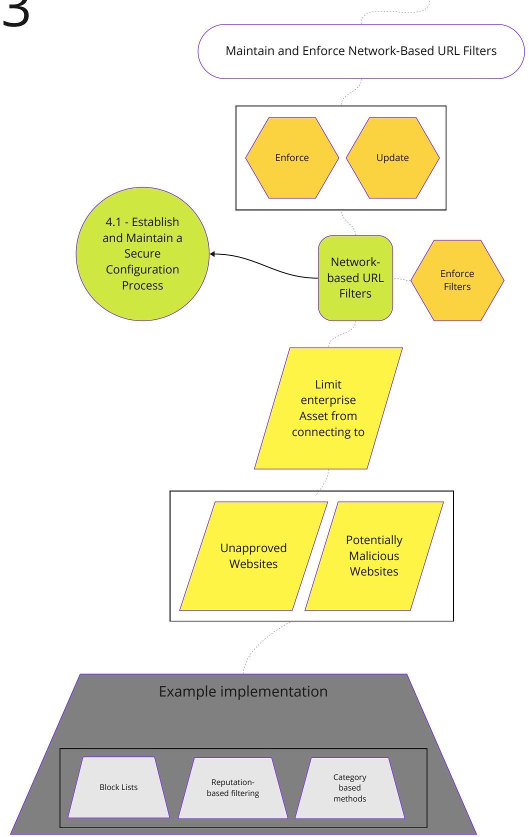
Devices

Potentially OS Dependent

Group Validated

9.3

Enforce and update network-based URL filters to limit an enterprise asset from connecting to potentially malicious or unapproved websites. Example implementations include category-based filtering, reputation-based filtering, or through the use of block lists. Enforce filters for all enterprise assets.



Maintain and Enforce Network-Based URL Filters

Enforce

Update

4.1 - Establish and Maintain a Secure Configuration Process

Network-based URL Filters

Enforce Filters

Limit enterprise Asset from connecting to

Unapproved Websites

Potentially Malicious Websites

Example implementation

Block Lists

Reputation-based filtering

Category based methods

IG2

Malware Defense

Protect

URL Filtering Tool

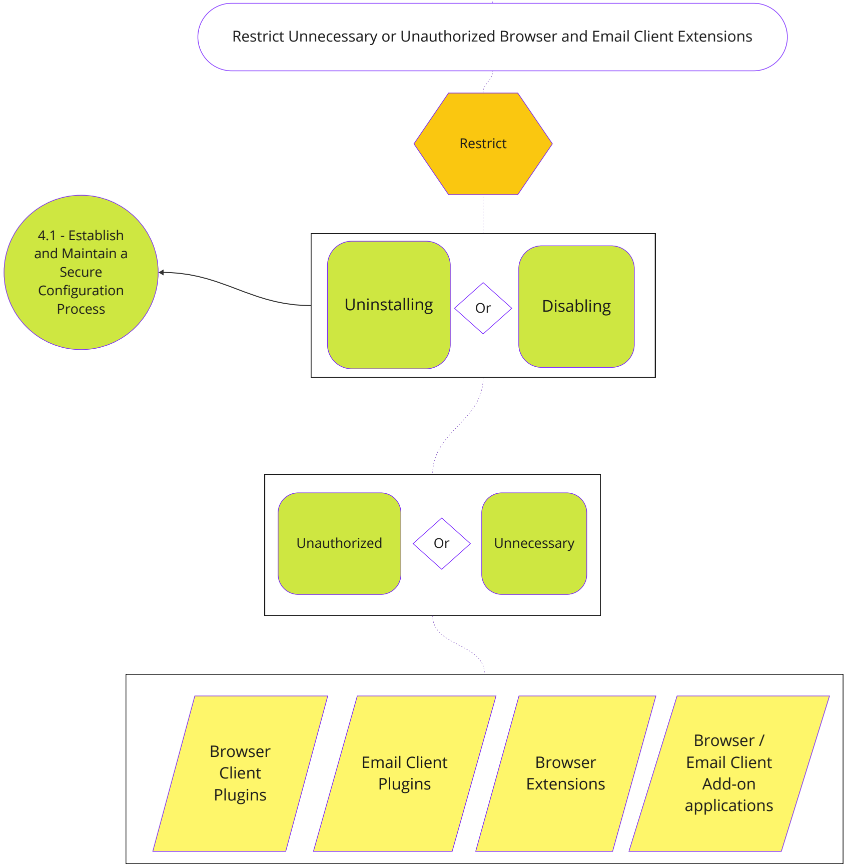
Network

Potentially OS Dependent

Group Validated

9.4

Restrict, either through uninstalling or disabling, any unauthorized or unnecessary browser or email client plugins, extensions, and add-on applications.



Restrict Unnecessary or Unauthorized Browser and Email Client Extensions

Restrict

4.1 - Establish and Maintain a Secure Configuration Process

Uninstalling

Or

Disabling

Unauthorized

Or

Unnecessary

Browser Client Plugins

Email Client Plugins

Browser Extensions

Browser / Email Client Add-on applications

IG2

Secure Configurations

Protect

Software

Configuration Management Tool

Potentially OS Dependent

Group Validated

9.5

To lower the chance of spoofed or modified emails from valid domains, implement DMARC policy and verification, starting with implementing the Sender Policy Framework (SPF) and the DomainKeys Identified Mail (DKIM) standards.

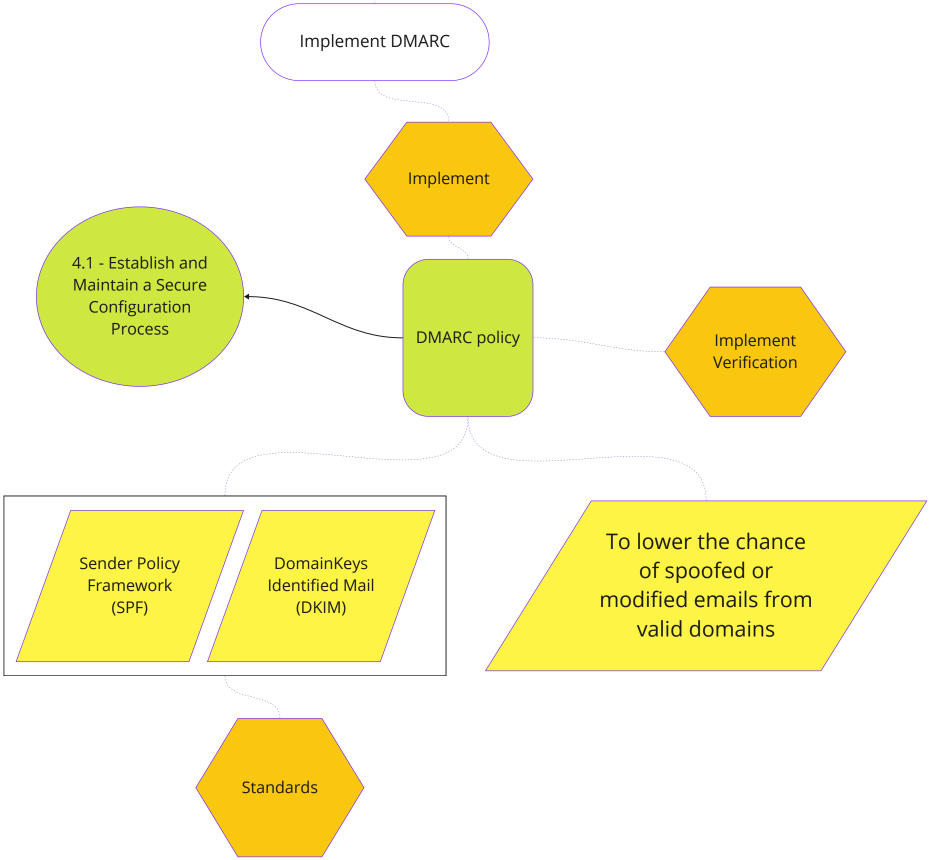
IG2

Protect

Network

Malware Defense

DMARC Management Tool



Implement DMARC

Implement

DMARC policy

4.1 - Establish and Maintain a Secure Configuration Process

Implement Verification

Sender Policy Framework (SPF)

DomainKeys Identified Mail (DKIM)

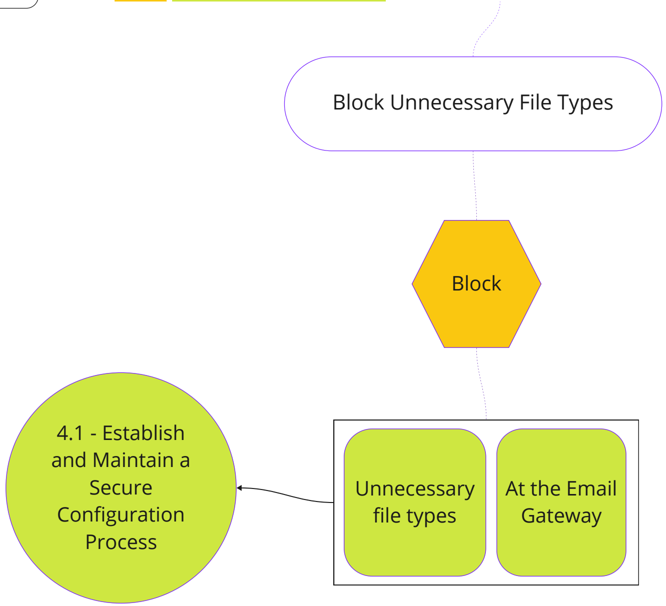
To lower the chance of spoofed or modified emails from valid domains

Standards

Group Validated

9.6

Block unnecessary file types attempting to enter the enterprise’s email gateway.



Block Unnecessary File Types

Block

Unnecessary file types

At the Email Gateway

4.1 - Establish and Maintain a Secure Configuration Process

IG2

Malware Defense

Protect

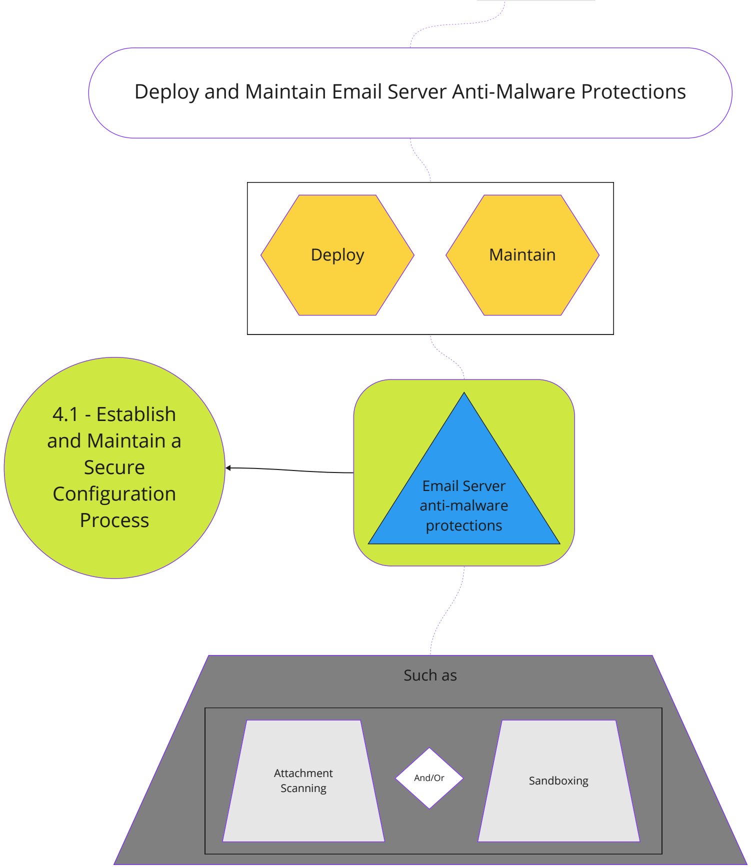
Network

Email Security Tool

Group Validated

9.7

Deploy and maintain email server anti-malware protections, such as attachment scanning and/or sandboxing.



Deploy and Maintain Email Server Anti-Malware Protections

Deploy

Maintain

4.1 - Establish and Maintain a Secure Configuration Process

Email Server anti-malware protections

Such as

Attachment Scanning

And/Or

Sandboxing

IG1

Malware Defense

Protect

Network

Email Security Tool

CONTROL 10

Malware Defenses

Safeguards: 7	IG1: 3/7	IG2: 7/7	IG3: 7/7

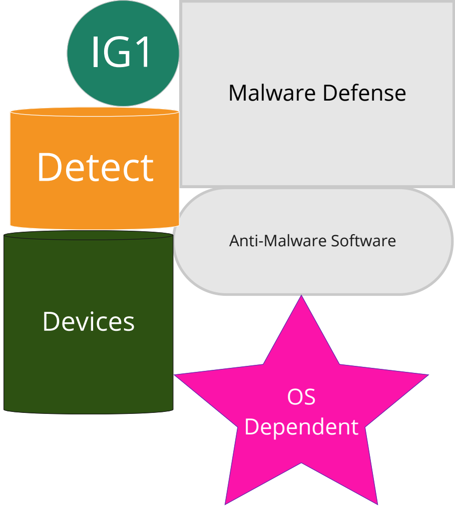
Overview

Prevent or control the installation, spread, and execution of malicious applications, code, or scripts on enterprise assets.

Group Validated

10.1

Deploy and maintain anti-malware software on all enterprise assets.



IG1

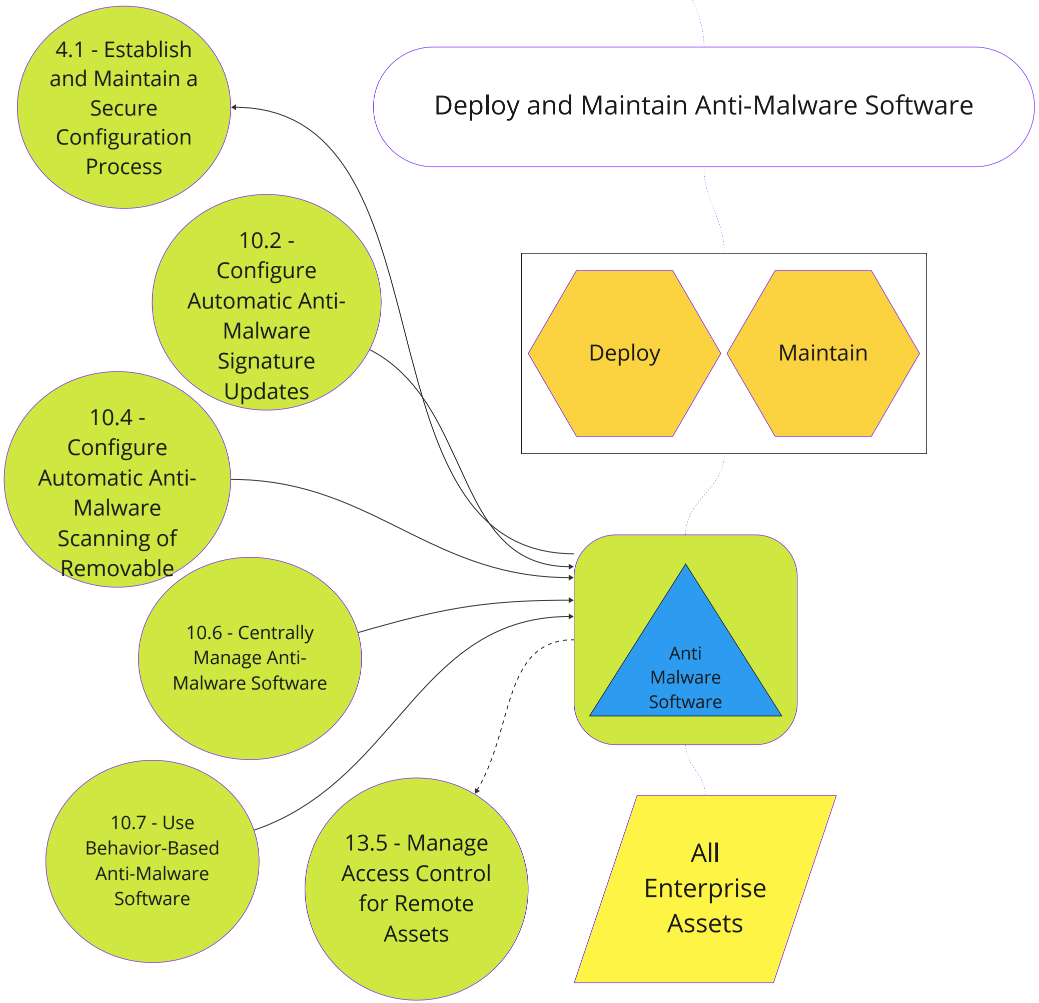
Malware Defense

Detect

Devices

Anti-Malware Software

OS Dependent



Deploy and Maintain Anti-Malware Software

Deploy

Maintain

Anti Malware Software

All Enterprise Assets

4.1 - Establish and Maintain a Secure Configuration Process

10.2 - Configure Automatic Anti-Malware Signature Updates

10.4 - Configure Automatic Anti-Malware Scanning of Removable

10.6 - Centrally Manage Anti-Malware Software

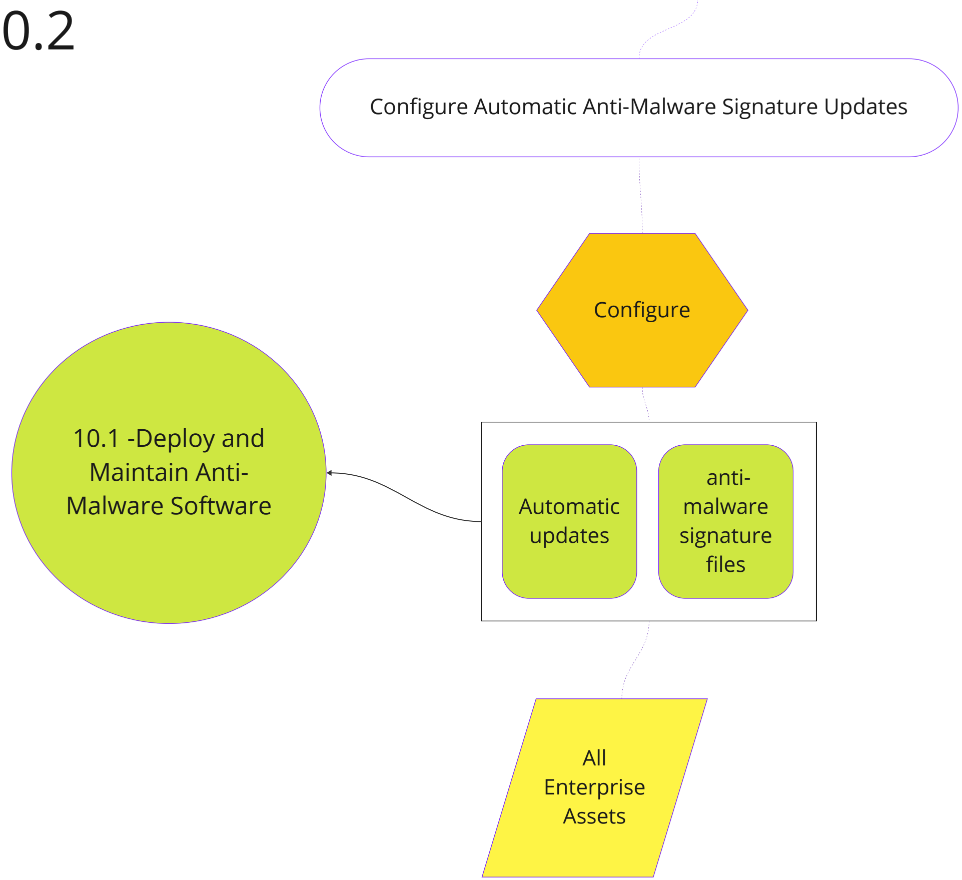
10.7 - Use Behavior-Based Anti-Malware Software

13.5 - Manage Access Control for Remote Assets

Group Validated

10.2

Configure automatic updates for anti-malware signature files on all enterprise assets.



Configure Automatic Anti-Malware Signature Updates

Configure

Automatic updates

anti-malware signature files

10.1 -Deploy and Maintain Anti-Malware Software

All Enterprise Assets

IG1

Malware Defense

Protect

Anti-Malware Software

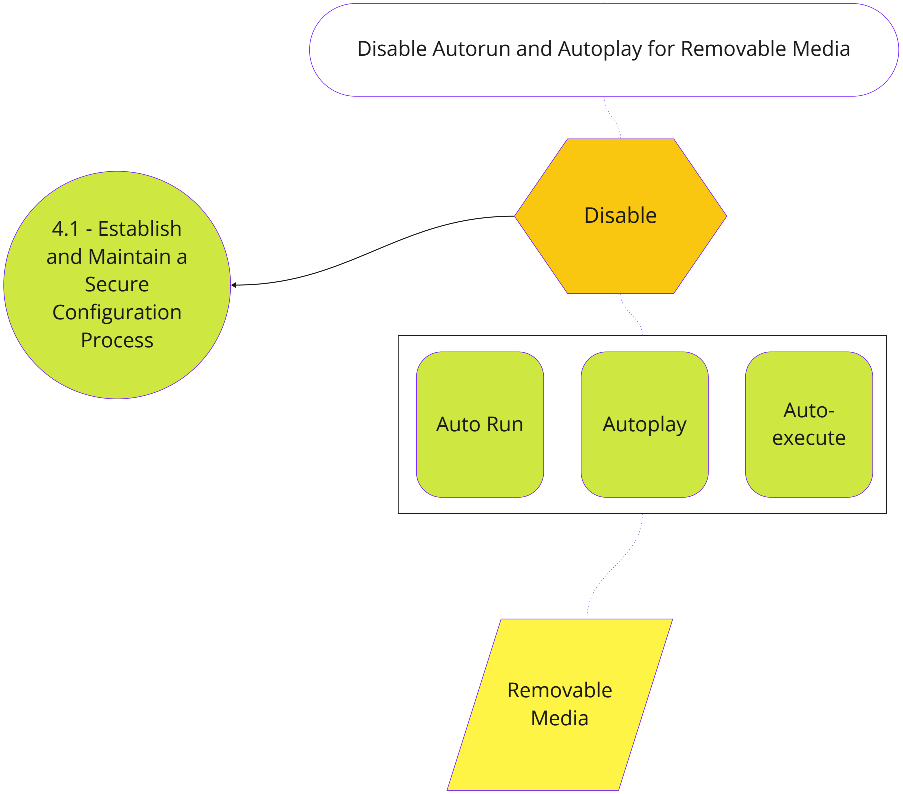
Devices

OS Dependent

Group Validated

10.3

Disable autorun and autoplay auto-execute functionality for removable media.



Disable Autorun and Autoplay for Removable Media

Disable

4.1 - Establish and Maintain a Secure Configuration Process

Auto Run

Autoplay

Auto-execute

Removable Media

IG1

Secure Configurations

Protect

Configuration Management Tool

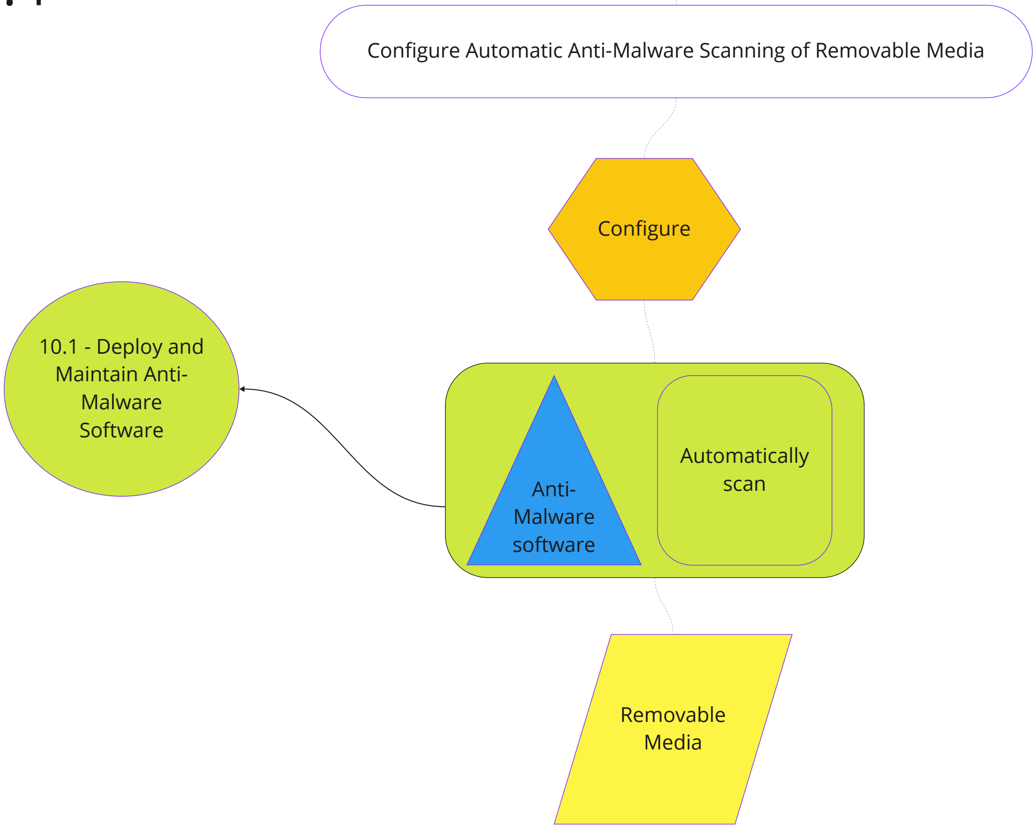
Devices

OS Dependent

Group Validated

10.4

Configure anti-malware software to automatically scan removable media.



Configure Automatic Anti-Malware Scanning of Removable Media

Configure

10.1 - Deploy and Maintain Anti-Malware Software

Anti-Malware software

Automatically scan

Removable Media

IG2

Malware Defense

Detect

Devices

Anti-Malware Software Configuration Policy / Process

Anti-Malware Software

OS Dependent

Group Validated

10.5

Enable anti-exploitation features on enterprise assets and software, where possible, such as Microsoft® Data Execution Prevention (DEP), Windows® Defender Exploit Guard (WDEG), or Apple® System Integrity Protection (SIP) and GatekeeperTM.

IG2

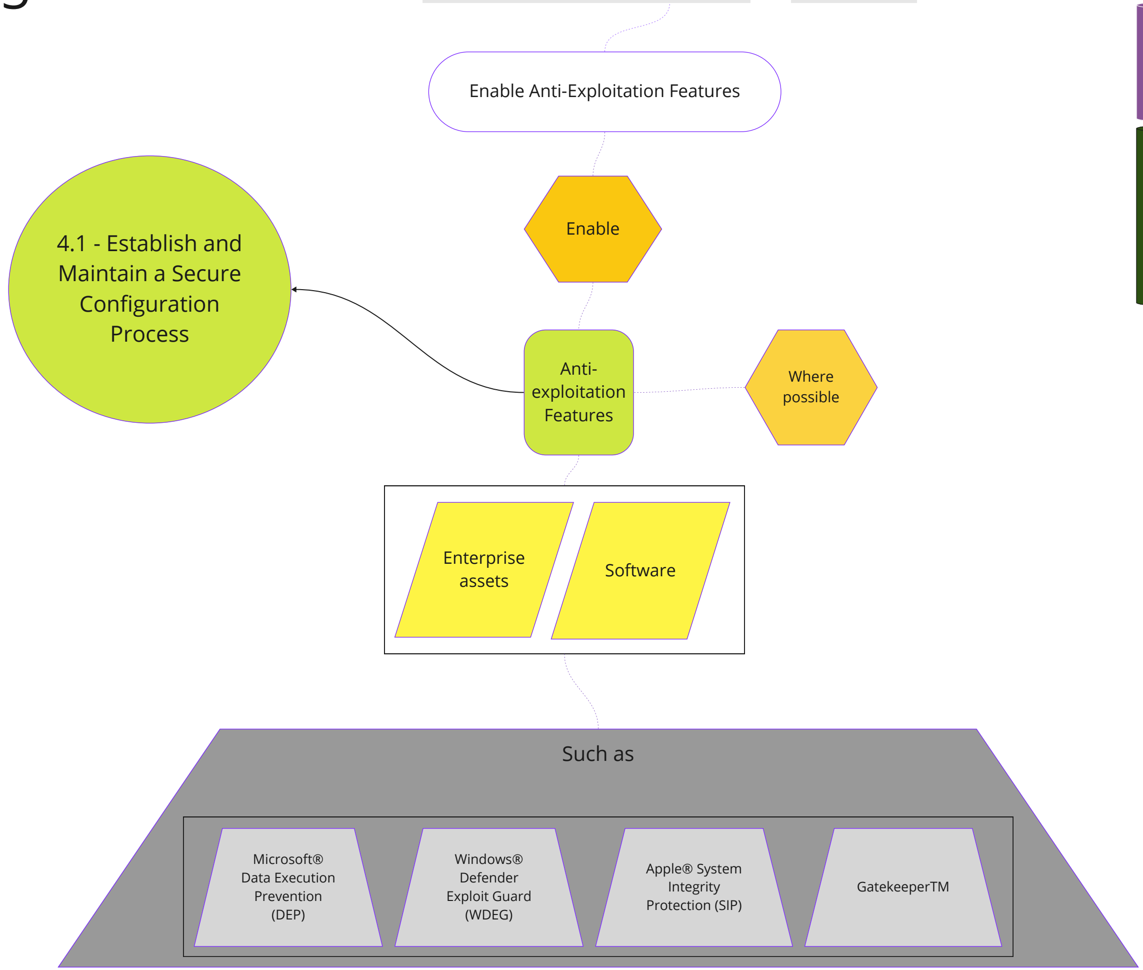
Secure Configurations

Protect

Devices

Configuration Management Tool

OS Dependent



Enable Anti-Exploitation Features

Enable

4.1 - Establish and Maintain a Secure Configuration Process

Anti-exploitation Features

Where possible

Enterprise assets

Software

Such as

Microsoft® Data Execution Prevention (DEP)

Windows® Defender Exploit Guard (WDEG)

Apple® System Integrity Protection (SIP)

GatekeeperTM

Group Validated

10.6

IG2

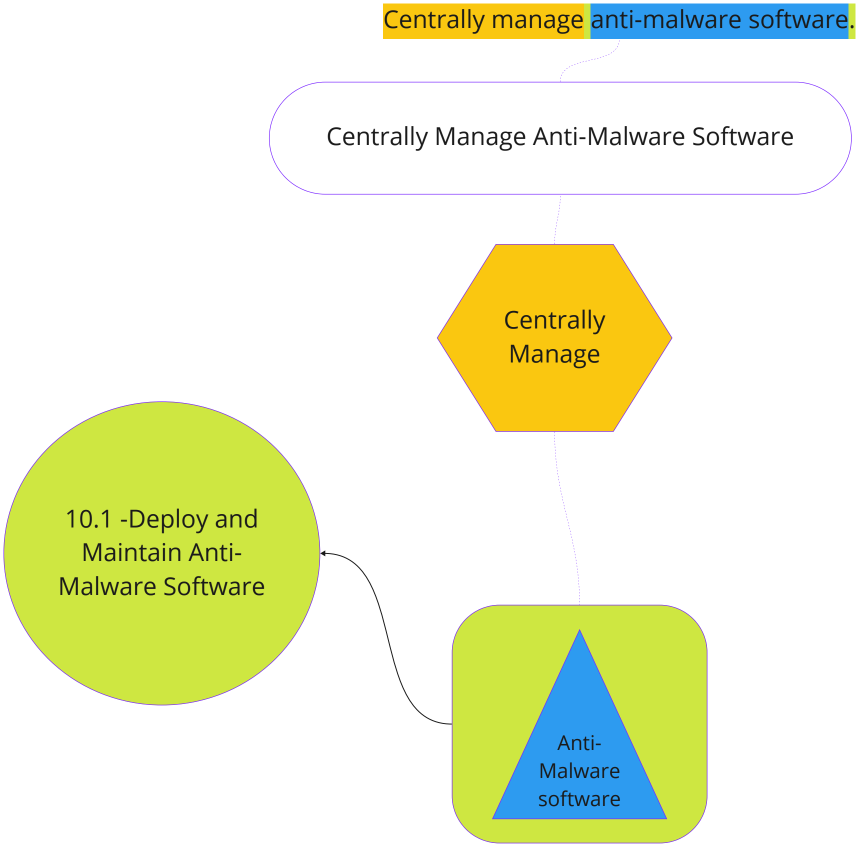
Malware Defense

Protect

Devices

Anti-Malware Software Configuration Policy / Process

Anti-Malware Software



Centrally manage anti-malware software.

Centrally Manage Anti-Malware Software

Centrally Manage

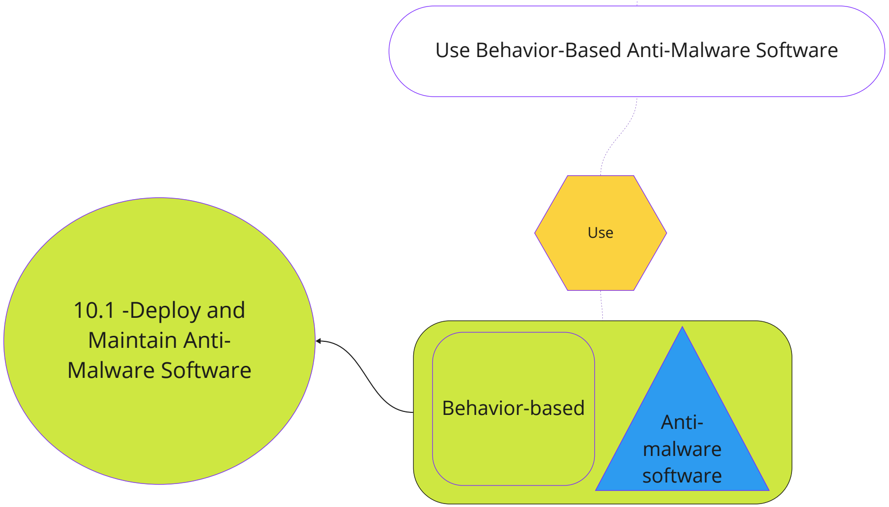
10.1 -Deploy and Maintain Anti-Malware Software

Anti-Malware software

Group Validated

10.7

Use behavior-based anti-malware software.



Use Behavior-Based Anti-Malware Software

Use

Behavior-based

Anti-malware software

10.1 -Deploy and Maintain Anti-Malware Software

IG2

Malware Defense

Detect

Devices

Anti-Malware Software Configuration Policy / Process

Anti-Malware Software

CONTROL 11

Data Recovery

Safeguards: 5	IG1: 4/5	IG2: 5/5	IG3: 5/5

Overview

Establish and maintain data recovery practices sufficient to restore in-scope enterprise assets to a pre-incident and trusted state.

Group Validated

11.1

Establish and maintain a documented data recovery process. In the process, address the scope of data recovery activities, recovery prioritization, and the security of backup data. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

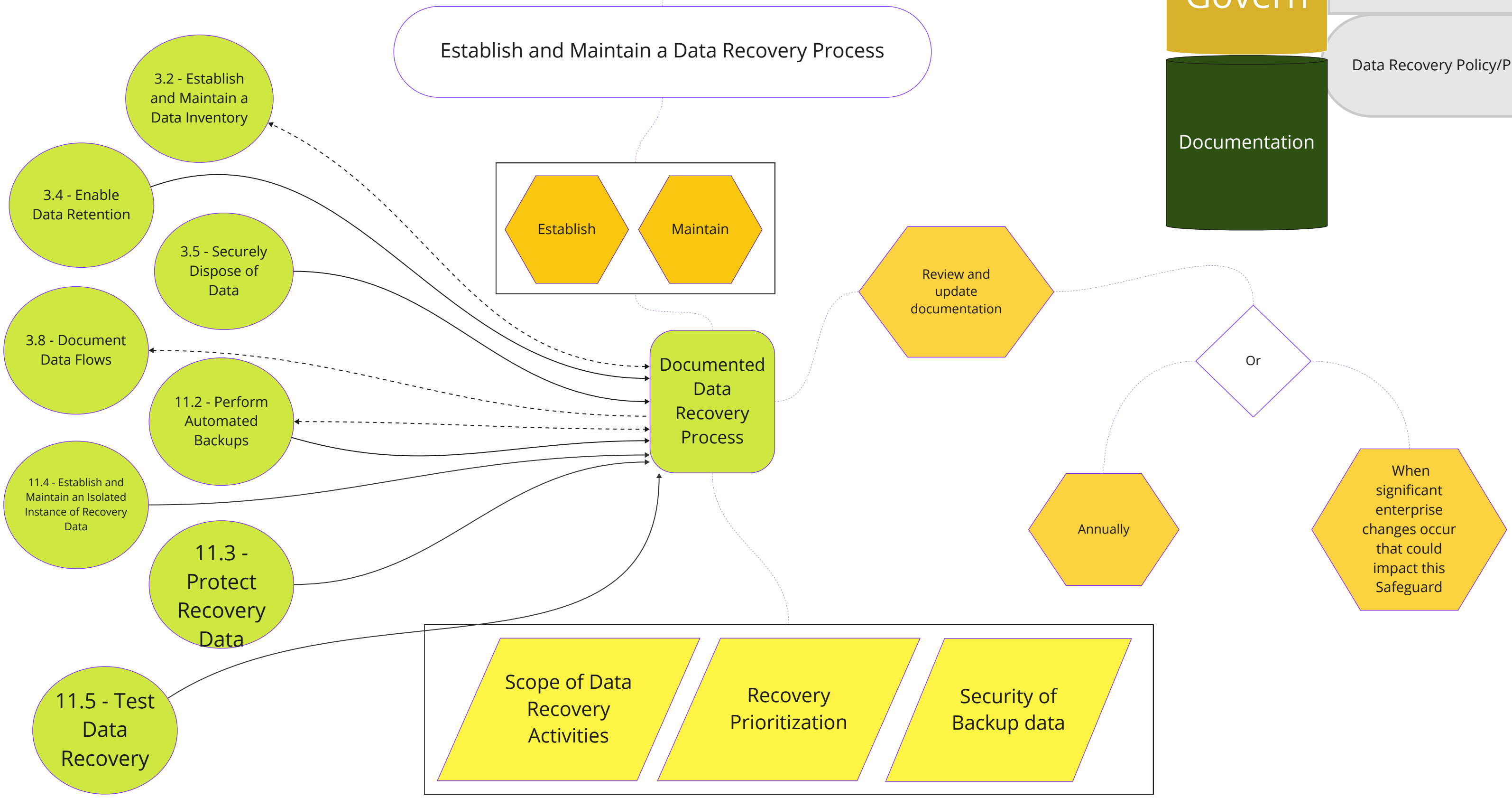
IG1

Data Recovery

Govern

Documentation

Data Recovery Policy/Process



Establish and Maintain a Data Recovery Process

Establish

Maintain

Documented Data Recovery Process

Review and update documentation

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

3.2 - Establish and Maintain a Data Inventory

3.4 - Enable Data Retention

3.5 - Securely Dispose of Data

3.8 - Document Data Flows

11.2 - Perform Automated Backups

11.4 - Establish and Maintain an Isolated Instance of Recovery Data

11.3 - Protect Recovery Data

11.5 - Test Data Recovery

Scope of Data Recovery Activities

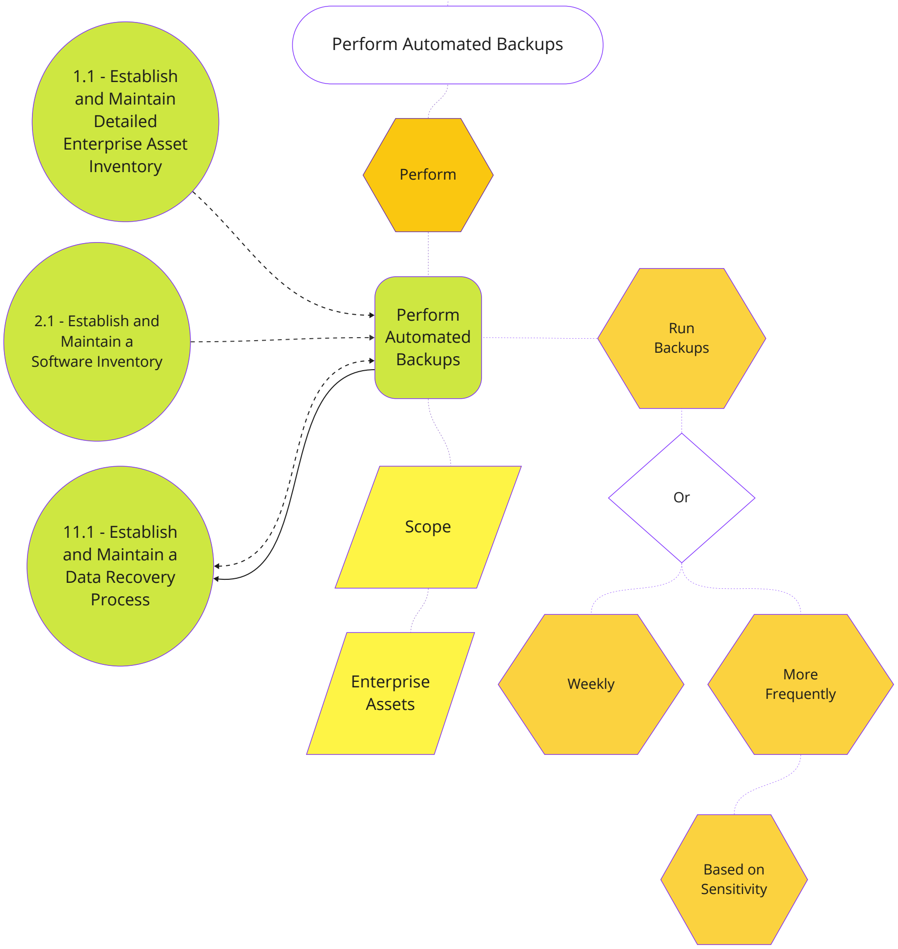
Recovery Prioritization

Security of Backup data

Group Validated

11.2

Perform automated backups of in-scope enterprise assets. Run backups weekly, or more frequently, based on the sensitivity of the data.



Perform Automated Backups

Perform

Perform Automated Backups

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

2.1 - Establish and Maintain a Software Inventory

11.1 - Establish and Maintain a Data Recovery Process

Scope

Enterprise Assets

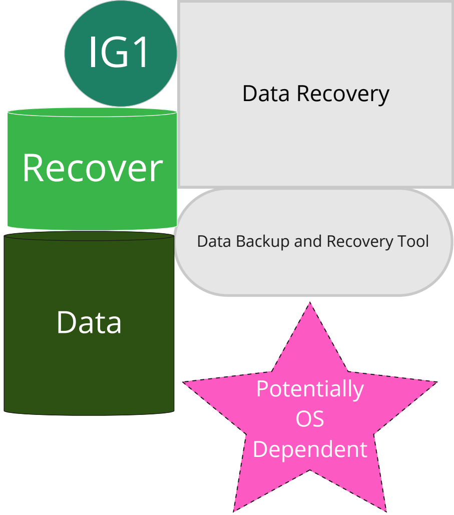
Run Backups

Or

Weekly

More Frequently

Based on Sensitivity



IG1

Recover

Data

Data Recovery

Data Backup and Recovery Tool

Potentially OS Dependent

Group Validated

11.3

Protect recovery data with equivalent controls to the original data. Reference encryption or data separation, based on requirements.

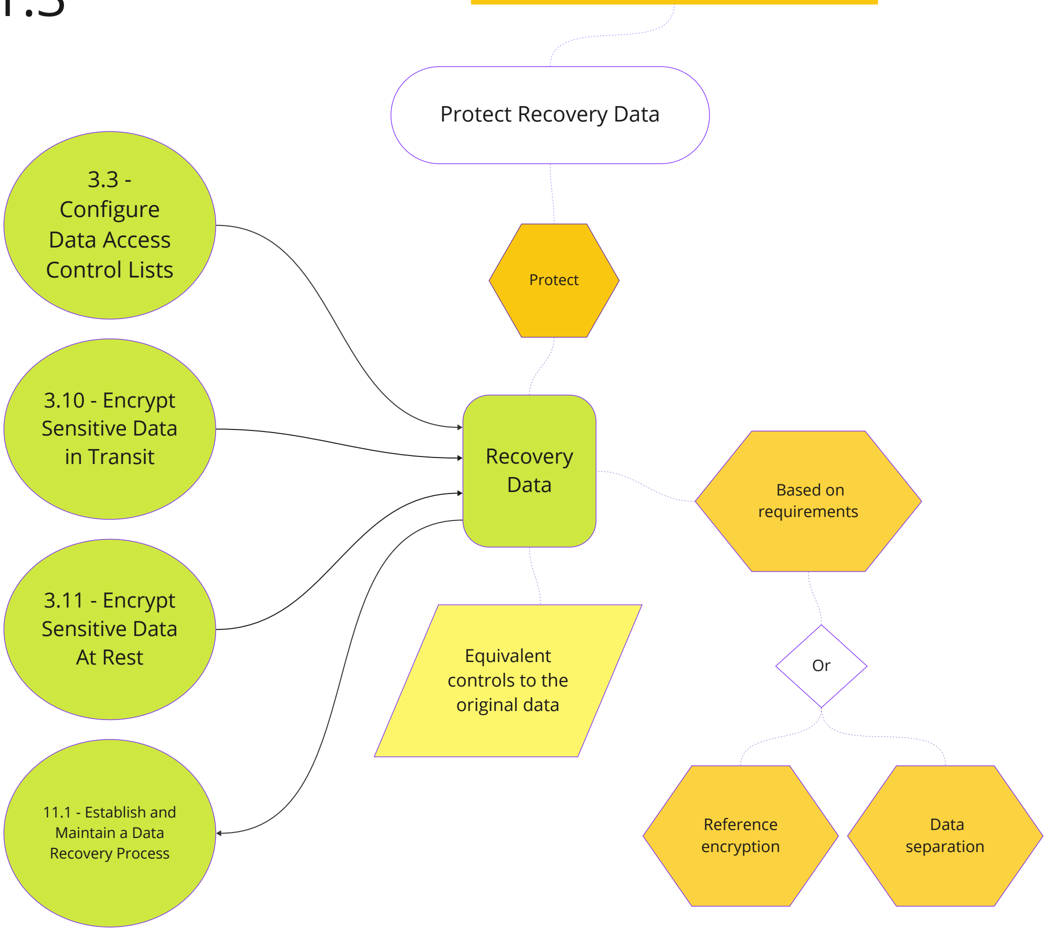
IG1

Data Recovery

Protect

Data

Data Backup and Recovery Tool



Protect Recovery Data

Protect

Recovery Data

3.3 - Configure Data Access Control Lists

3.10 - Encrypt Sensitive Data in Transit

3.11 - Encrypt Sensitive Data At Rest

11.1 - Establish and Maintain a Data Recovery Process

Equivalent controls to the original data

Based on requirements

Or

Reference encryption

Data separation

Group Validated

11.4

Establish and maintain an isolated instance of recovery data. Example implementations include version controlling backup destinations through offline, cloud, or off-site systems or services.

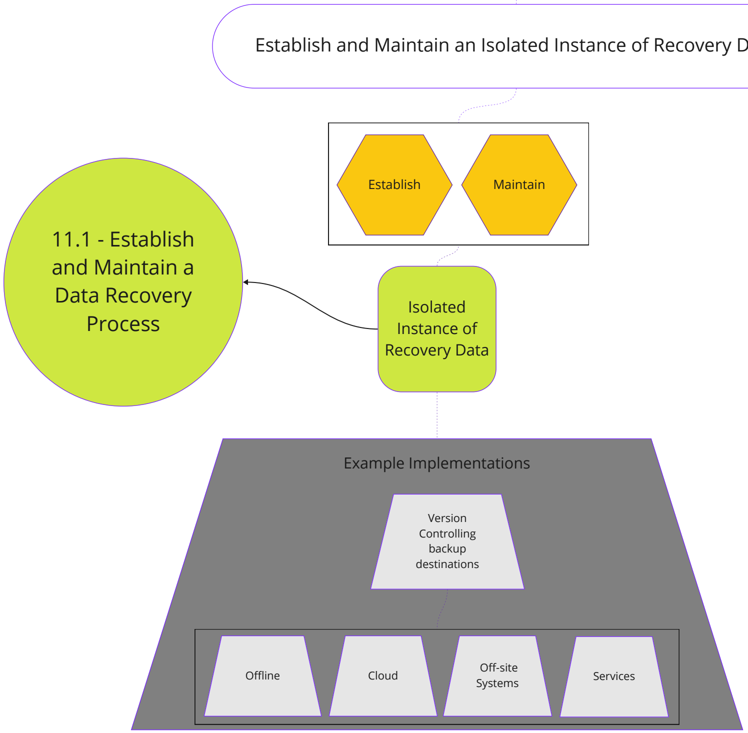
IG1

Recover

Data

Data Recovery

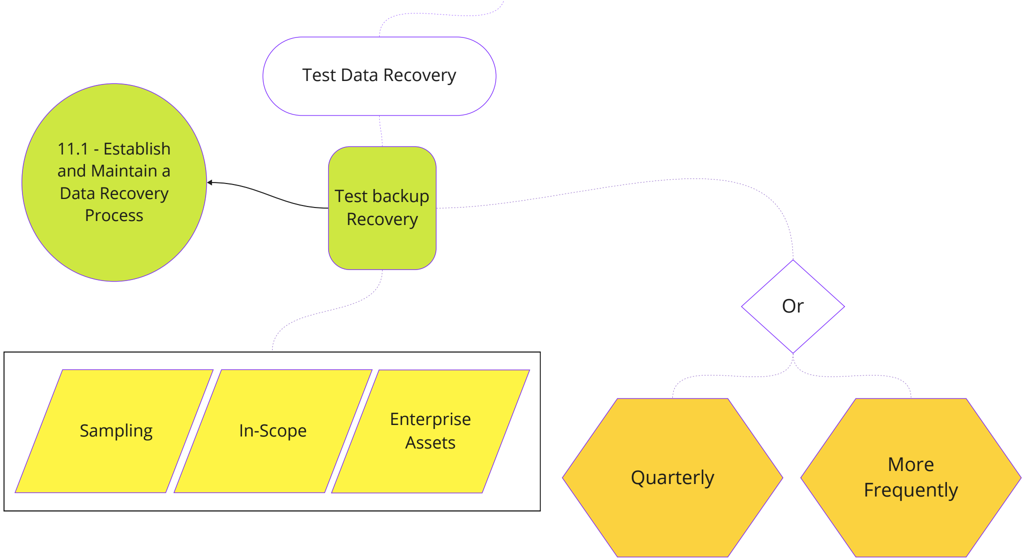
Data Backup and Recovery Tool


Establish and Maintain an Isolated Instance of Recovery Data
Establish
Maintain
Isolated Instance of Recovery Data
11.1 - Establish and Maintain a Data Recovery Process
Example Implementations
Version Controlling backup destinations
Offline
Cloud
Off-site Systems
Services

Group Validated

11.5

Test backup recovery quarterly, or more frequently, for a sampling of in-scope enterprise assets



Test Data Recovery

Test backup Recovery

11.1 - Establish and Maintain a Data Recovery Process

Or

Sampling

In-Scope

Enterprise Assets

Quarterly

More Frequently

IG2

Recover

Data

Data Recovery

Data Recovery Policy/Process

Data Backup and Recovery Tool

CONTROL 12

Network Infrastructure Management

Safeguards: 8	IG1: 1/8	IG2: 7/8	IG3: 8/8

Overview

Establish, implement, and actively manage (track, report, correct) network devices, in order to prevent attackers from exploiting vulnerable network services and access points.

Group Validated

12.1

Ensure network infrastructure is kept up-to-date. Example implementations include running the latest stable release of software and/or using currently supported network-as-a-service (NaaS) offerings. Review software versions monthly, or more frequently, to verify software support.

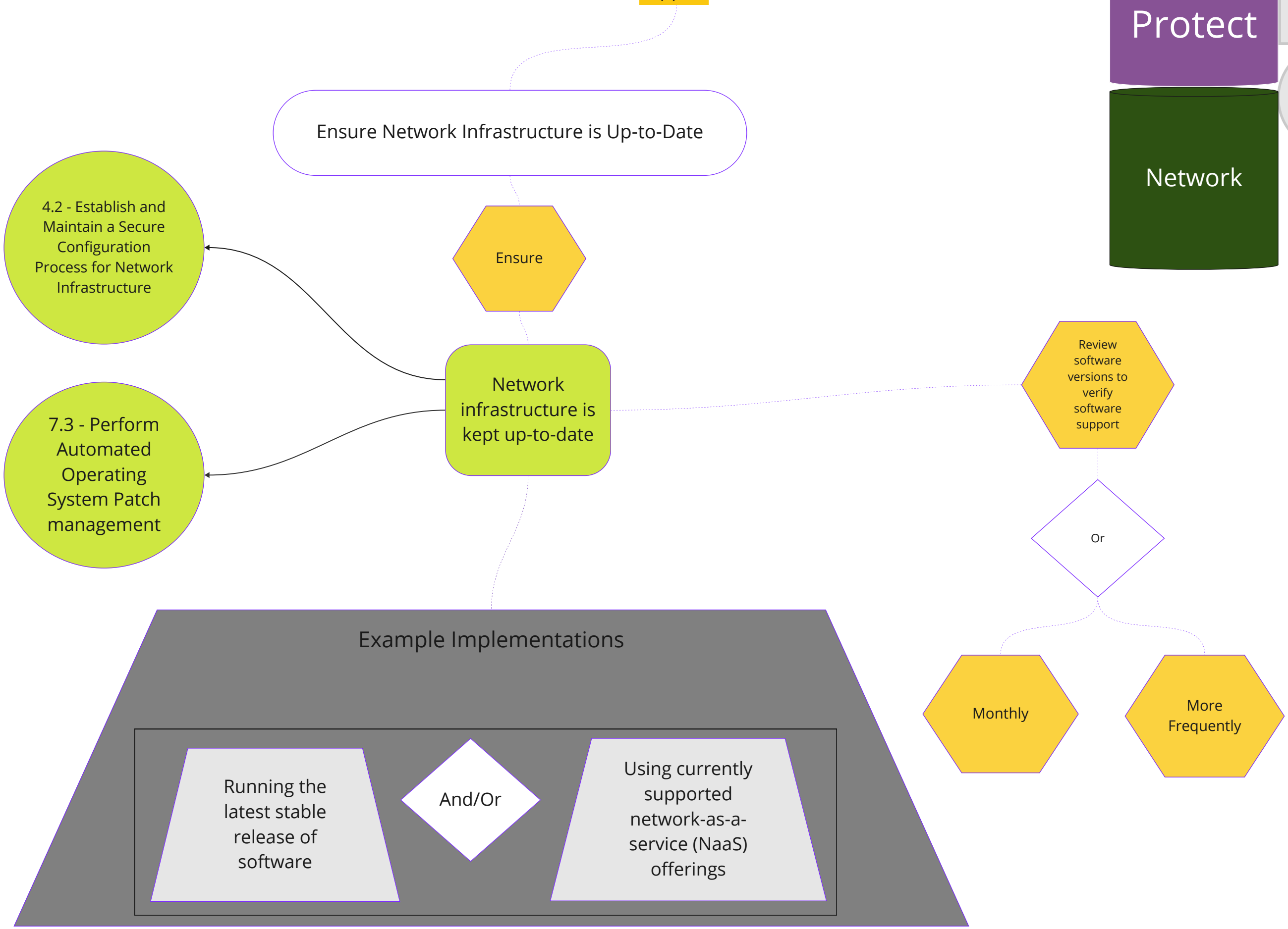
IG1

Protect

Network

Asset Management

Enterprise and Software Asset Management Tool



Ensure Network Infrastructure is Up-to-Date

Ensure

Network infrastructure is kept up-to-date

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

7.3 - Perform Automated Operating System Patch management

Review software versions to verify software support

Or

Monthly

More Frequently

Example Implementations

Running the latest stable release of software

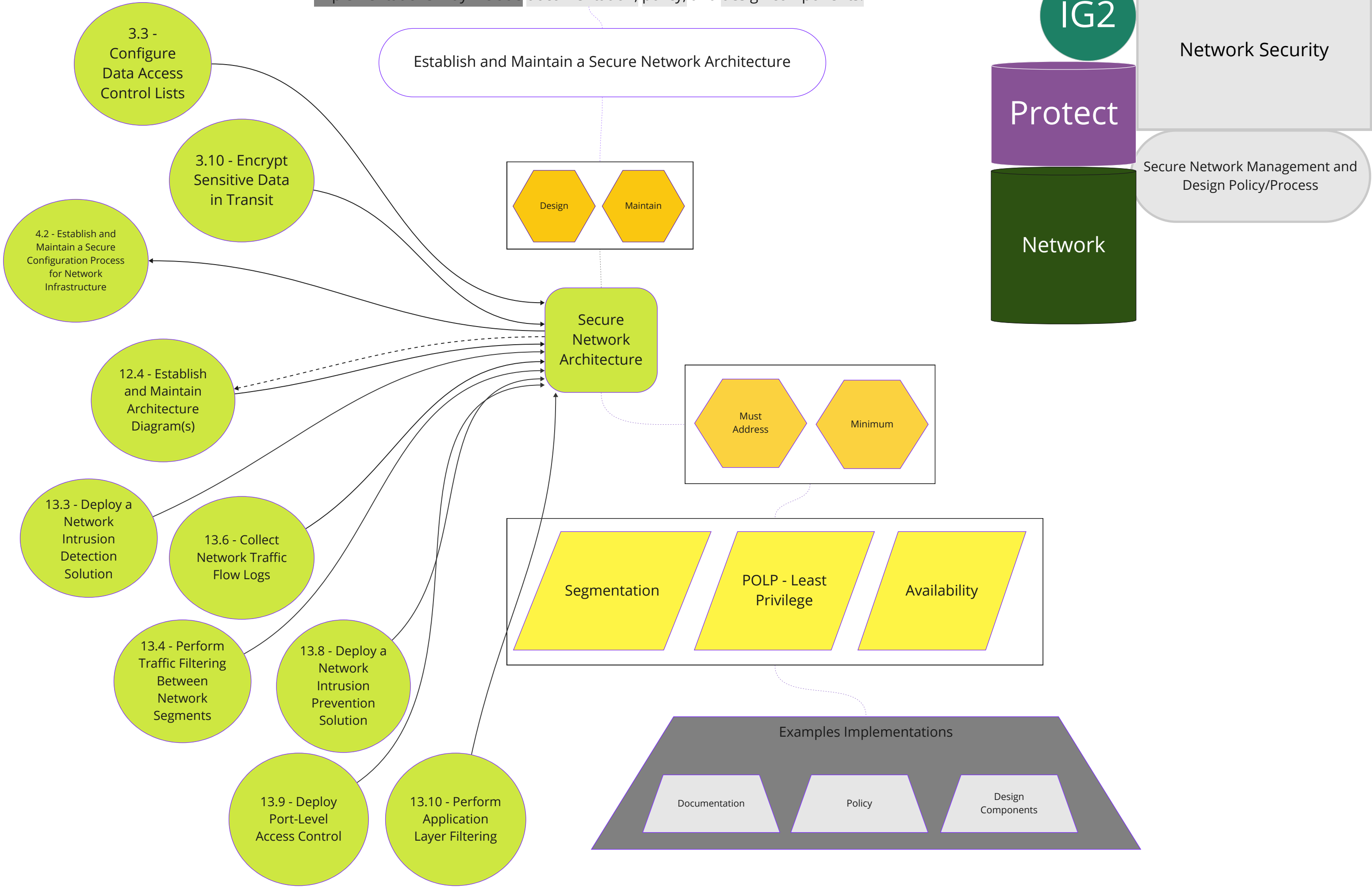
And/Or

Using currently supported network-as-a-service (NaaS) offerings

Group Validated

12.2

Design and maintain a secure network architecture. A secure network architecture must address segmentation, least privilege, and availability, at a minimum. Example implementations may include documentation, policy, and design components.



Process Oriented Safeguard

IG2

Network Security

Protect

Secure Network Management and Design Policy/Process

Network

Establish and Maintain a Secure Network Architecture

Design

Maintain

Secure Network Architecture

Must Address

Minimum

Segmentation

POLP - Least Privilege

Availability

Examples Implementations

Documentation

Policy

Design Components

3.3 - Configure Data Access Control Lists

3.10 - Encrypt Sensitive Data in Transit

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

12.4 - Establish and Maintain Architecture Diagram(s)

13.3 - Deploy a Network Intrusion Detection Solution

13.6 - Collect Network Traffic Flow Logs

13.4 - Perform Traffic Filtering Between Network Segments

13.8 - Deploy a Network Intrusion Prevention Solution

13.9 - Deploy Port-Level Access Control

13.10 - Perform Application Layer Filtering

Group Validated

12.3

Securely manage network infrastructure. Example implementations include version-controlled-infrastructure-as code, and the use of secure network protocols, such as SSH and HTTPS.

Process Oriented Safeguard

IG2

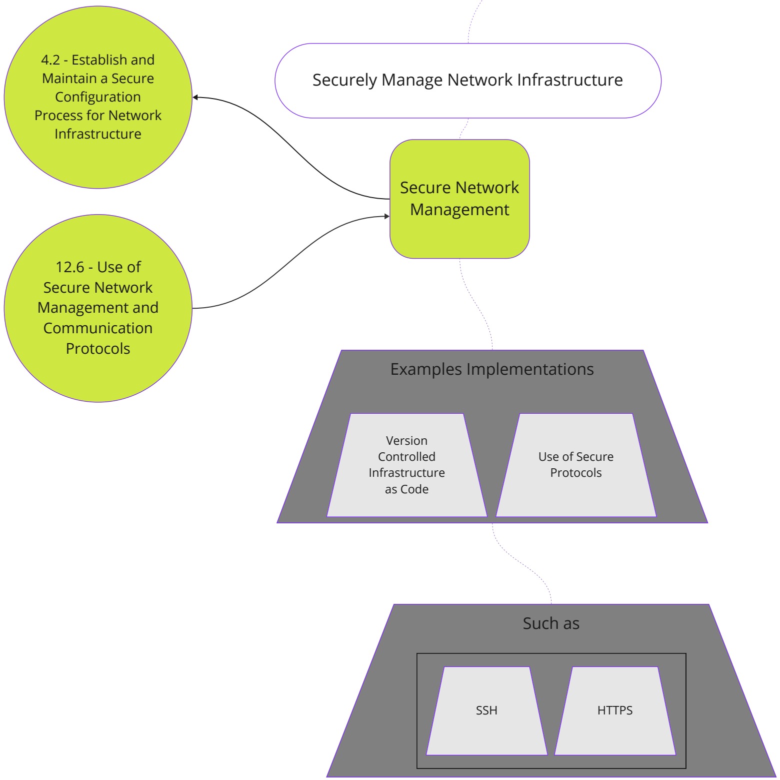
Network Security

Protect

Network

Secure Network Management and Design Policy/Process

Network Management and Monitoring Tool



Securely Manage Network Infrastructure

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

Secure Network Management

12.6 - Use of Secure Network Management and Communication Protocols

Examples Implementations

Version Controlled Infrastructure as Code

Use of Secure Protocols

Such as

SSH

HTTPS

Group Validated

12.4

Process Oriented Safeguard

IG2

Network Security

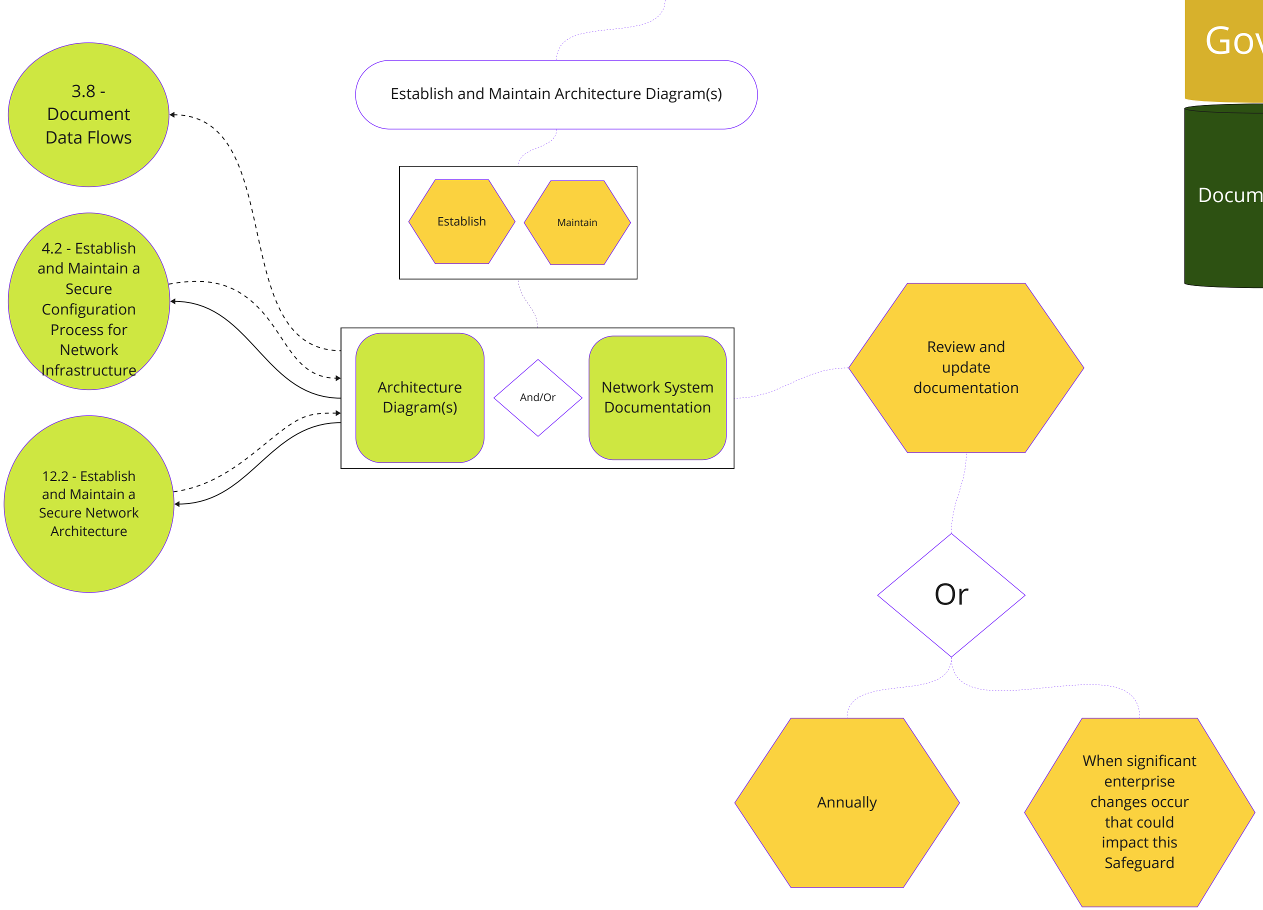
Govern

Documentation

Secure Network Management and Design Policy/Process

Network Architecture Diagramming Tool

Establish and maintain architecture diagram(s) and/or other network system documentation. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.


Establish and Maintain Architecture Diagram(s)
Establish
Maintain
3.8 - Document Data Flows
4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure
12.2 - Establish and Maintain a Secure Network Architecture
Architecture Diagram(s)
And/Or
Network System Documentation
Review and update documentation
Or
Annually
When significant enterprise changes occur that could impact this Safeguard

Group Validated

12.5

IG2

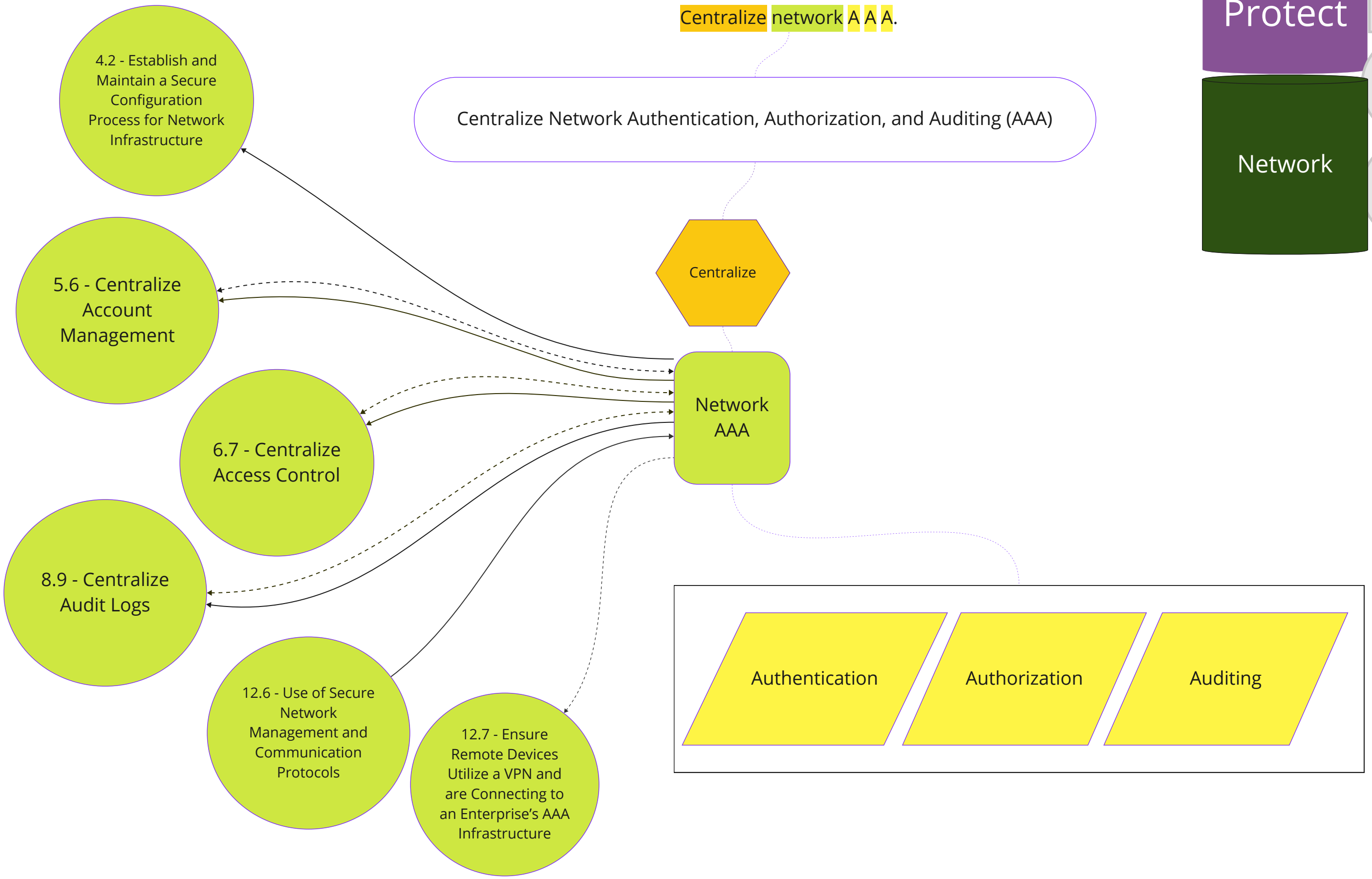
Protect

Network

Account and Access Control Management

Secure Network Management and Design Policy/Process

Identity and Access Management Tool



Centralize network A A A.

Centralize Network Authentication, Authorization, and Auditing (AAA)

Centralize

Network AAA

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

5.6 - Centralize Account Management

6.7 - Centralize Access Control

8.9 - Centralize Audit Logs

12.6 - Use of Secure Network Management and Communication Protocols

12.7 - Ensure Remote Devices Utilize a VPN and are Connecting to an Enterprise's AAA Infrastructure

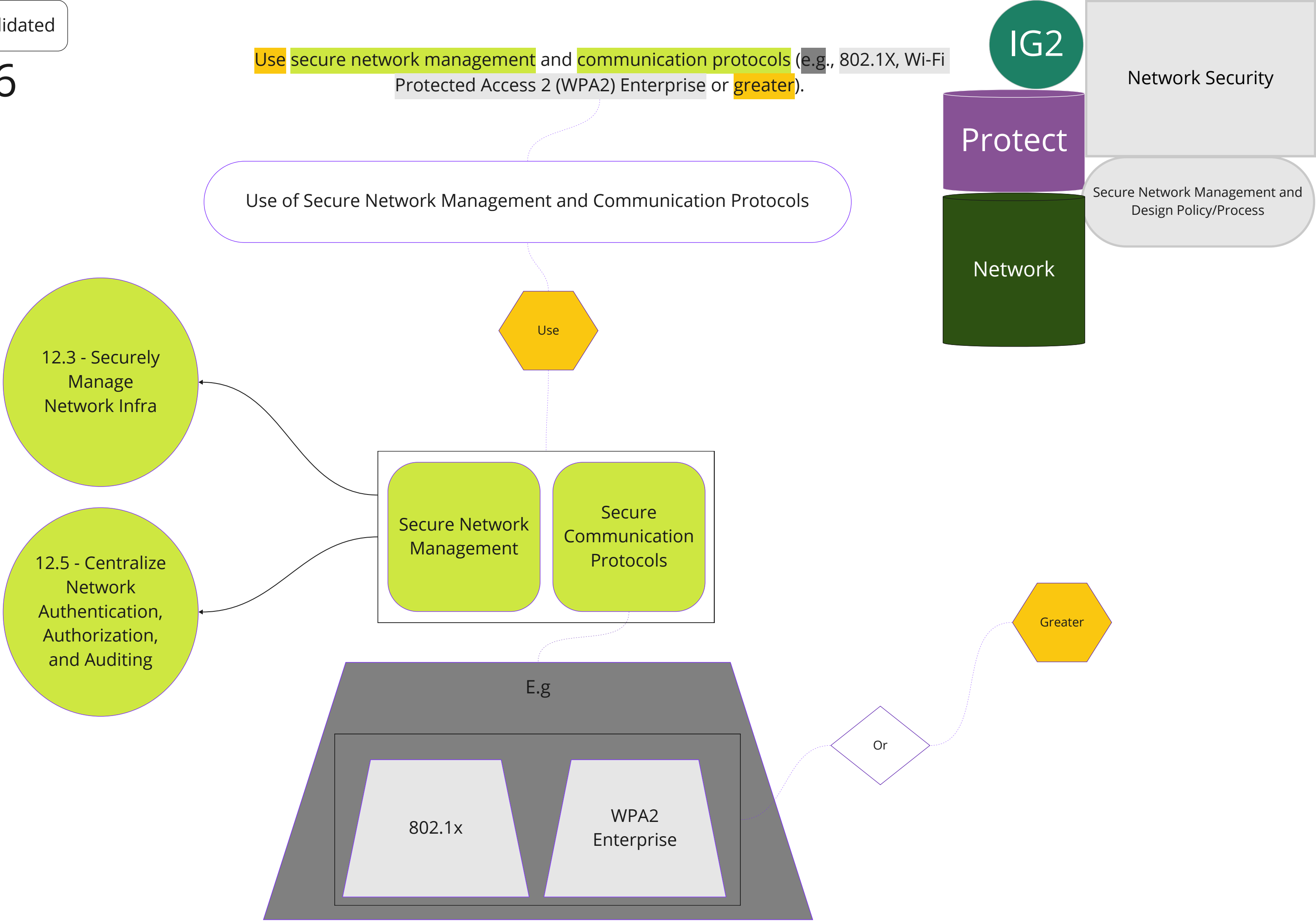
Authentication

Authorization

Auditing

Group Validated

12.6



Use secure network management and communication protocols (e.g., 802.1X, Wi-Fi Protected Access 2 (WPA2) Enterprise or greater).

IG2

Network Security

Protect

Secure Network Management and Design Policy/Process

Network

Use of Secure Network Management and Communication Protocols

Use

12.3 - Securely Manage Network Infra

12.5 - Centralize Network Authentication, Authorization, and Auditing

Secure Network Management

Secure Communication Protocols

E.g

802.1x

WPA2 Enterprise

Or

Greater

Group Validated

12.7

Require users to authenticate to enterprise-managed VPN and authentication services prior to accessing enterprise resources on end-user devices

IG2

Protect

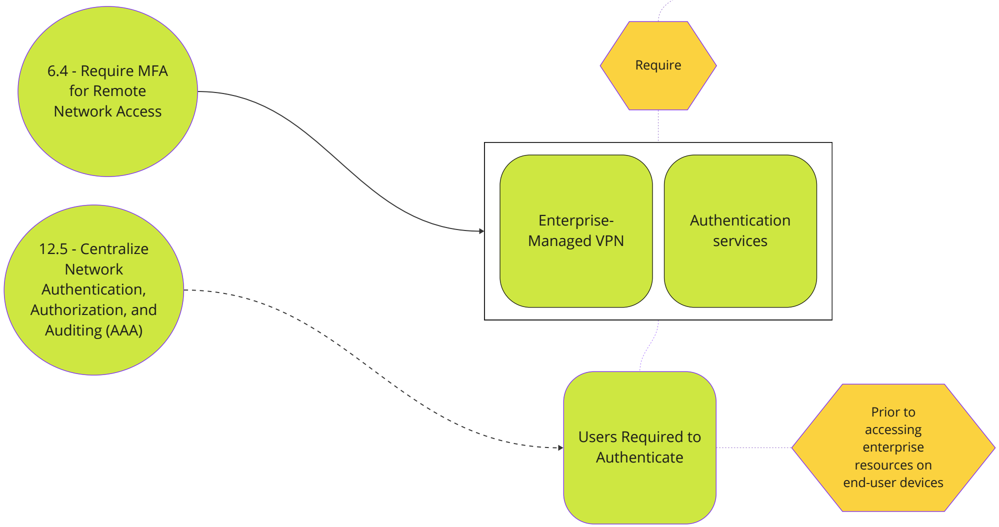
Devices

Network Security

Secure Network Management and Design Policy/Process

VPN / Encryption Tool

Ensure Remote Devices Utilize a VPN and are Connecting to an Enterprise’s AAA Infrastructure



Require

6.4 - Require MFA for Remote Network Access

Enterprise-Managed VPN

Authentication services

12.5 - Centralize Network Authentication, Authorization, and Auditing (AAA)

Users Required to Authenticate

Prior to accessing enterprise resources on end-user devices

Group Validated

12.8

Establish and maintain dedicated computing resources, either physically or logically separated, for all administrative tasks or tasks requiring administrative access. The computing resources should be segmented from the enterprise's primary network and not be allowed internet access.

Process Oriented Safeguard

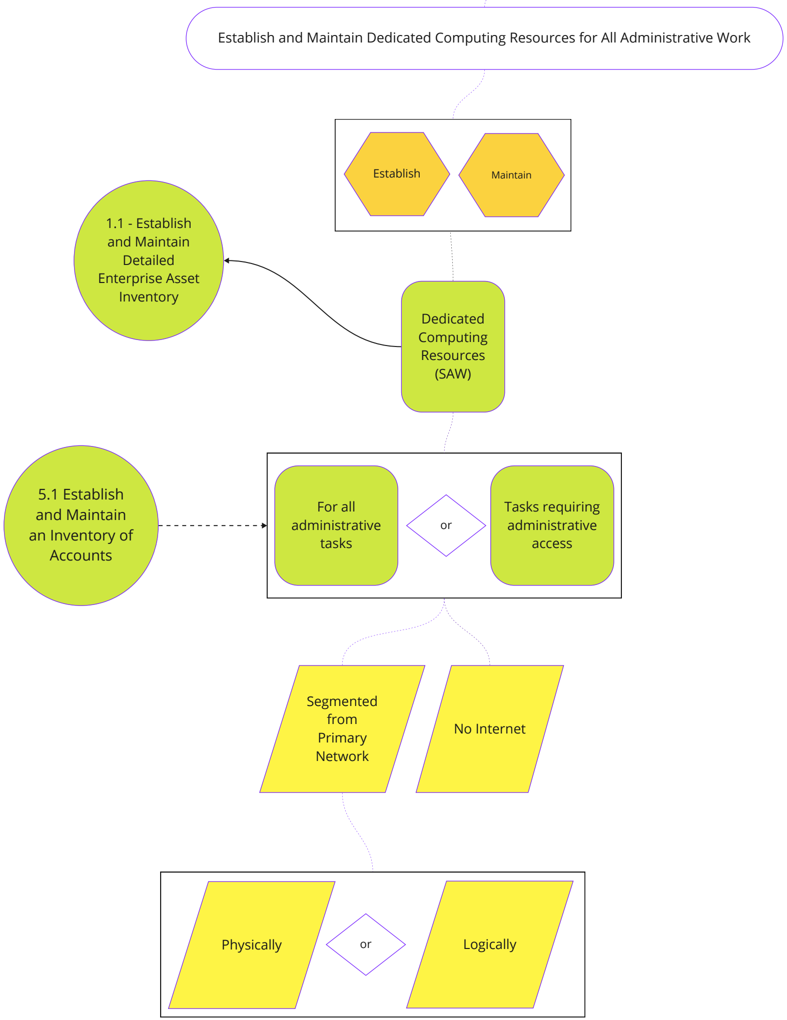
IG3

Network Security

Protect

Secure Network Management and Design Policy/Process

Devices



Establish and Maintain Dedicated Computing Resources for All Administrative Work

Establish

Maintain

1.1 - Establish and Maintain Detailed Enterprise Asset Inventory

Dedicated Computing Resources (SAW)

5.1 Establish and Maintain an Inventory of Accounts

For all administrative tasks

or

Tasks requiring administrative access

Segmented from Primary Network

No Internet

Physically

or

Logically

CONTROL 13

Network Monitoring and Defense

Safeguards: 11	IG1: 0/11	IG2: 6/11	IG3: 11/11

Overview

Operate processes and tooling to establish and maintain comprehensive network monitoring and defense against security threats across the enterprise's network infrastructure and user base.

Group Validated

13.1

Centralize security event alerting across enterprise assets for log correlation and analysis. Best practice implementation requires the use of a SIEM, which includes vendor-defined event correlation alerts. A log analytics platform configured with security-relevant correlation alerts also satisfies this Safeguard.

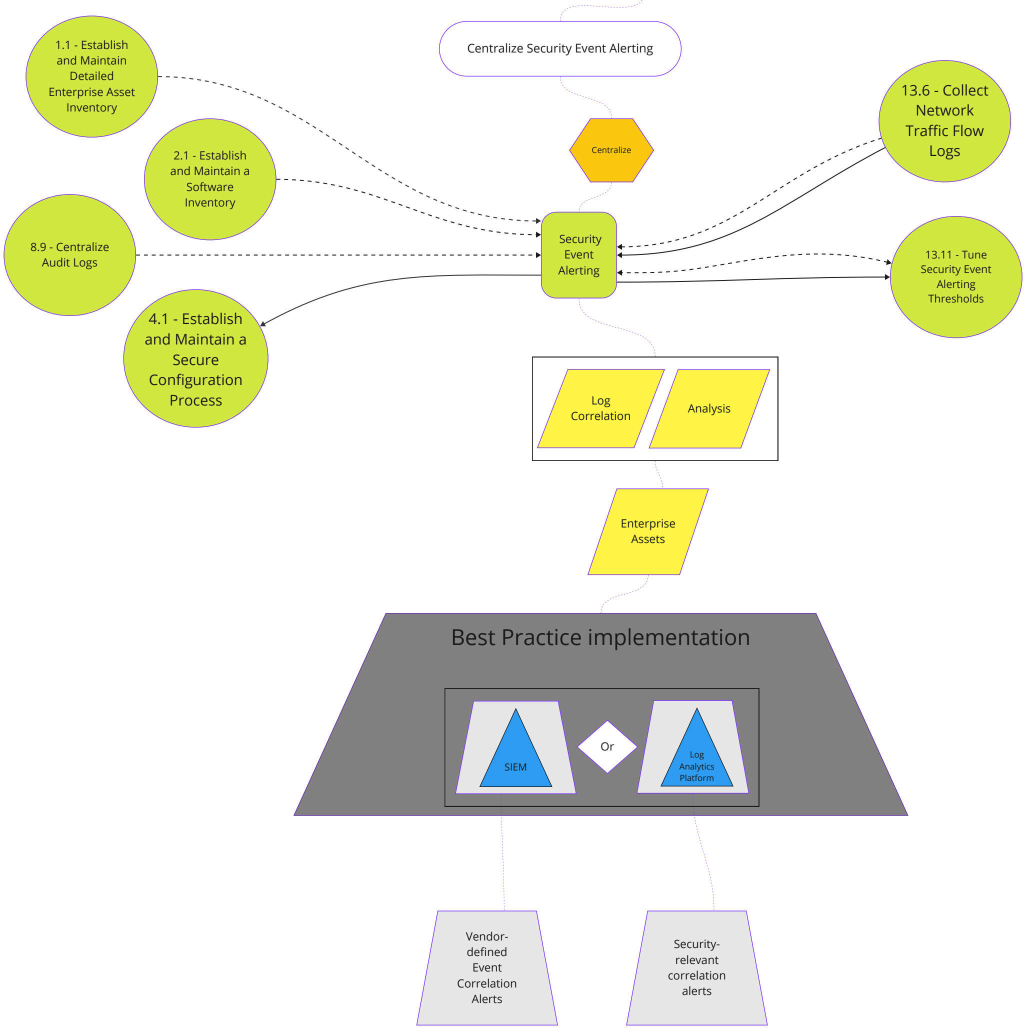
IG2

Malware Defense

Detect

Network

Security Alert Correlation Tool


Centralize Security Event Alerting
Centralize
1.1 - Establish and Maintain Detailed Enterprise Asset Inventory
2.1 - Establish and Maintain a Software Inventory
8.9 - Centralize Audit Logs
4.1 - Establish and Maintain a Secure Configuration Process
Security Event Alerting
13.6 - Collect Network Traffic Flow Logs
13.11 - Tune Security Event Alerting Thresholds
Log Correlation
Analysis
Enterprise Assets
Best Practice implementation
SIEM
Or
Log Analytics Platform
Vendor-defined Event Correlation Alerts
Security-relevant correlation alerts

Group Validated

13.2

IG2

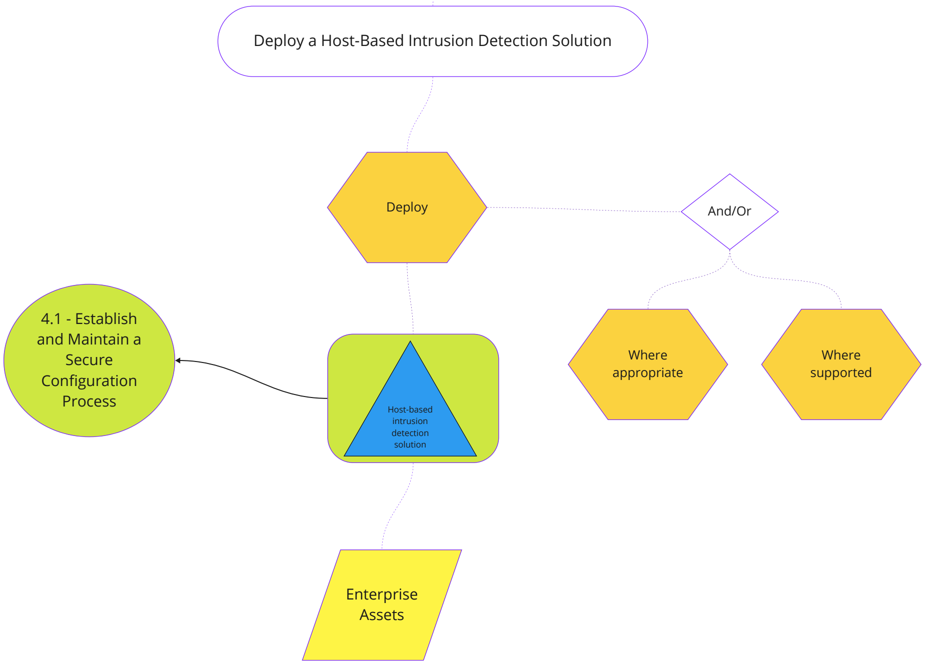
Detect

Devices

Malware Defense

Anti-Malware Software

Deploy a host-based intrusion detection solution on enterprise assets, where appropriate and/or supported.



Deploy a Host-Based Intrusion Detection Solution

Deploy

And/Or

Where appropriate

Where supported

4.1 - Establish and Maintain a Secure Configuration Process

Host-based intrusion detection solution

Enterprise Assets

Group Validated

13.3

Deploy a network intrusion detection solution on enterprise assets, where appropriate.
Example implementations include the use of a Network Intrusion Detection System (NIDS)
or equivalent cloud service provider (CSP) service

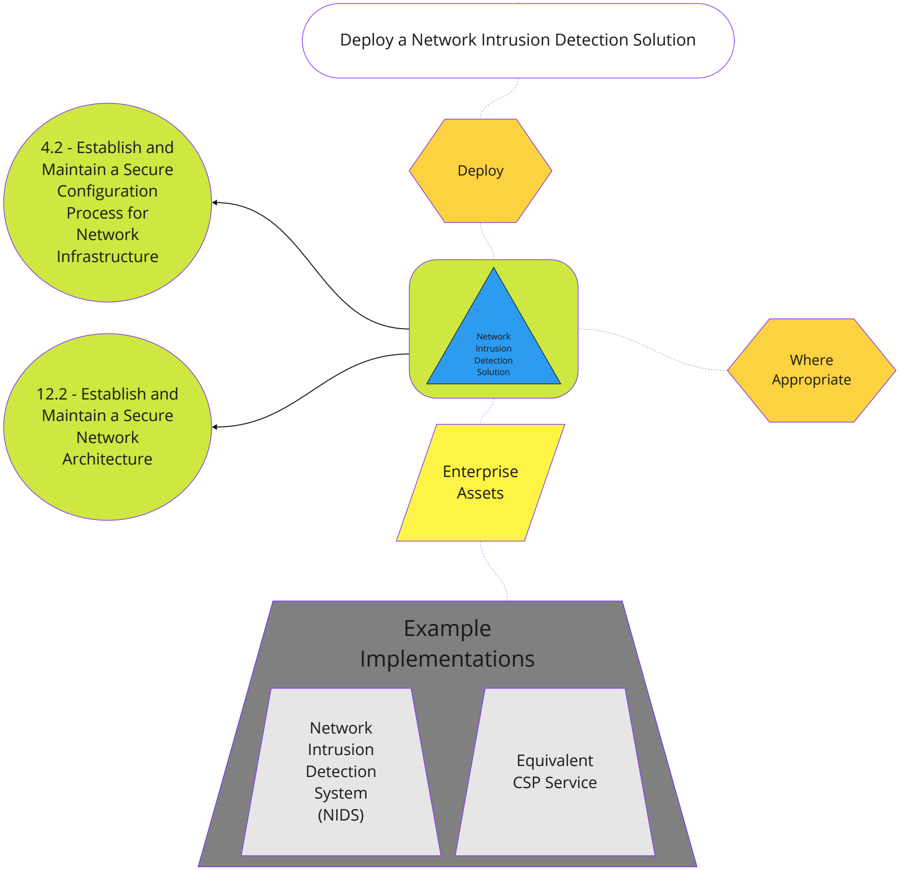
IG2

Network Defense

Detect

Network

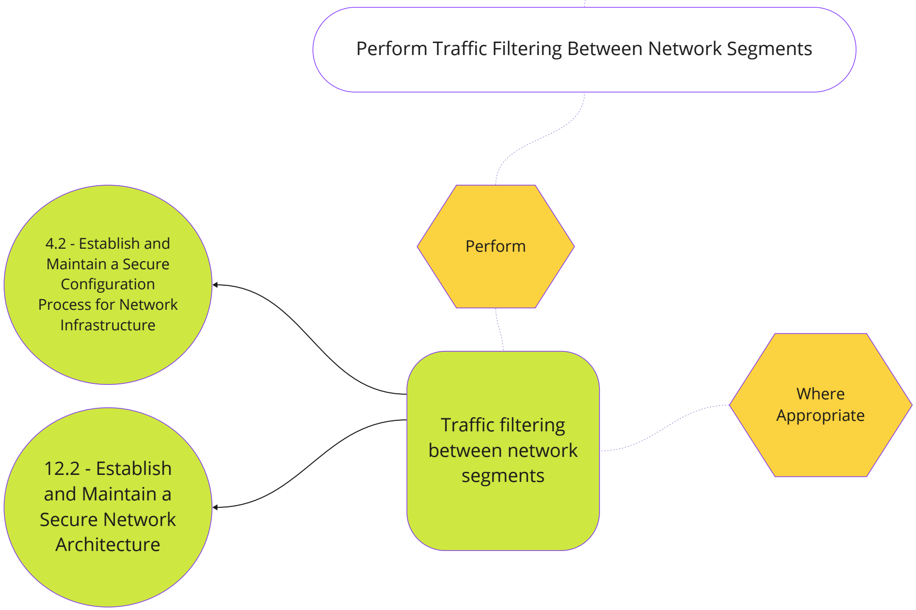
Intrusion Detection System


Deploy a Network Intrusion Detection Solution
Deploy
4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure
Network Intrusion Detection Solution
Where Appropriate
12.2 - Establish and Maintain a Secure Network Architecture
Enterprise Assets
Example Implementations
Network Intrusion Detection System (NIDS)
Equivalent CSP Service

Group Validated

13.4

Perform traffic filtering between network segments, where appropriate



Perform Traffic Filtering Between Network Segments

Perform

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

Traffic filtering between network segments

Where Appropriate

12.2 - Establish and Maintain a Secure Network Architecture

IG2

Secure Configurations

Protect

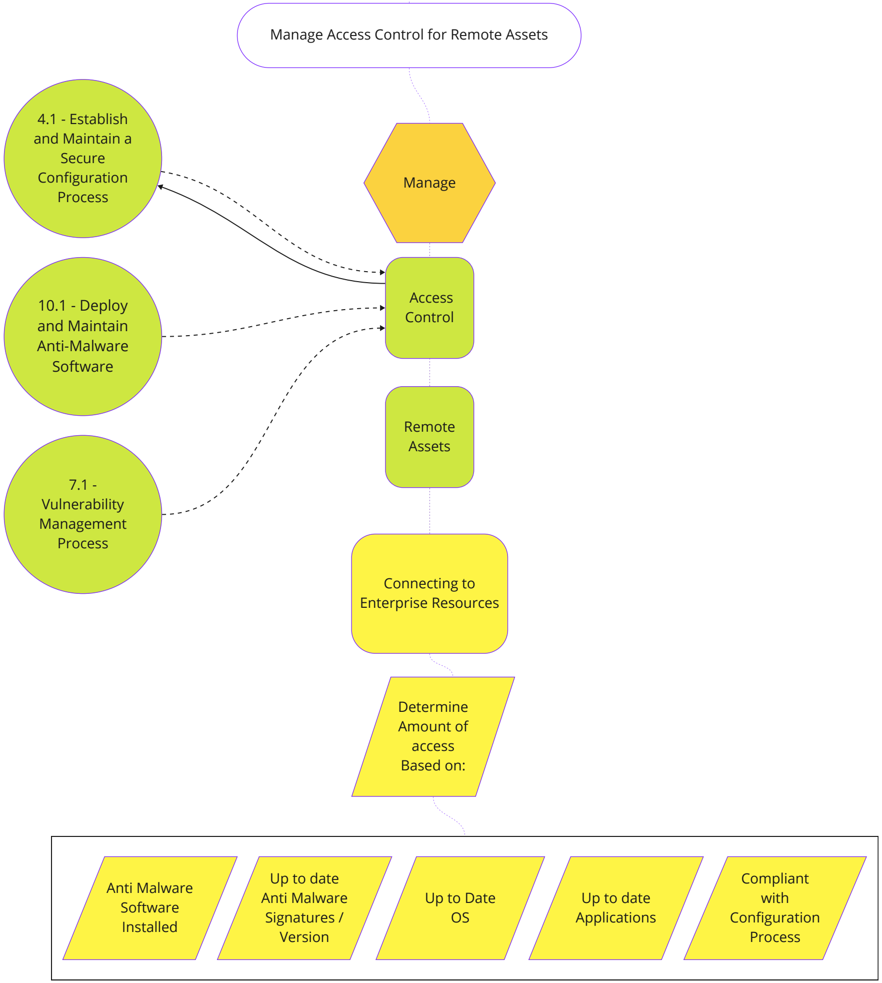
Firewall

Network

Group Validated

13.5

Manage access control for assets remotely connecting to enterprise resources. Determine amount of access to enterprise resources based on: up-to-date anti-malware software installed, configuration compliance with the enterprise's secure configuration process, and ensuring the operating system and applications are up-to-date



Manage Access Control for Remote Assets

Manage

Access Control

Remote Assets

Connecting to Enterprise Resources

Determine Amount of access Based on:

Anti Malware Software Installed

Up to date Anti Malware Signatures / Version

Up to Date OS

Up to date Applications

Compliant with Configuration Process

4.1 - Establish and Maintain a Secure Configuration Process

10.1 - Deploy and Maintain Anti-Malware Software

7.1 - Vulnerability Management Process

IG2

Network Defense

Protect

Devices

Device Posture Tool

Group Validated

13.6

Collect network traffic flow logs and/or network traffic to review and alert upon from network devices.

IG2

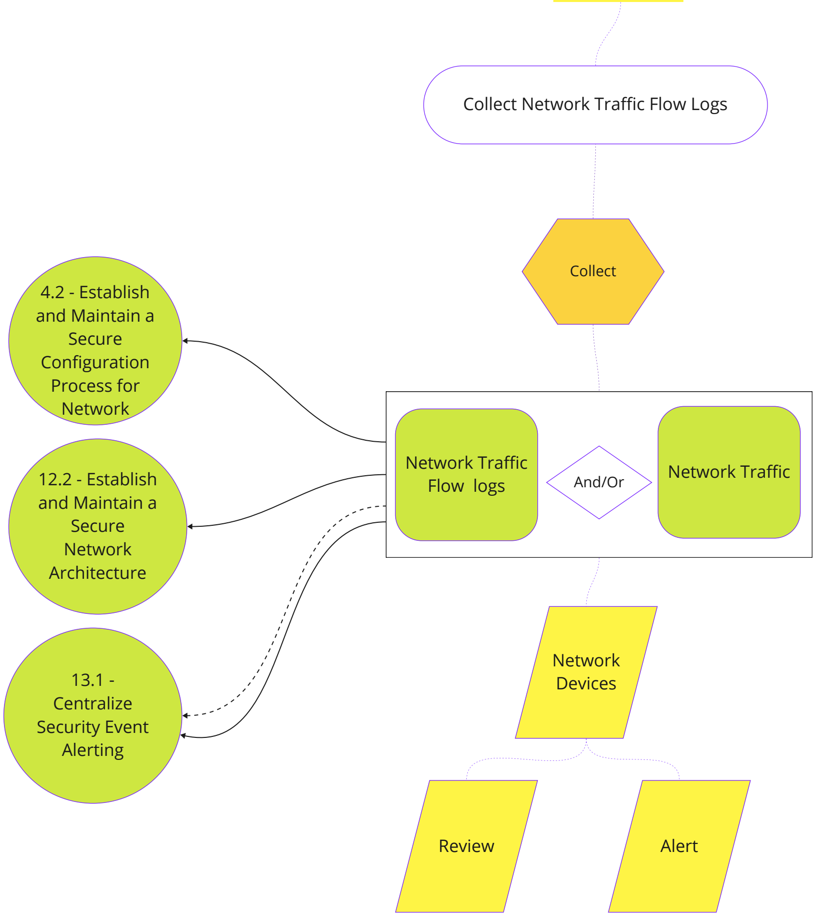
Network Defense

Detect

Network

Network Flow Collection Tool

Security Alert Correlation Tool



Collect Network Traffic Flow Logs

Collect

Network Traffic Flow logs

And/Or

Network Traffic

Network Devices

Review

Alert

4.2 - Establish and Maintain a Secure Configuration Process for Network

12.2 - Establish and Maintain a Secure Network Architecture

13.1 - Centralize Security Event Alerting

Group Validated

13.7

Deploy a host-based intrusion prevention solution on enterprise assets, where appropriate and/or supported. Example implementations include use of an Endpoint Detection and Response (EDR) client or host-based IPS agent.

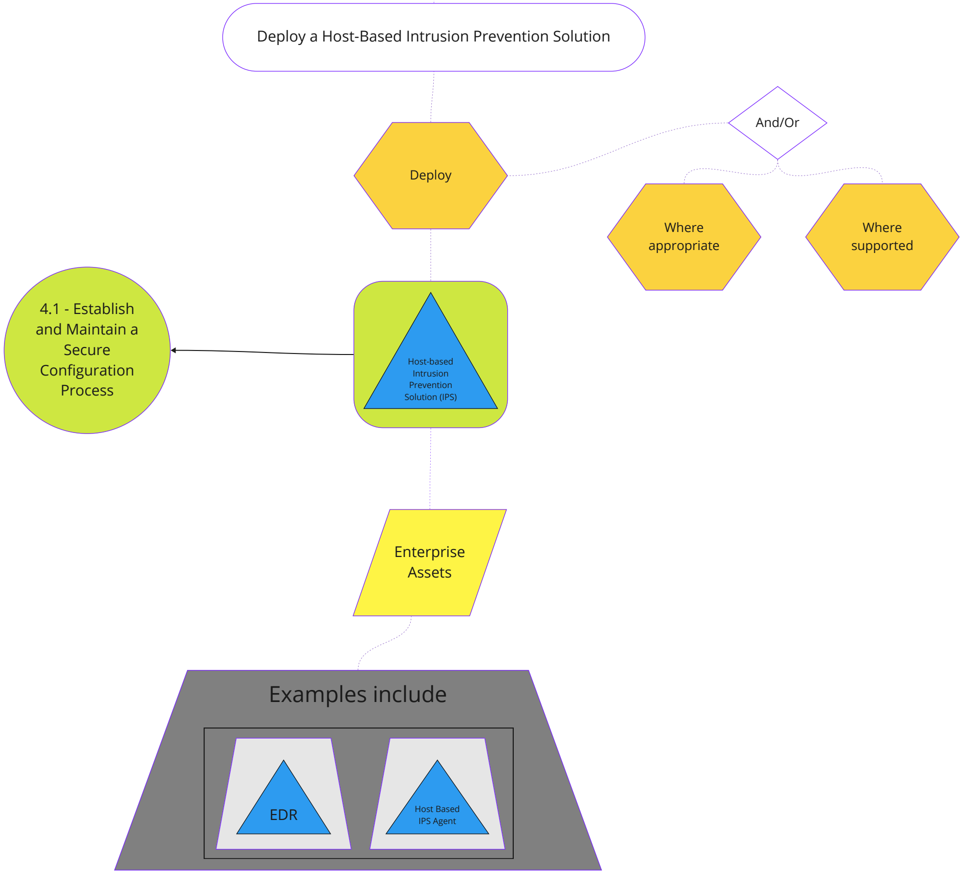
IG3

Network Defense

Protect

Devices

Intrusion Prevention Solution



Deploy a Host-Based Intrusion Prevention Solution

Deploy

And/Or

Where appropriate

Where supported

4.1 - Establish and Maintain a Secure Configuration Process

Host-based Intrusion Prevention Solution (IPS)

Enterprise Assets

Examples include

EDR

Host Based IPS Agent

Group Validated

13.8

Deploy a network intrusion prevention solution, where appropriate. Example implementations include the use of a Network Intrusion Prevention System (NIPS) or equivalent CSP service.

IG3

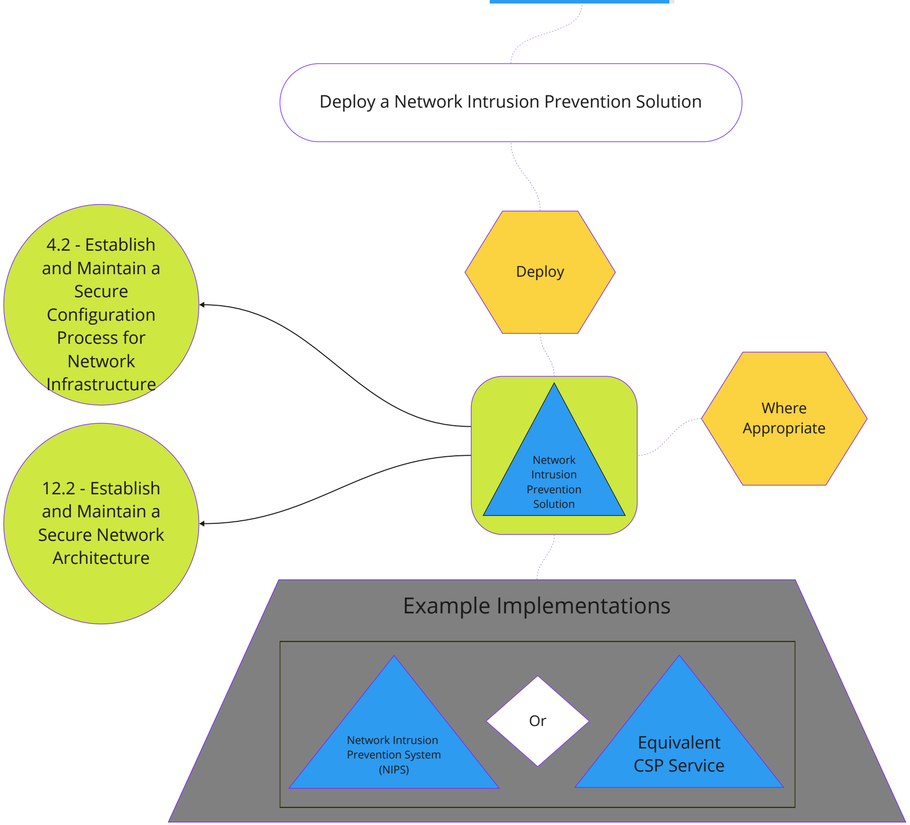
Network Defense

Protect

Network

Intrusion Prevention System

Firewall



Deploy a Network Intrusion Prevention Solution

Deploy

Network Intrusion Prevention Solution

Where Appropriate

4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure

12.2 - Establish and Maintain a Secure Network Architecture

Example Implementations

Network Intrusion Prevention System (NIPS)

Or

Equivalent CSP Service

Group Validated

13.9

Deploy port-level access control. Port-level access control utilizes 802.1x, or similar network access control protocols, such as certificates, and may incorporate user and/or device authentication

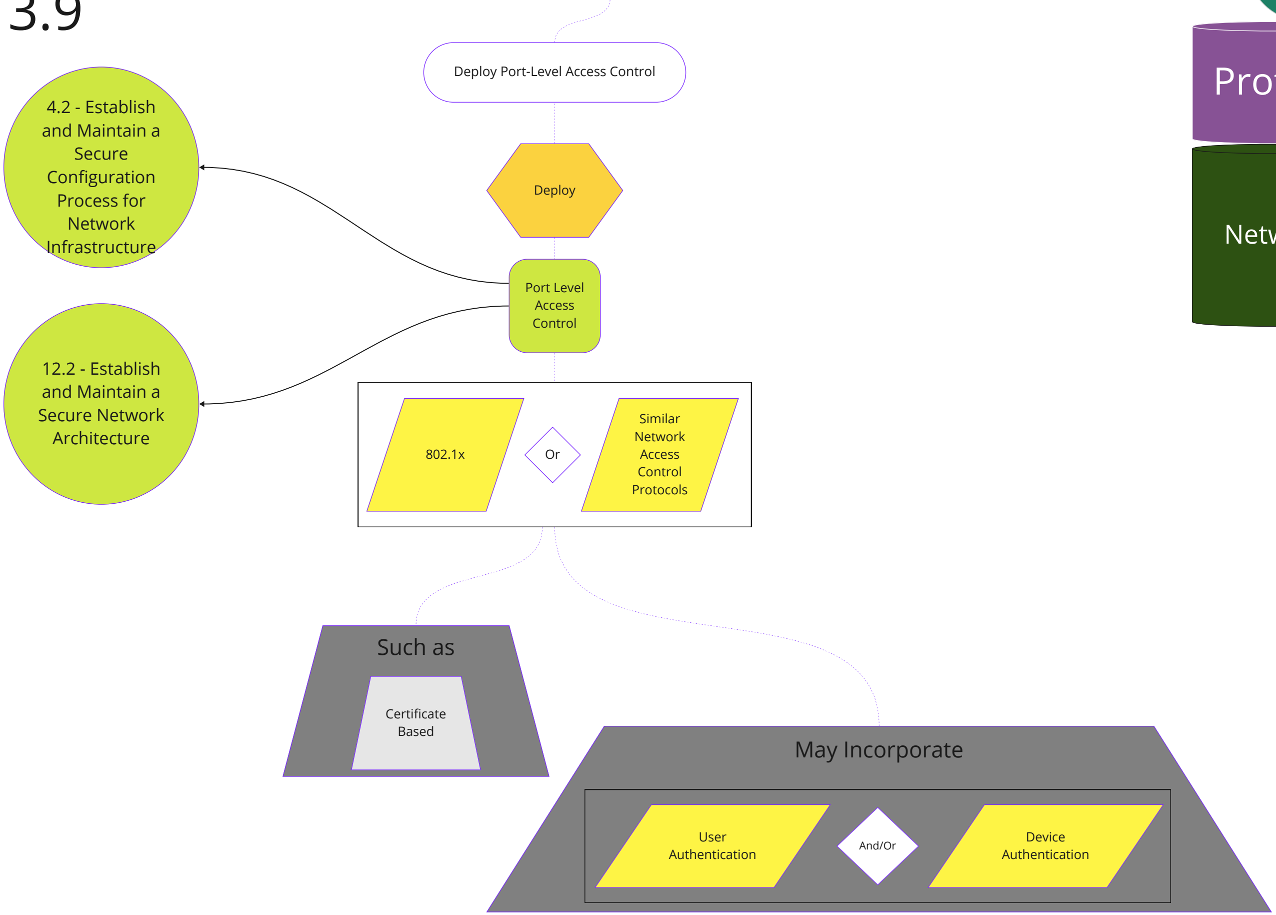
IG3

Protect

Network

Network Defense

Network Access Control Tool


Deploy Port-Level Access Control
Deploy
Port Level Access Control
4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure
12.2 - Establish and Maintain a Secure Network Architecture
802.1x
Or
Similar Network Access Control Protocols
Such as
Certificate Based
May Incorporate
User Authentication
And/Or
Device Authentication

Group Validated

13.10

Perform application layer filtering. Example implementations include a filtering proxy, application layer firewall, or gateway.

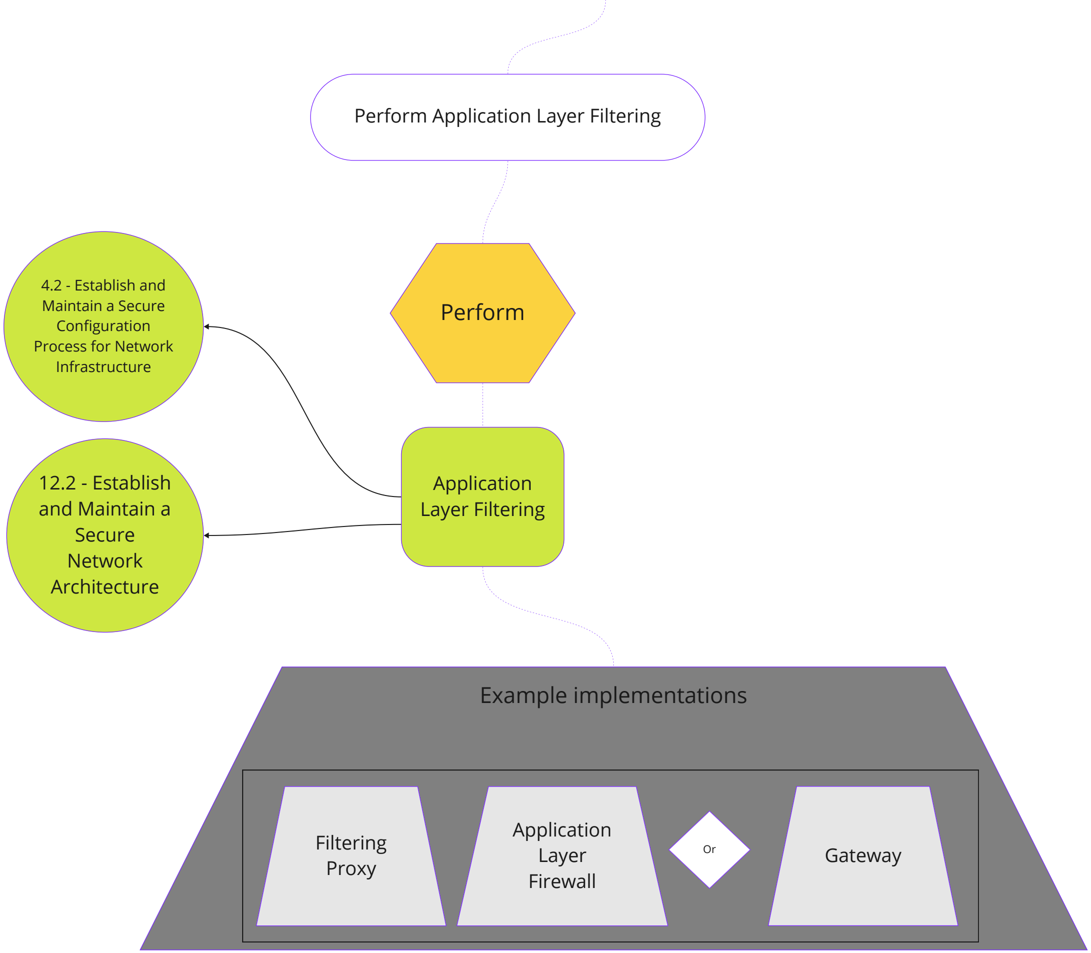
IG3

Network Defense

Protect

Firewall

Network


Perform Application Layer Filtering
Perform
4.2 - Establish and Maintain a Secure Configuration Process for Network Infrastructure
12.2 - Establish and Maintain a Secure Network Architecture
Application Layer Filtering
Example implementations
Filtering Proxy
Application Layer Firewall
Or
Gateway

Group Validated

13.11

Tune security event alerting thresholds monthly, or more frequently

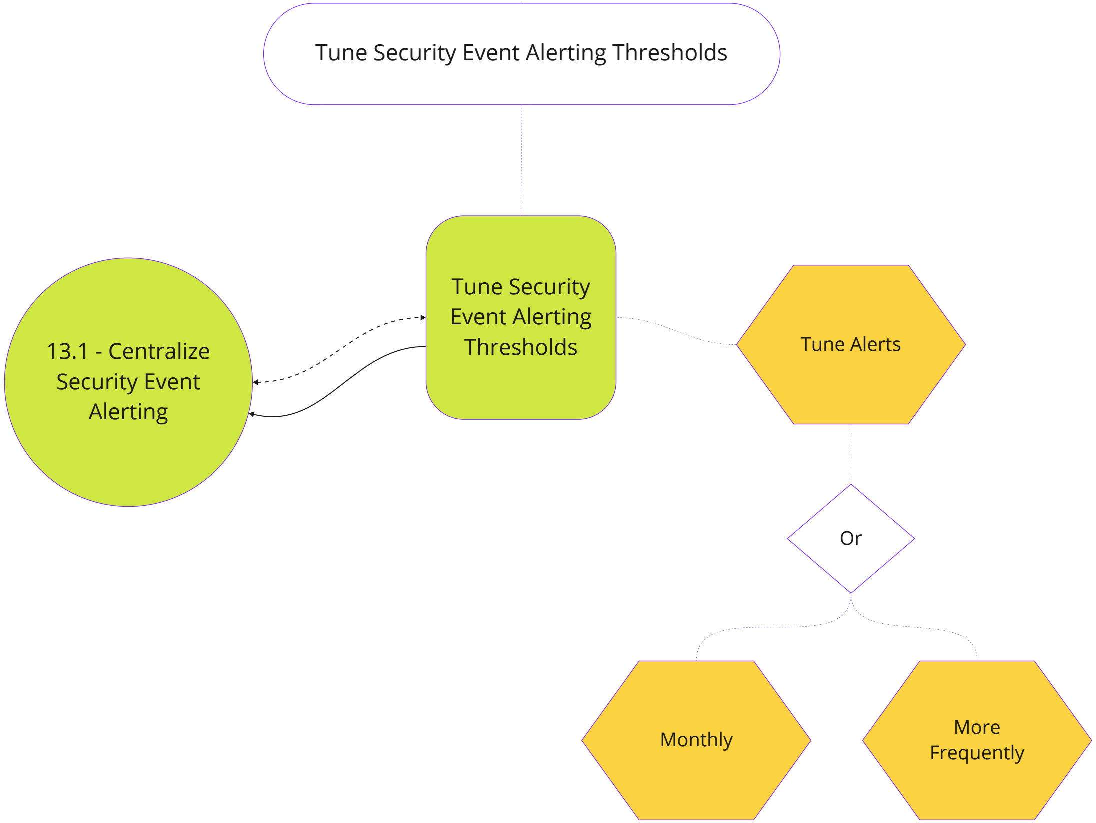
IG3

Network Defense

Detect

SOC Operations

Network



Tune Security Event Alerting Thresholds

13.1 - Centralize Security Event Alerting

Tune Security Event Alerting Thresholds

Tune Alerts

Or

Monthly

More Frequently

CONTROL 14

Security Awareness and Skills Training

Safeguards: 9	IG1: 8/9	IG2: 9/9	IG3: 9/9

Overview

Establish and maintain a security awareness program to influence behavior among the workforce to be security conscious and properly skilled to reduce cybersecurity risks to the enterprise.

Group Validated

14.1

Establish and maintain a security awareness program. The purpose of a security awareness program is to educate the enterprise's workforce on how to interact with enterprise assets and data in a secure manner. Conduct training at hire and, at a minimum, annually. Review and update content annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

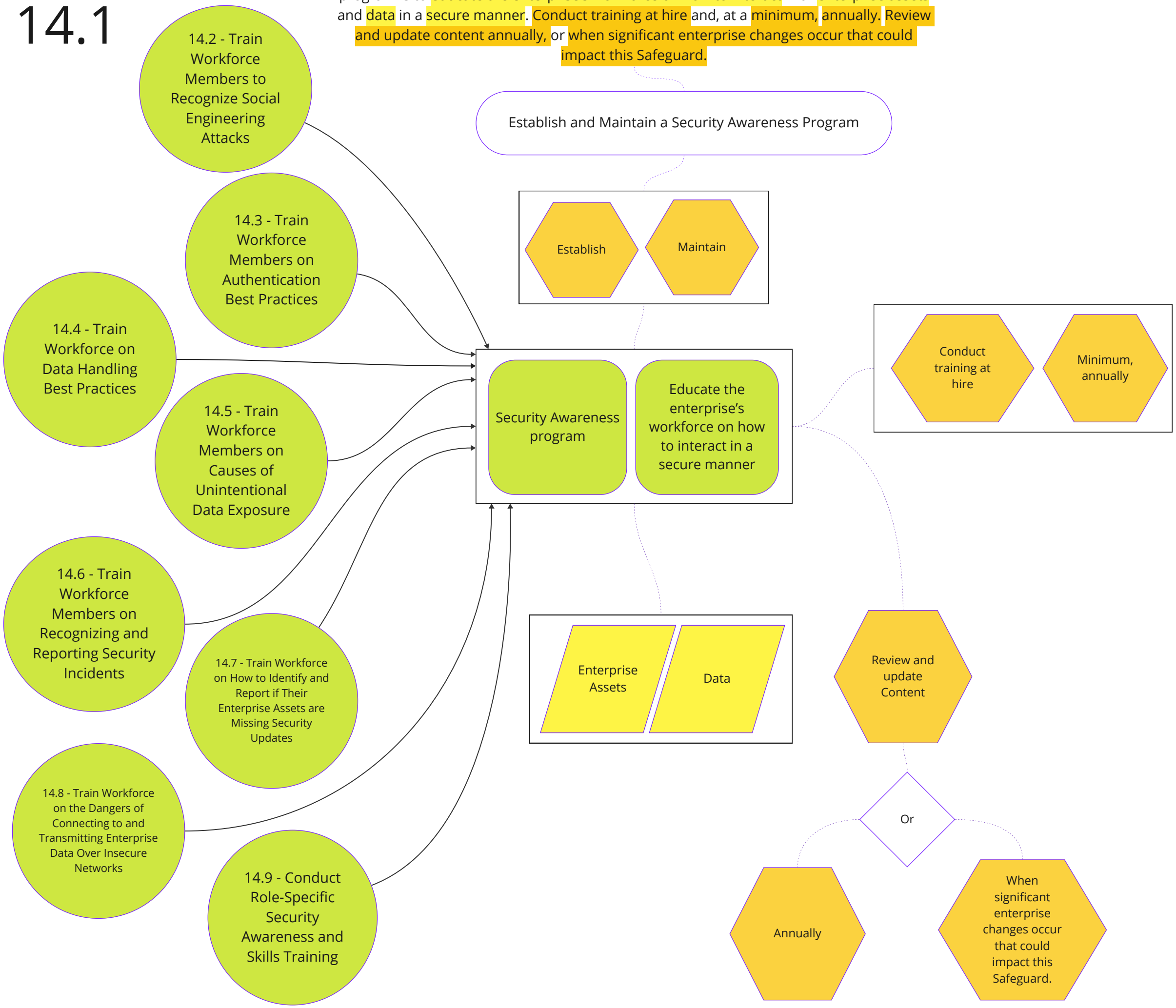
IG1

Security Training

Govern

Documentation

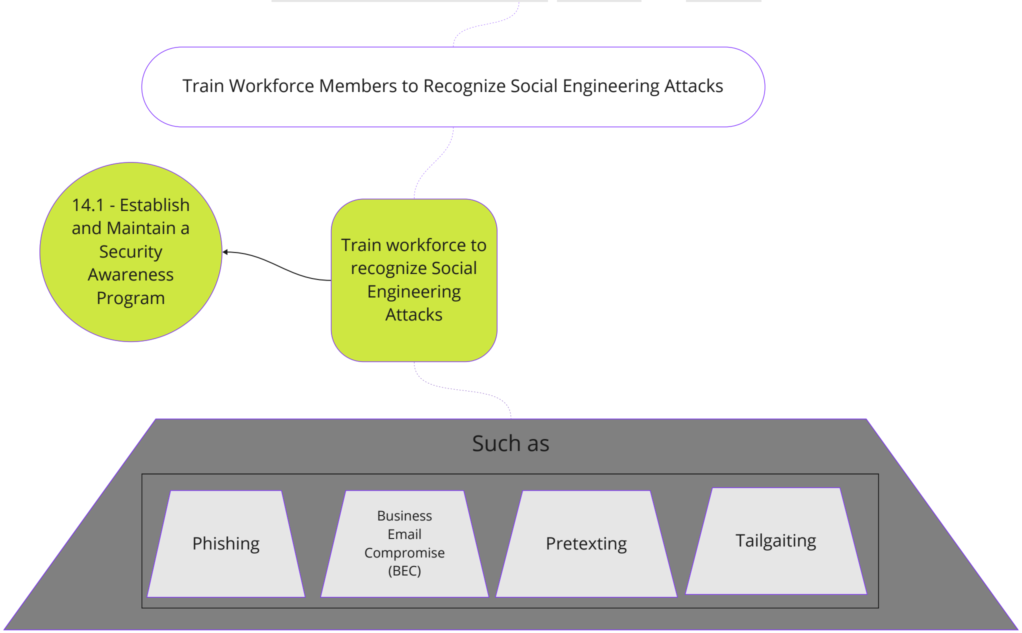
Security Training and Awareness Policy/Process


Establish and Maintain a Security Awareness Program
Establish
Maintain
Security Awareness program
Educate the enterprise's workforce on how to interact in a secure manner
Conduct training at hire
Minimum, annually
Enterprise Assets
Data
Review and update Content
Or
Annually
When significant enterprise changes occur that could impact this Safeguard.
14.2 - Train Workforce Members to Recognize Social Engineering Attacks
14.3 - Train Workforce Members on Authentication Best Practices
14.4 - Train Workforce on Data Handling Best Practices
14.5 - Train Workforce Members on Causes of Unintentional Data Exposure
14.6 - Train Workforce Members on Recognizing and Reporting Security Incidents
14.7 - Train Workforce on How to Identify and Report if Their Enterprise Assets are Missing Security Updates
14.8 - Train Workforce on the Dangers of Connecting to and Transmitting Enterprise Data Over Insecure Networks
14.9 - Conduct Role-Specific Security Awareness and Skills Training

Group Validated

14.2

Train workforce members to recognize social engineering attacks, such as phishing, business email compromise (BEC), pretexting, and tailgating.



Train Workforce Members to Recognize Social Engineering Attacks

14.1 - Establish and Maintain a Security Awareness Program

Train workforce to recognize Social Engineering Attacks

Such as

Phishing

Business Email Compromise (BEC)

Pretexting

Tailgating

IG1

Protect

Users

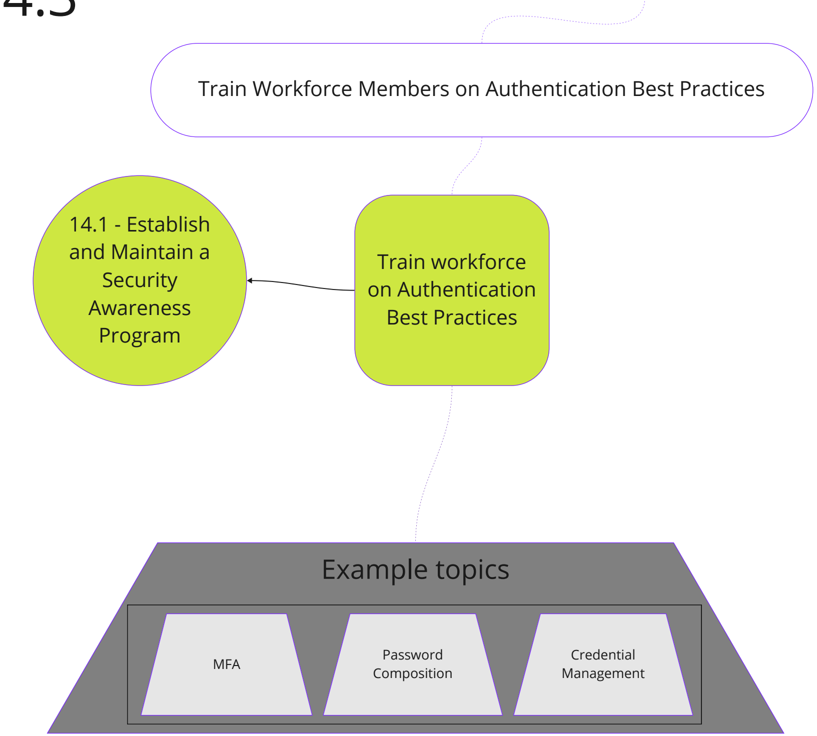
Security Training

Security Training and Awareness Tool(s)

Group Validated

14.3

Train workforce members on authentication best practices. Example topics include MFA, password composition, and credential management.



Train Workforce Members on Authentication Best Practices

14.1 - Establish and Maintain a Security Awareness Program

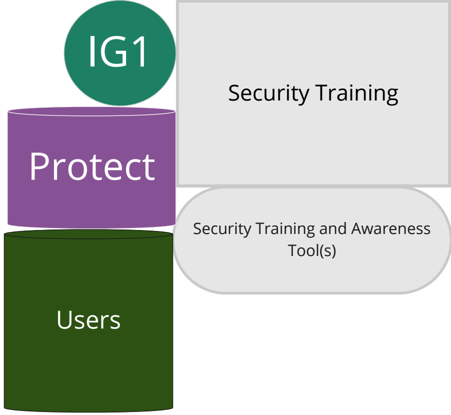
Train workforce on Authentication Best Practices

Example topics

MFA

Password Composition

Credential Management



IG1

Security Training

Protect

Security Training and Awareness Tool(s)

Users

Group Validated

14.4

Train workforce members on how to identify and properly store, transfer, archive, and destroy sensitive data. This also includes training workforce members on clear screen and desk best practices, such as locking their screen when they step away from their enterprise asset, erasing physical and virtual whiteboards at the end of meetings, and storing data and assets securely.

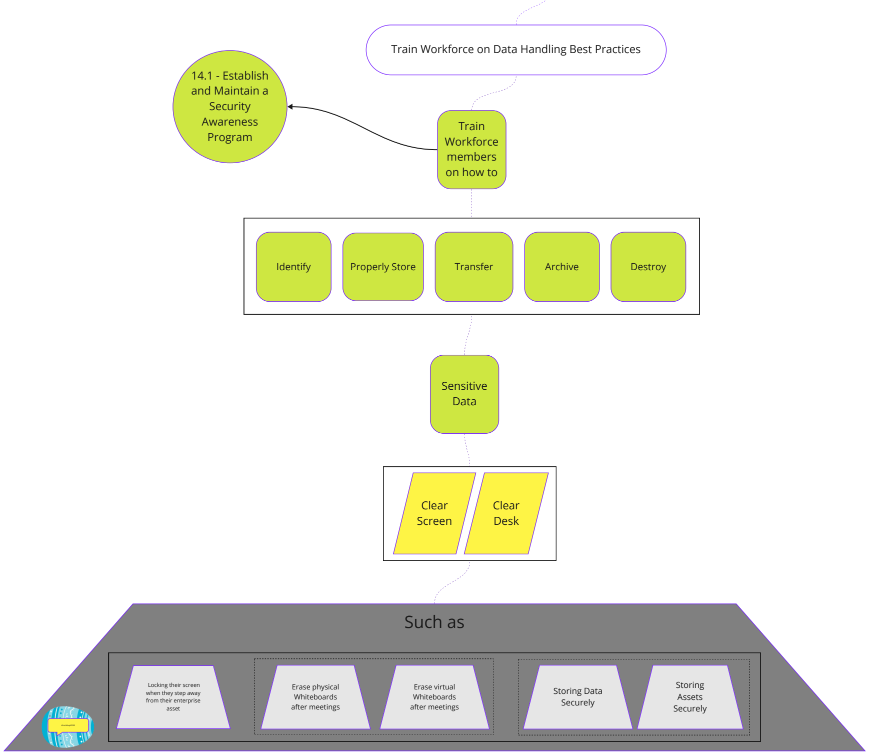
IG1

Security Training

Protect

Security Training and Awareness Tool(s)

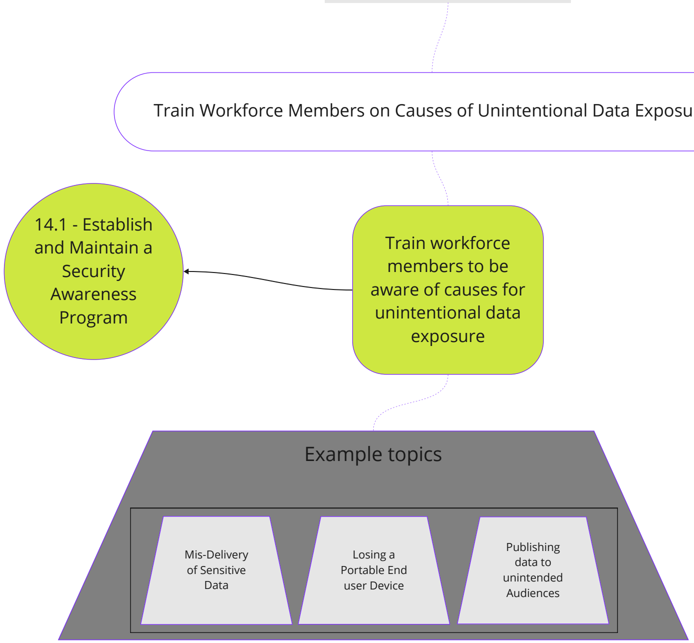
Users


Train Workforce on Data Handling Best Practices
14.1 - Establish and Maintain a Security Awareness Program
Train Workforce members on how to
Identify
Properly Store
Transfer
Archive
Destroy
Sensitive Data
Clear Screen
Clear Desk
Such as
Locking their screen when they step away from their enterprise asset
Erase physical Whiteboards after meetings
Erase virtual Whiteboards after meetings
Storing Data Securely
Storing Assets Securely

Group Validated

14.5

Train workforce members to be aware of causes for unintentional data exposure. Example topics include mis-delivery of sensitive data, losing a portable end-user device, or publishing data to unintended audiences.



Train Workforce Members on Causes of Unintentional Data Exposure

Train workforce members to be aware of causes for unintentional data exposure

14.1 - Establish and Maintain a Security Awareness Program

Example topics

Mis-Delivery of Sensitive Data

Losing a Portable End user Device

Publishing data to unintended Audiences

IG1

Security Training

Protect

Users

Security Training and Awareness Tool(s)

Group Validated

14.6

Train workforce members to be able to recognize a potential incident and be able to report such an incident.

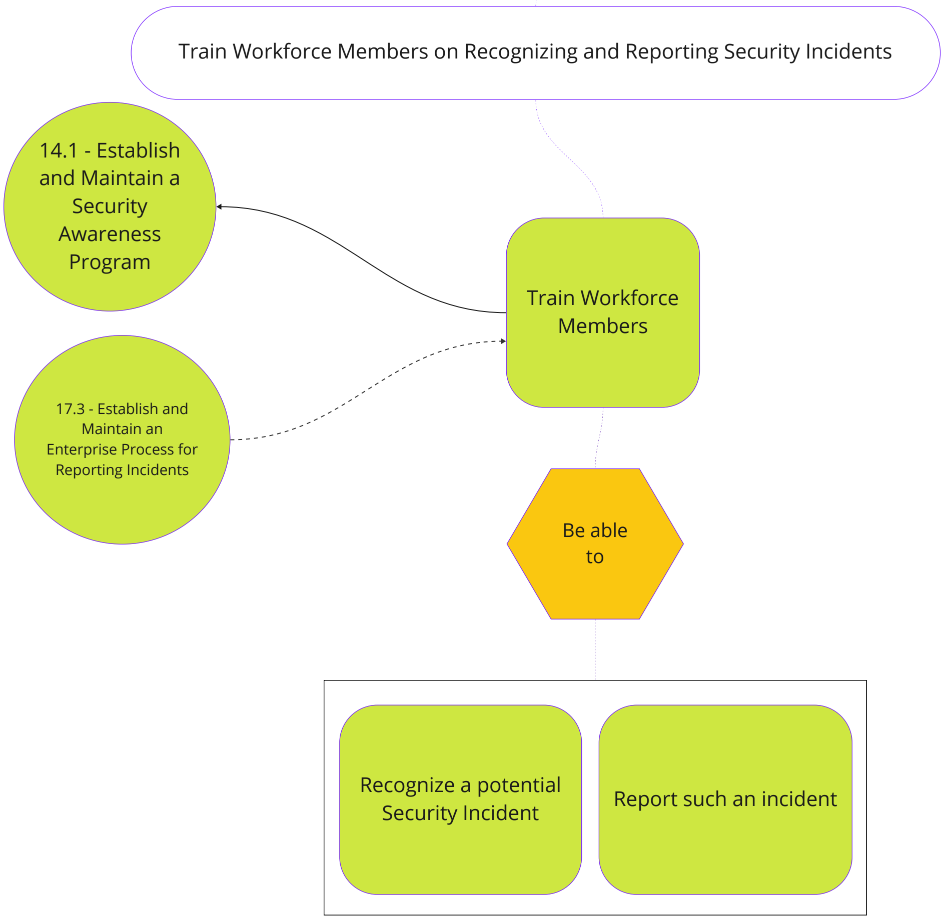
IG1

Security Training

Protect

Security Training and Awareness Tool(s)

Users



Train Workforce Members on Recognizing and Reporting Security Incidents

14.1 - Establish and Maintain a Security Awareness Program

Train Workforce Members

17.3 - Establish and Maintain an Enterprise Process for Reporting Incidents

Be able to

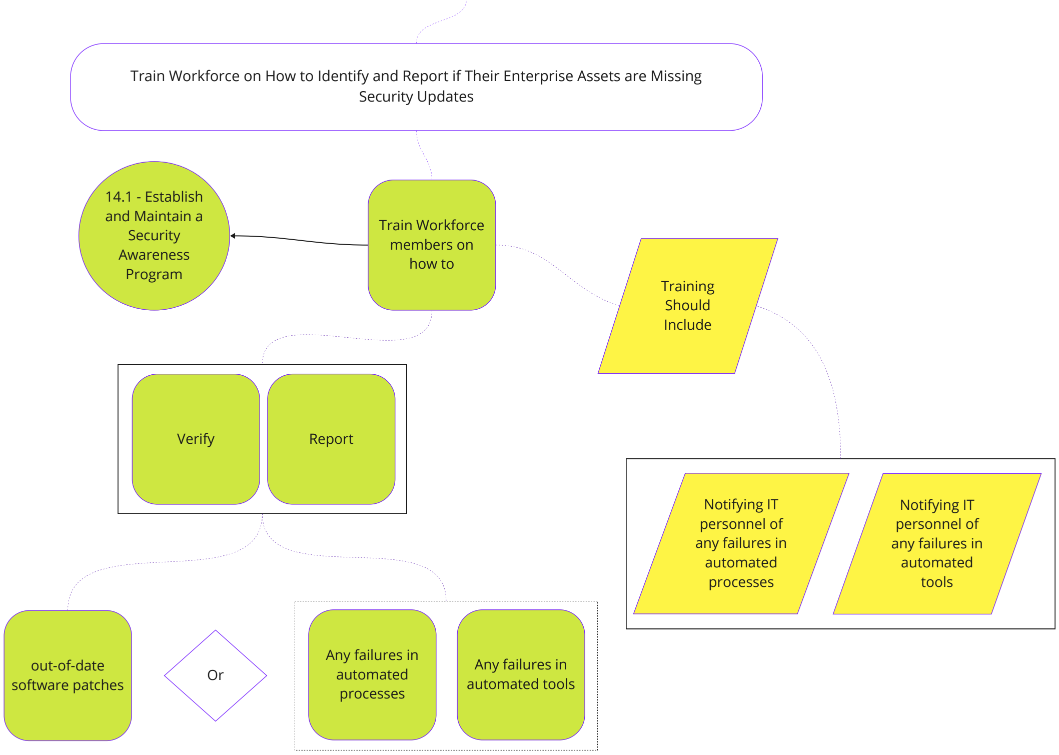
Recognize a potential Security Incident

Report such an incident

Group Validated

14.7

Train workforce to understand how to verify and report out-of-date software patches or any failures in automated processes and tools. Part of this training should include notifying IT personnel of any failures in automated processes and tools.



Train Workforce on How to Identify and Report if Their Enterprise Assets are Missing Security Updates

Train Workforce members on how to

14.1 - Establish and Maintain a Security Awareness Program

Verify

Report

out-of-date software patches

Or

Any failures in automated processes

Any failures in automated tools

Training Should Include

Notifying IT personnel of any failures in automated processes

Notifying IT personnel of any failures in automated tools

IG1

Protect

Users

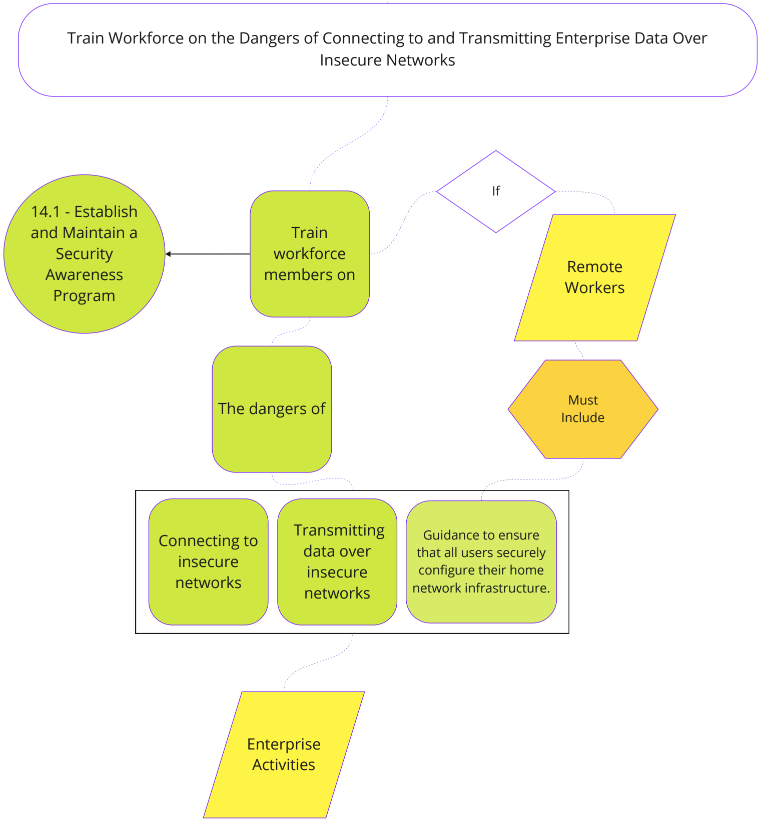
Security Training

Security Training and Awareness Tool(s)

Group Validated

14.8

Train workforce members on the dangers of connecting to, and transmitting data over, insecure networks for enterprise activities. If the enterprise has remote workers, training must include guidance to ensure that all users securely configure their home network infrastructure.



Train Workforce on the Dangers of Connecting to and Transmitting Enterprise Data Over Insecure Networks

14.1 - Establish and Maintain a Security Awareness Program

Train workforce members on

If

Remote Workers

Must Include

The dangers of

Connecting to insecure networks

Transmitting data over insecure networks

Guidance to ensure that all users securely configure their home network infrastructure.

Enterprise Activities

IG1

Protect

Users

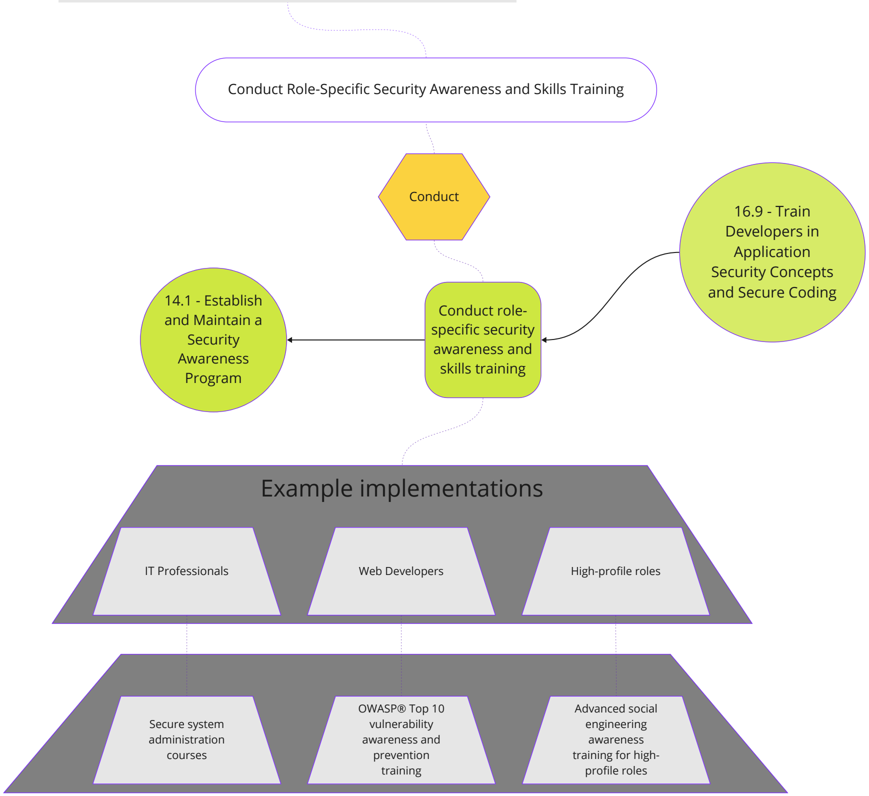
Security Training

Security Training and Awareness Tool(s)

Group Validated

14.9

Conduct role-specific security awareness and skills training. Example implementations include secure system administration courses for IT professionals, OWASP® Top 10 vulnerability awareness and prevention training for web application developers, and advanced social engineering awareness training for high-profile roles.



Conduct Role-Specific Security Awareness and Skills Training

Conduct

14.1 - Establish and Maintain a Security Awareness Program

Conduct role-specific security awareness and skills training

16.9 - Train Developers in Application Security Concepts and Secure Coding

Example implementations

IT Professionals

Web Developers

High-profile roles

Secure system administration courses

OWASP® Top 10 vulnerability awareness and prevention training

Advanced social engineering awareness training for high-profile roles

IG2

Protect

Users

Security Training

Security Training and Awareness Tool(s)

CONTROL 15

Service Provider Management

Safeguards: 7	IG1: 1/7	IG2: 4/7	IG3: 7/7

Overview

Develop a process to evaluate service providers who hold sensitive data, or are responsible for an enterprise's critical IT platforms or processes, to ensure these providers are protecting those platforms and data appropriately.

Group Validated

15.1

Establish and maintain an inventory of service providers. The inventory is to list all known service providers, include classification(s), and designate an enterprise contact for each service provider. Review and update the inventory annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

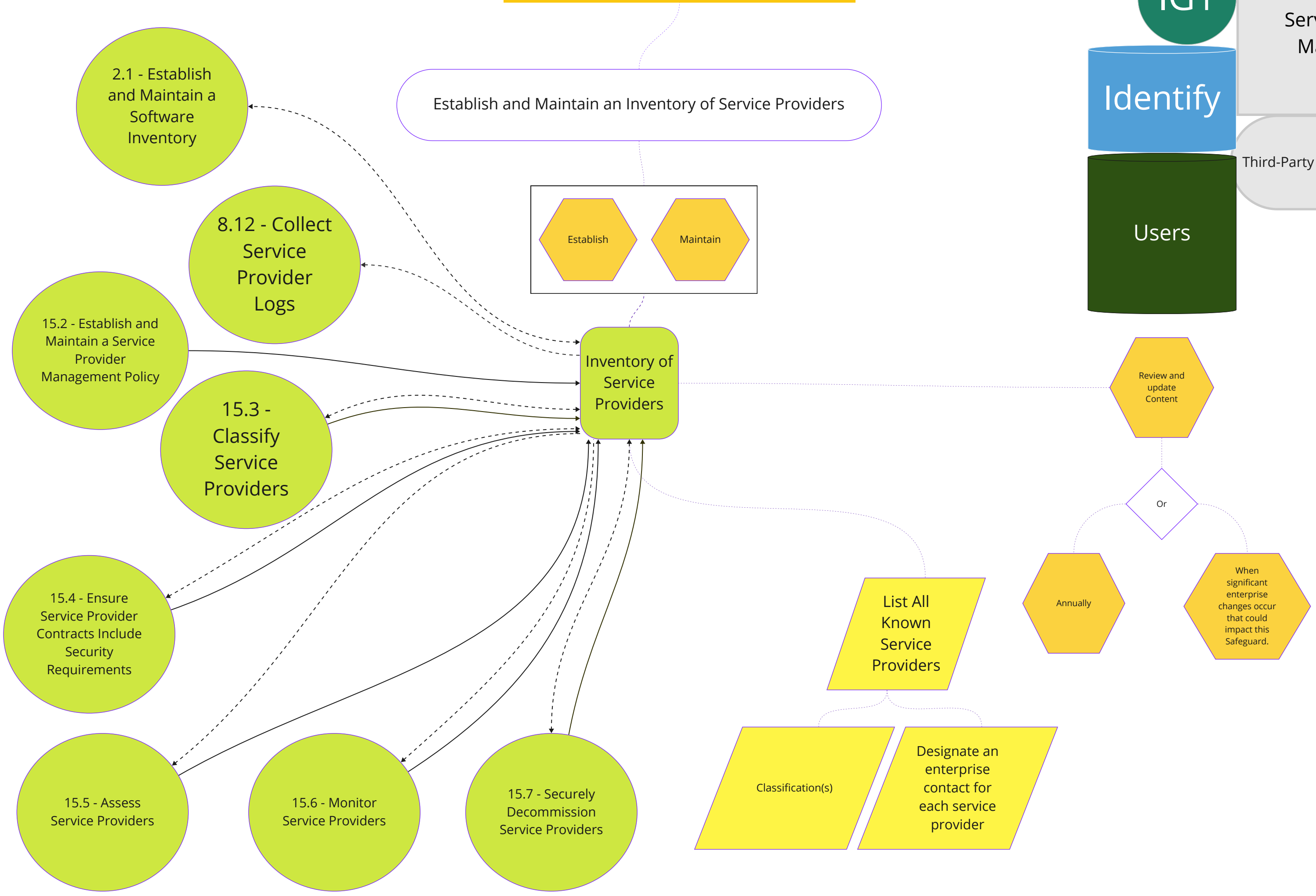
IG1

Service Provider Management

Identify

Users

Third-Party Risk Management Tool


Establish and Maintain an Inventory of Service Providers
Establish
Maintain
Inventory of Service Providers
2.1 - Establish and Maintain a Software Inventory
8.12 - Collect Service Provider Logs
15.2 - Establish and Maintain a Service Provider Management Policy
15.3 - Classify Service Providers
15.4 - Ensure Service Provider Contracts Include Security Requirements
15.5 - Assess Service Providers
15.6 - Monitor Service Providers
15.7 - Securely Decommission Service Providers
List All Known Service Providers
Classification(s)
Designate an enterprise contact for each service provider
Review and update Content
Or
Annually
When significant enterprise changes occur that could impact this Safeguard.

Group Validated

15.2

Establish and maintain a service provider management policy. Ensure the policy addresses the classification, inventory, assessment, monitoring, and decommissioning of service providers. Review and update the policy annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

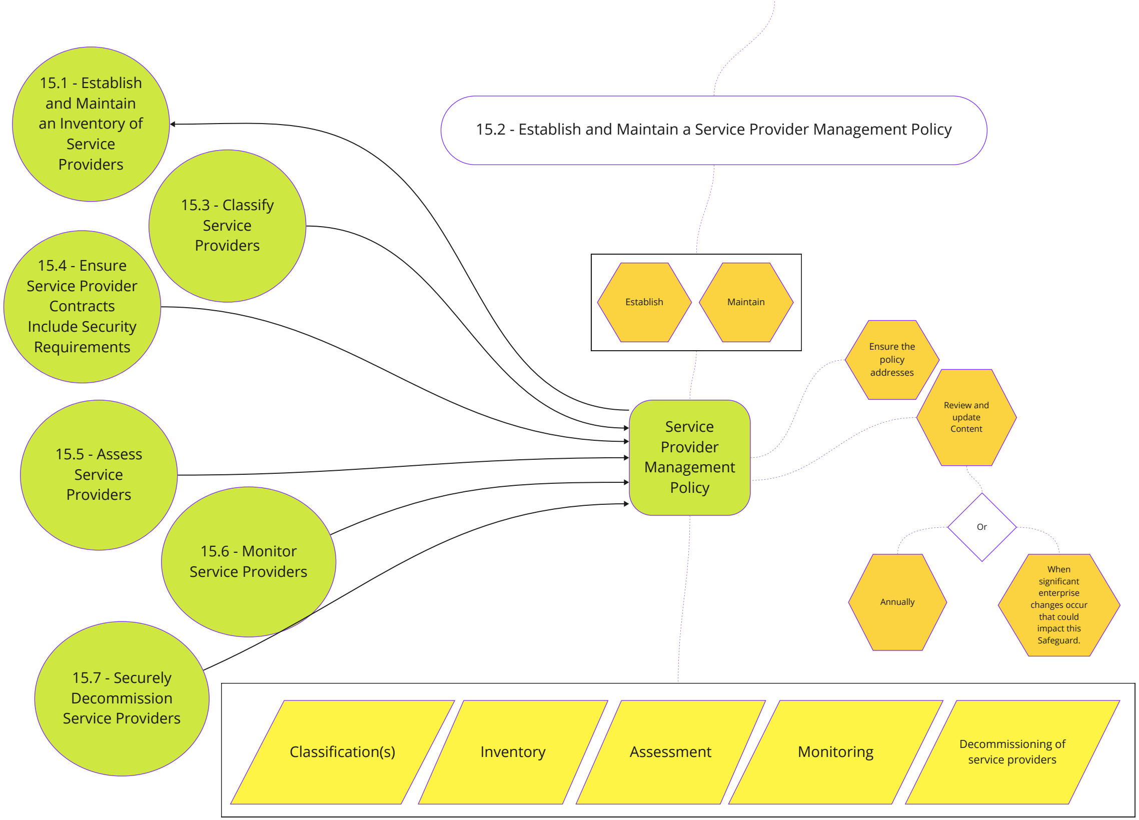
IG2

Service Provider Management

Govern

Service Provider Management Policy

Documentation



15.2 - Establish and Maintain a Service Provider Management Policy

15.1 - Establish and Maintain an Inventory of Service Providers

15.3 - Classify Service Providers

15.4 - Ensure Service Provider Contracts Include Security Requirements

15.5 - Assess Service Providers

15.6 - Monitor Service Providers

15.7 - Securely Decommission Service Providers

Establish

Maintain

Service Provider Management Policy

Ensure the policy addresses

Review and update Content

Or

Annually

When significant enterprise changes occur that could impact this Safeguard.

Classification(s)

Inventory

Assessment

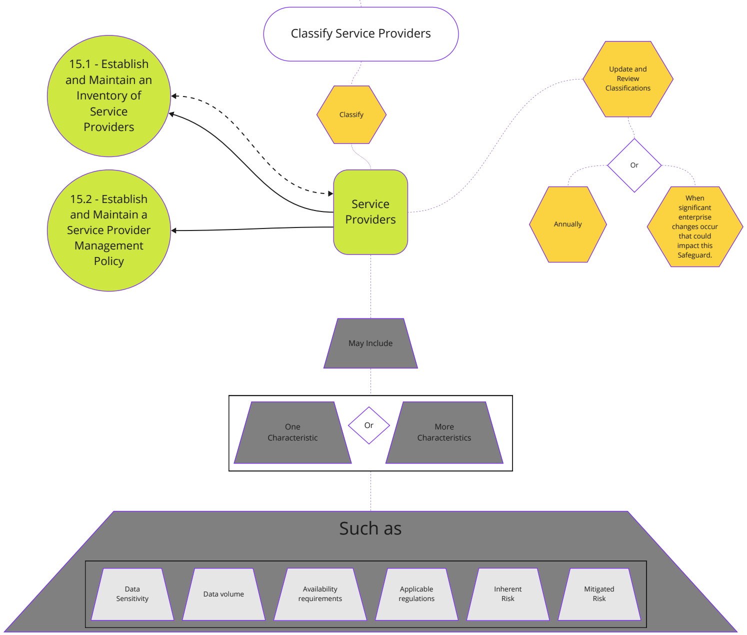
Monitoring

Decommissioning of service providers

Group Validated

15.3

Classify service providers. Classification consideration may include one or more characteristics, such as data sensitivity, data volume, availability requirements, applicable regulations, inherent risk, and mitigated risk. Update and review classifications annually, or when significant enterprise changes occur that could impact this Safeguard.



Classify Service Providers

Classify

Service Providers

15.1 - Establish and Maintain an Inventory of Service Providers

15.2 - Establish and Maintain a Service Provider Management Policy

Update and Review Classifications

Or

Annually

When significant enterprise changes occur that could impact this Safeguard.

May Include

One Characteristic

Or

More Characteristics

Such as

Data Sensitivity

Data volume

Availability requirements

Applicable regulations

Inherent Risk

Mitigated Risk

Process Oriented Safeguard

IG2

Service Provider Management

Govern

Users

Service Provider Management Policy

Group Validated

15.4

Ensure service provider contracts include security requirements. Example requirements may include minimum security program requirements, security incident and/or data breach notification and response, data encryption requirements, and data disposal commitments. These security requirements must be consistent with the enterprise's service provider management policy. Review service provider contracts annually to ensure contracts are not missing security requirements.

Process Oriented Safeguard

IG2

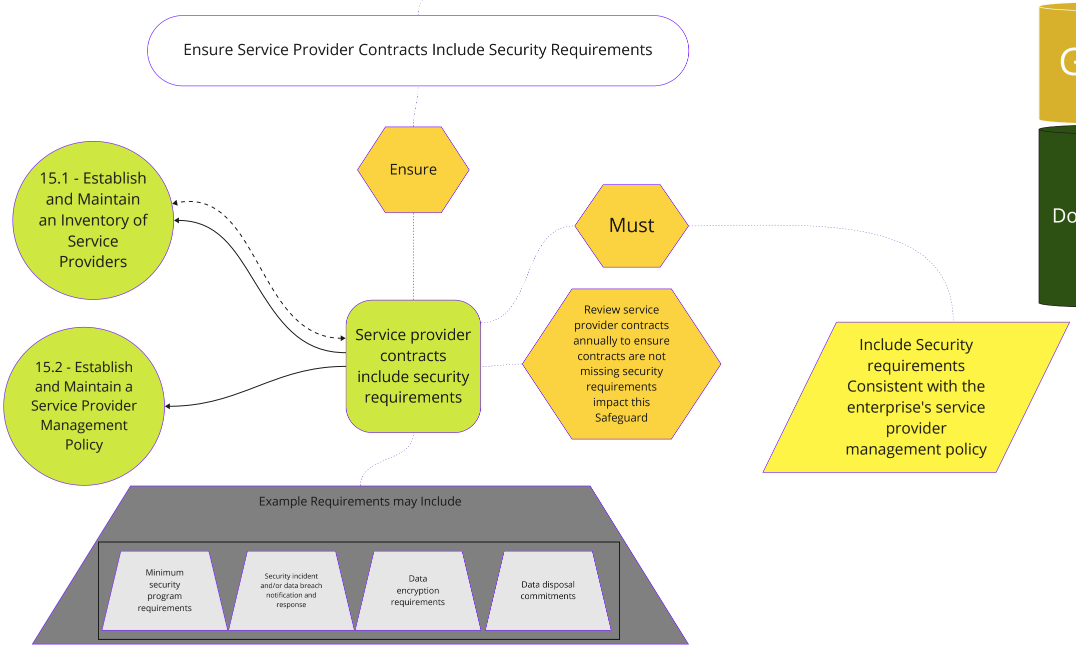
Service Provider Management

Govern

Documentation

Service Provider Management Policy

Contract Management

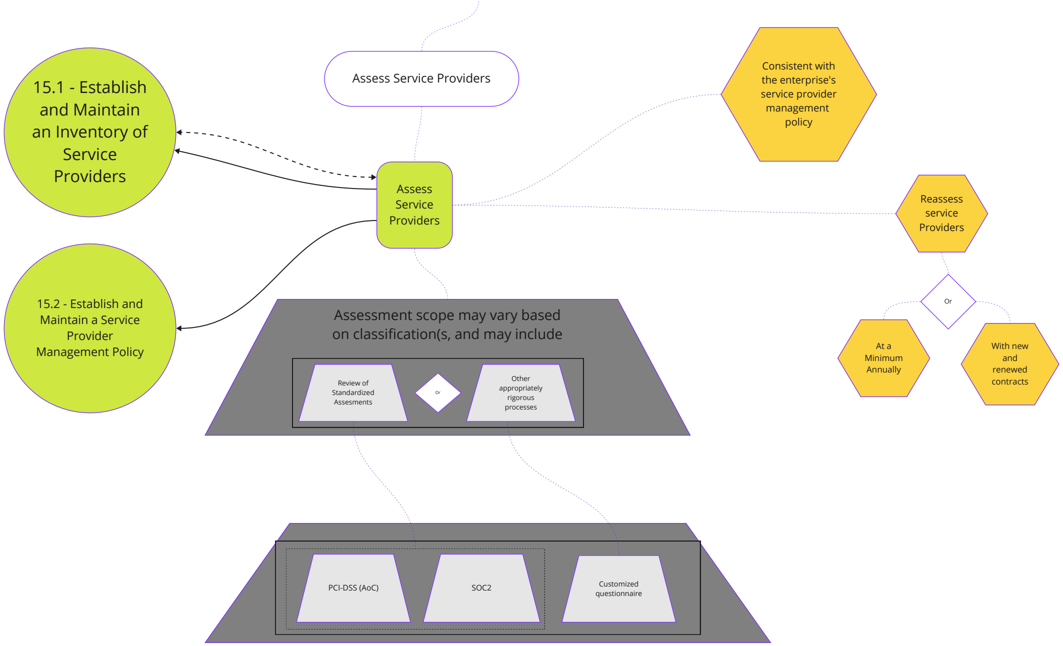


Ensure Service Provider Contracts Include Security Requirements
Ensure
Must
15.1 - Establish and Maintain an Inventory of Service Providers
15.2 - Establish and Maintain a Service Provider Management Policy
Service provider contracts include security requirements
Review service provider contracts annually to ensure contracts are not missing security requirements impact this Safeguard
Include Security requirements Consistent with the enterprise's service provider management policy
Example Requirements may Include
Minimum security program requirements
Security incident and/or data breach notification and response
Data encryption requirements
Data disposal commitments

Group Validated

15.5

Assess service providers consistent with the enterprise’s service provider management policy. Assessment scope may vary based on classification(s), and may include review of standardized assessment reports, such as Service Organization Control 2 (SOC 2) and Payment Card Industry (PCI) Attestation of Compliance (AoC), customized questionnaires, or other appropriately rigorous processes. Reassess service providers annually, at a minimum, or with new and renewed contracts.


Assess Service Providers
15.1 - Establish and Maintain an Inventory of Service Providers
Assess Service Providers
15.2 - Establish and Maintain a Service Provider Management Policy
Consistent with the enterprise's service provider management policy
Reassess service Providers
Or
At a Minimum Annually
With new and renewed contracts
Assessment scope may vary based on classification(s, and may include
Review of Standardized Assesments
Or
Other appropriately rigorous processes
PCI-DSS (AoC)
SOC2
Customized questionnaire

Process Oriented Safeguard

IG3

Service Provider Management

Govern

Users

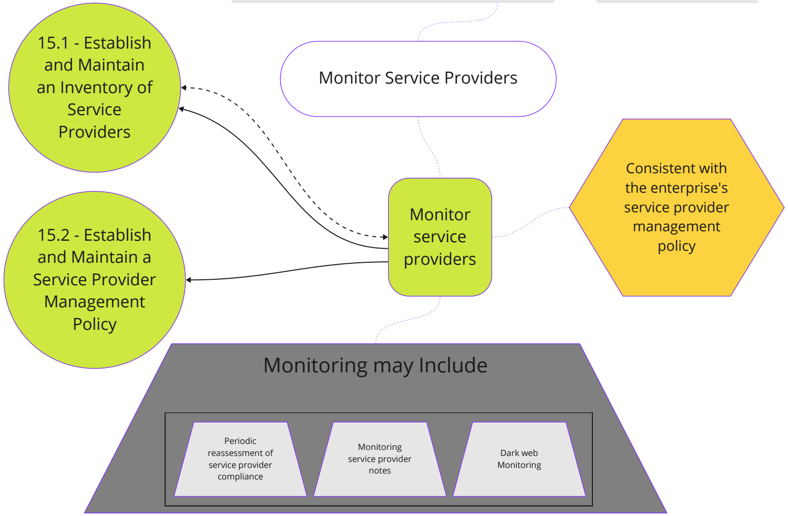
Service Provider Management Policy

Third-Party Risk Management Tool

Group Validated

15.6

Monitor service providers consistent with the enterprise’s service provider management policy. Monitoring may include periodic reassessment of service provider compliance, monitoring service provider release notes, and dark web monitoring.



Monitor Service Providers

15.1 - Establish and Maintain an Inventory of Service Providers

15.2 - Establish and Maintain a Service Provider Management Policy

Monitor service providers

Consistent with the enterprise's service provider management policy

Monitoring may Include

Periodic reassessment of service provider compliance

Monitoring service provider notes

Dark web Monitoring

Process Oriented Safeguard

IG3

Service Provider Management

Govern

Data

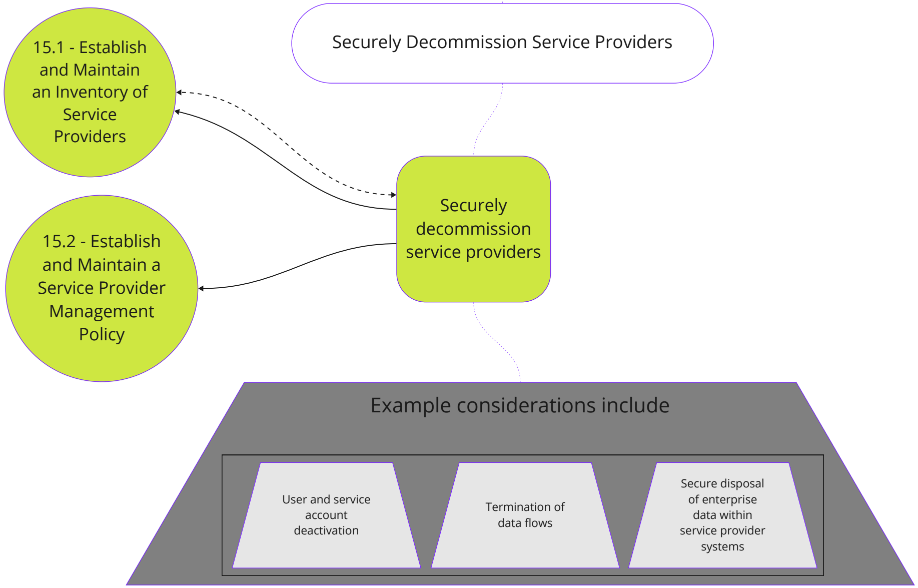
Service Provider Management Policy

Third-Party Risk Management Tool

Group Validated

15.7

Securely decommission service providers. Example considerations include user and service account deactivation, termination of data flows, and secure disposal of enterprise data within service provider systems.



Securely Decommission Service Providers

15.1 - Establish and Maintain an Inventory of Service Providers

15.2 - Establish and Maintain a Service Provider Management Policy

Securely decommission service providers

Example considerations include

User and service account deactivation

Termination of data flows

Secure disposal of enterprise data within service provider systems

Process Oriented Safeguard

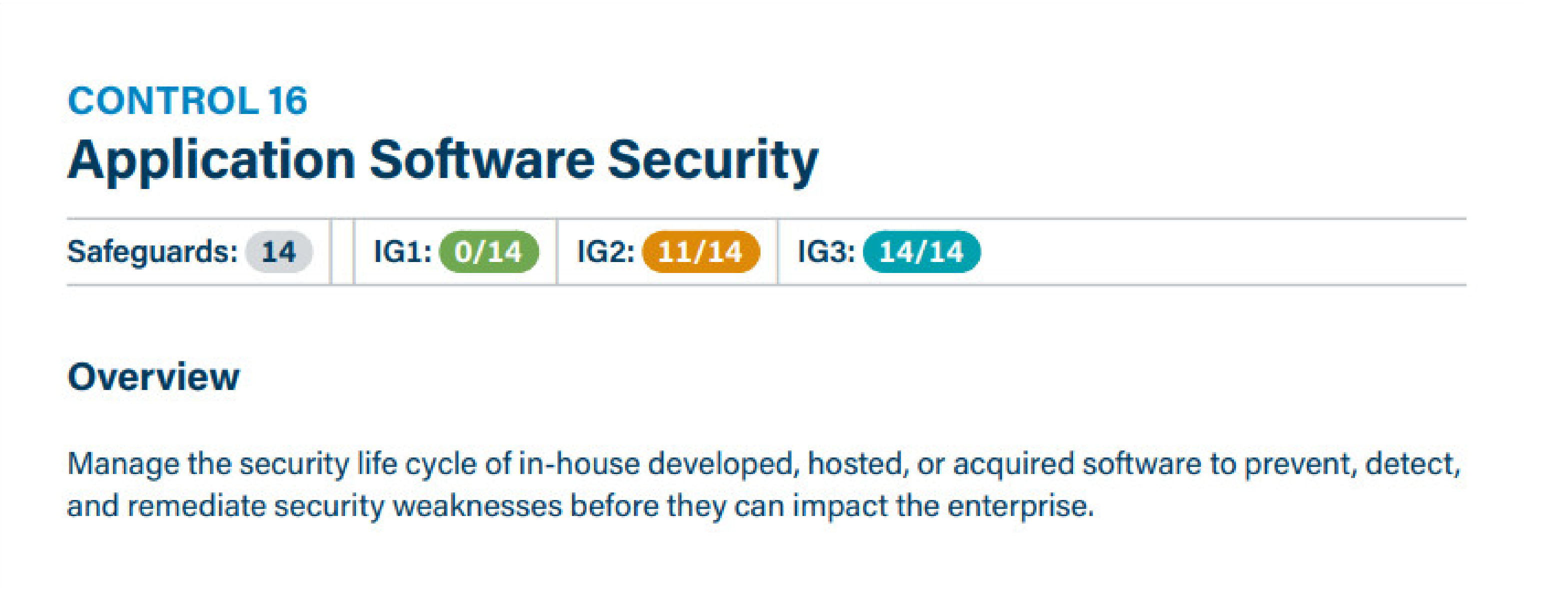
IG3

Protect

Data

Service Provider Management

Service Provider Management Policy



CONTROL 16

Application Software Security

Safeguards: 14	IG1: 0/14	IG2: 11/14	IG3: 14/14

Overview

Manage the security life cycle of in-house developed, hosted, or acquired software to prevent, detect, and remediate security weaknesses before they can impact the enterprise.

Group Validated

16.1

Process Oriented Safeguard

IG2

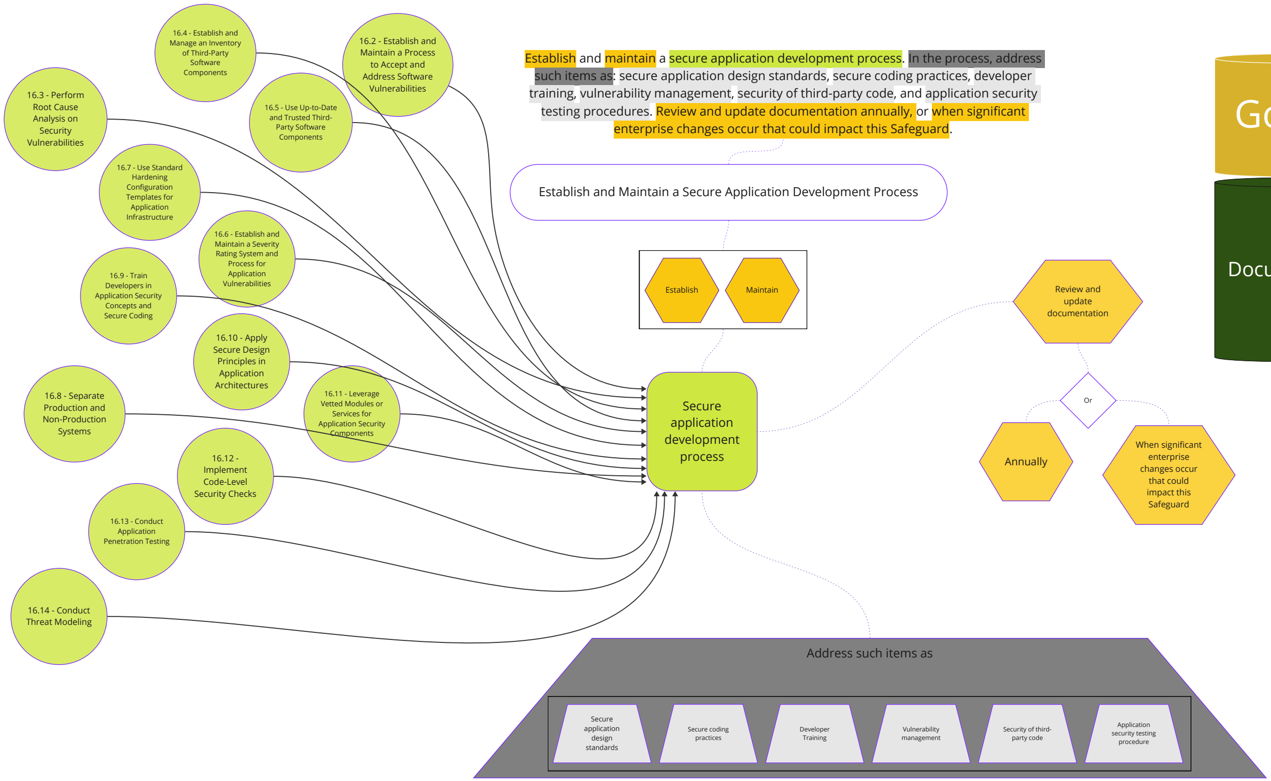
Secure Application Deveplopment

Govern

Secure Application Development Policy / Process

Documentation

Establish and maintain a secure application development process. In the process, address such items as: secure application design standards, secure coding practices, developer training, vulnerability management, security of third-party code, and application security testing procedures. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.



16.4 - Establish and Manage an Inventory of Third-Party Software Components
16.2 - Establish and Maintain a Process to Accept and Address Software Vulnerabilities
16.3 - Perform Root Cause Analysis on Security Vulnerabilities
16.5 - Use Up-to-Date and Trusted Third-Party Software Components
16.7 - Use Standard Hardening Configuration Templates for Application Infrastructure
16.6 - Establish and Maintain a Severity Rating System and Process for Application Vulnerabilities
16.9 - Train Developers in Application Security Concepts and Secure Coding
16.10 - Apply Secure Design Principles in Application Architectures
16.8 - Separate Production and Non-Production Systems
16.11 - Leverage Vetted Modules or Services for Application Security Components
16.12 - Implement Code-Level Security Checks
16.13 - Conduct Application Penetration Testing
16.14 - Conduct Threat Modeling
Establish and Maintain a Secure Application Development Process
Establish
Maintain
Secure application development process
Review and update documentation
Or
Annually
When significant enterprise changes occur that could impact this Safeguard
Address such items as
Secure application design standards
Secure coding practices
Developer Training
Vulnerability management
Security of third-party code
Application security testing procedure

Group Validated

16.2

Process Oriented Safeguard

IG2

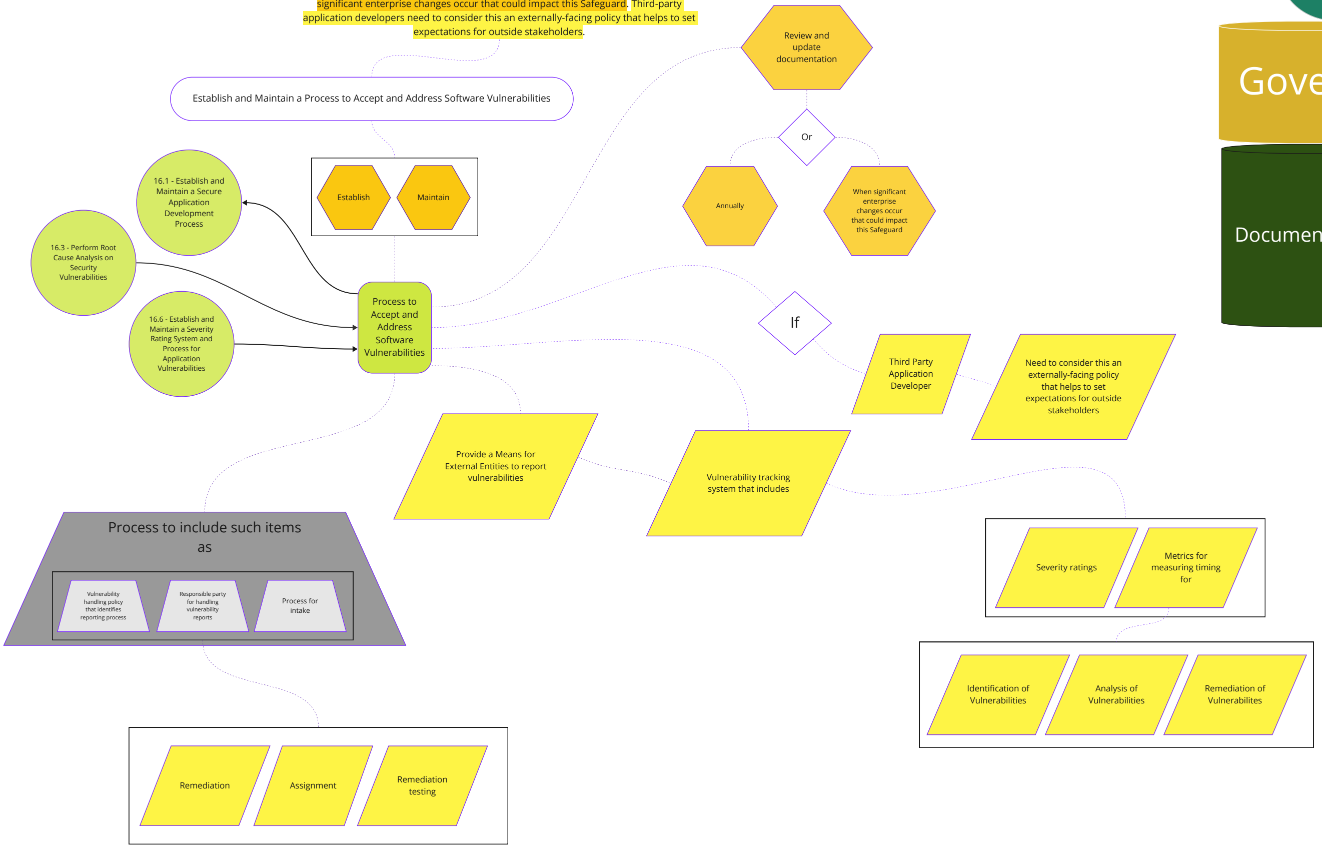
Secure Application Development

Govern

Documentation

Software Development Vulnerability Policy / Process

Establish and maintain a process to accept and address reports of software vulnerabilities, including providing a means for external entities to report. The process is to include such items as: a vulnerability handling policy that identifies reporting process, responsible party for handling vulnerability reports, and a process for intake, assignment, remediation, and remediation testing. As part of the process, use a vulnerability tracking system that includes severity ratings, and metrics for measuring timing for identification, analysis, and remediation of vulnerabilities. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard. Third-party application developers need to consider this an externally-facing policy that helps to set expectations for outside stakeholders.



Establish and Maintain a Process to Accept and Address Software Vulnerabilities

Establish

Maintain

Process to Accept and Address Software Vulnerabilities

16.1 - Establish and Maintain a Secure Application Development Process

16.3 - Perform Root Cause Analysis on Security Vulnerabilities

16.6 - Establish and Maintain a Severity Rating System and Process for Application Vulnerabilities

Review and update documentation

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

If

Third Party Application Developer

Need to consider this an externally-facing policy that helps to set expectations for outside stakeholders

Provide a Means for External Entities to report vulnerabilities

Vulnerability tracking system that includes

Severity ratings

Metrics for measuring timing for

Identification of Vulnerabilities

Analysis of Vulnerabilities

Remediation of Vulnerabilites

Process to include such items as

Vulnerability handling policy that identifies reporting process

Responsible party for handling vulnerability reports

Process for intake

Remediation

Assignment

Remediation testing

Group Validated

16.3

Perform root cause analysis on security vulnerabilities. When reviewing vulnerabilities, root cause analysis is the task of evaluating underlying issues that create vulnerabilities in code, and allows development teams to move beyond just fixing individual vulnerabilities as they arise.

Process Oriented Safeguard

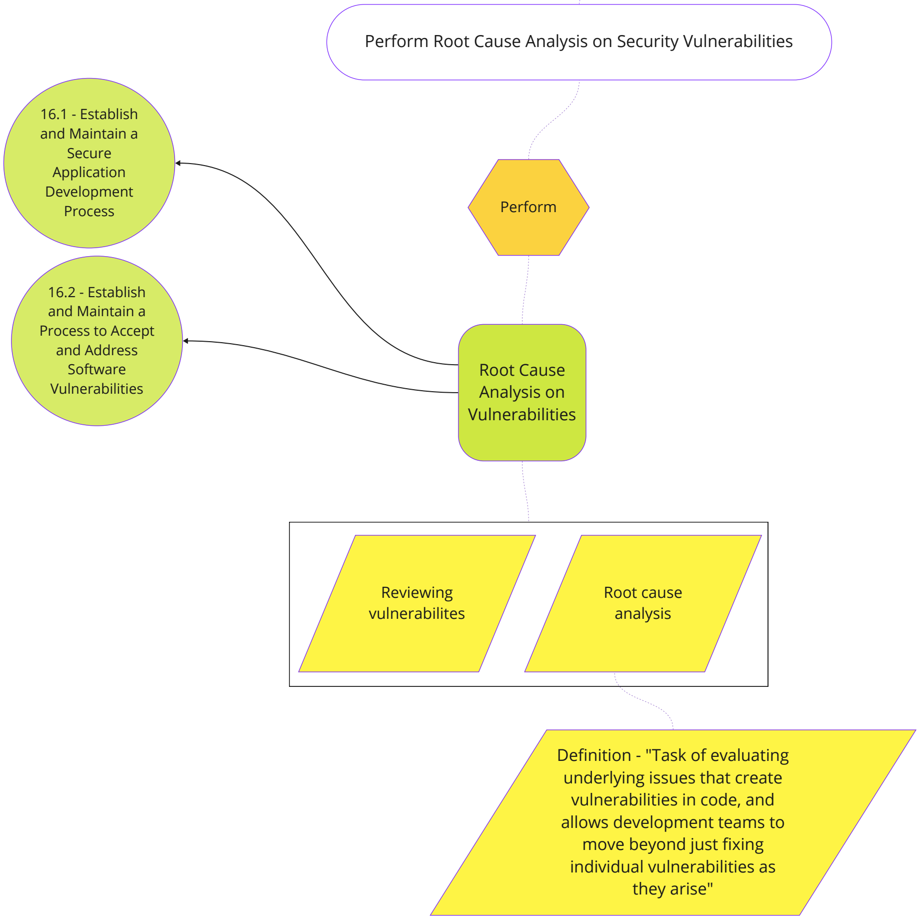
IG2

Secure Application Development

Protect

Software Development Vulnerability Policy / Process

Software



Perform Root Cause Analysis on Security Vulnerabilities

Perform

Root Cause Analysis on Vulnerabilities

16.1 - Establish and Maintain a Secure Application Development Process

16.2 - Establish and Maintain a Process to Accept and Address Software Vulnerabilities

Reviewing vulnerabilites

Root cause analysis

Definition - "Task of evaluating underlying issues that create vulnerabilities in code, and allows development teams to move beyond just fixing individual vulnerabilities as they arise"

Group Validated

16.4

Establish and manage an updated inventory of third-party components used in development, often referred to as a "bill of materials," as well as components slated for future use. This inventory is to include any risks that each third-party component could pose. Evaluate the list at least monthly to identify any changes or updates to these components, and validate that the component is still supported.

Process Oriented Safeguard

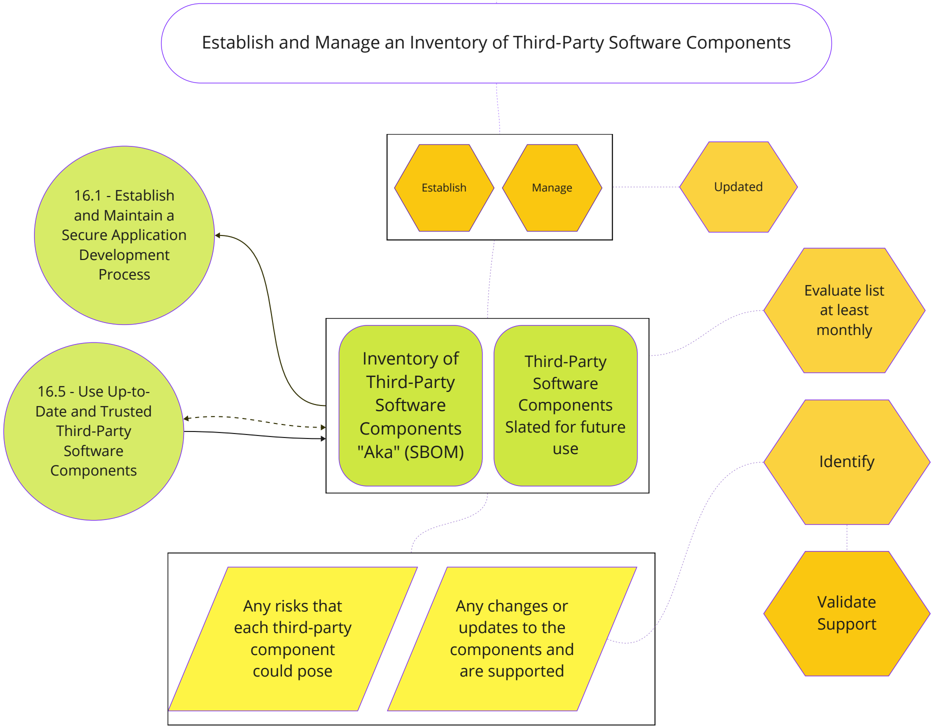
IG2

Secure Application Development

Identify

Software Composition Analysis (SCA) Tool

Software



Establish and Manage an Inventory of Third-Party Software Components

Establish

Manage

Updated

16.1 - Establish and Maintain a Secure Application Development Process

16.5 - Use Up-to-Date and Trusted Third-Party Software Components

Inventory of Third-Party Software Components "Aka" (SBOM)

Third-Party Software Components Slated for future use

Evaluate list at least monthly

Identify

Validate Support

Any risks that each third-party component could pose

Any changes or updates to the components and are supported

Group Validated

16.5

Use up-to-date and trusted third-party software components. When possible, choose established and proven frameworks and libraries that provide adequate security. Acquire these components from trusted sources or evaluate the software for vulnerabilities before use.

Process Oriented Safeguard

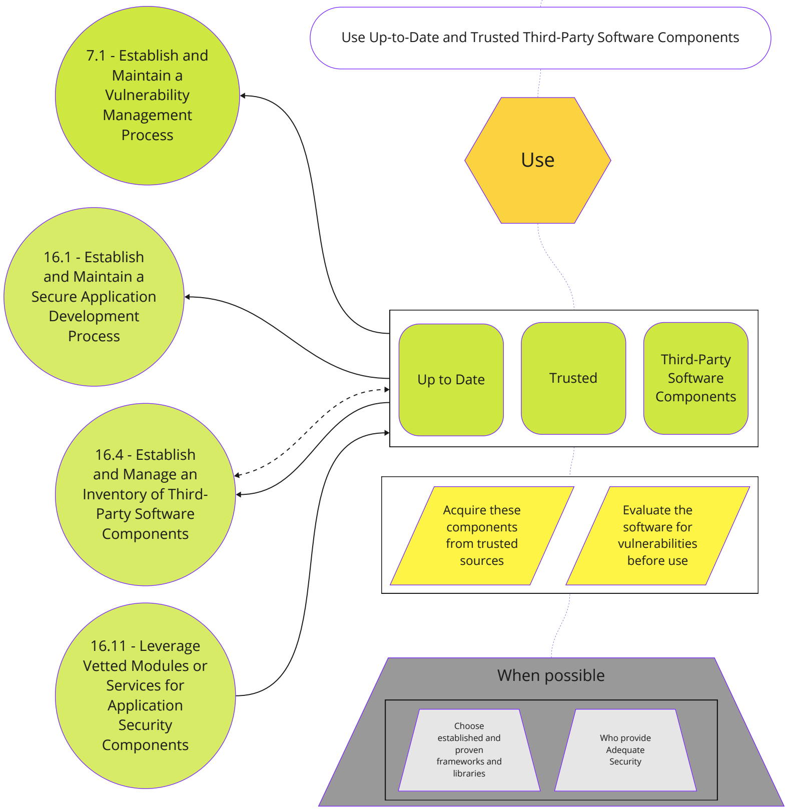
IG2

Secure Application Development

Protect

Software

Software Composition Analysis (SCA) Tool



Use Up-to-Date and Trusted Third-Party Software Components

Use

Up to Date

Trusted

Third-Party Software Components

Acquire these components from trusted sources

Evaluate the software for vulnerabilities before use

When possible

Choose established and proven frameworks and libraries

Who provide Adequate Security

7.1 - Establish and Maintain a Vulnerability Management Process

16.1 - Establish and Maintain a Secure Application Development Process

16.4 - Establish and Manage an Inventory of Third-Party Software Components

16.11 - Leverage Vetted Modules or Services for Application Security Components

Group Validated

16.6

Establish and maintain a severity rating system and process for application vulnerabilities that facilitates prioritizing the order in which discovered vulnerabilities are fixed. This process includes setting a minimum level of security acceptability for releasing code or applications. Severity ratings bring a systematic way of triaging vulnerabilities that improves risk management and helps ensure the most severe bugs are fixed first. Review and update the system and process annually.

Process Oriented Safeguard

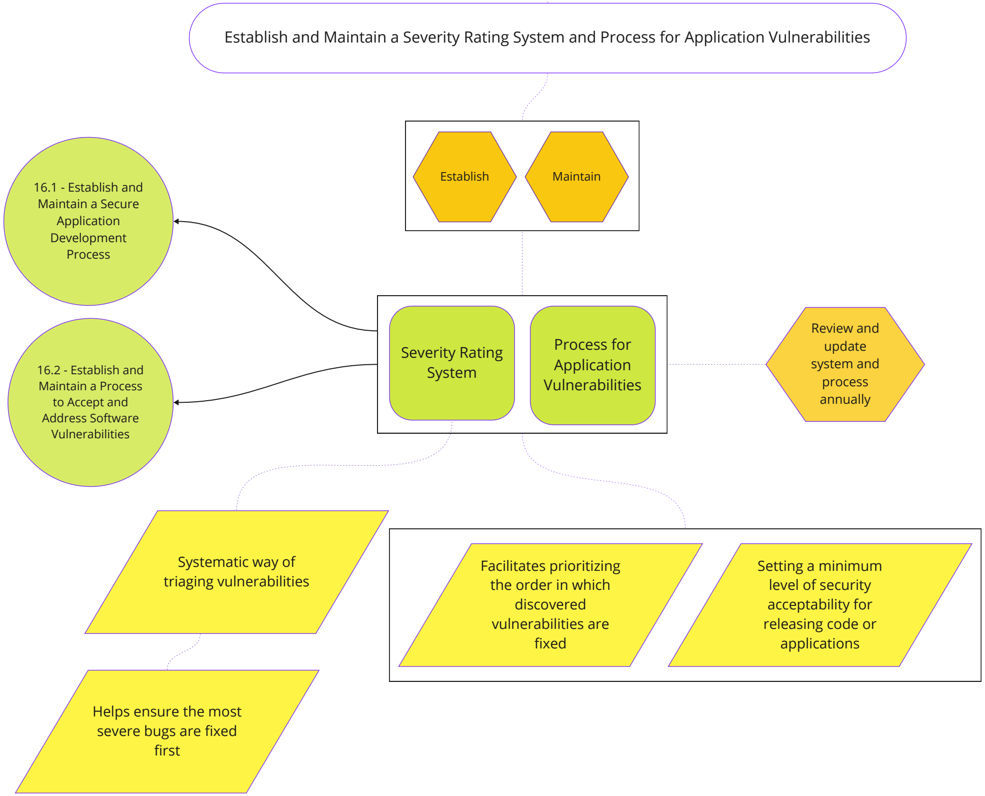
IG2

Secure Application Development

Govern

Documentation

Software Development Vulnerability Policy / Process



Establish and Maintain a Severity Rating System and Process for Application Vulnerabilities

Establish

Maintain

16.1 - Establish and Maintain a Secure Application Development Process

16.2 - Establish and Maintain a Process to Accept and Address Software Vulnerabilities

Severity Rating System

Process for Application Vulnerabilities

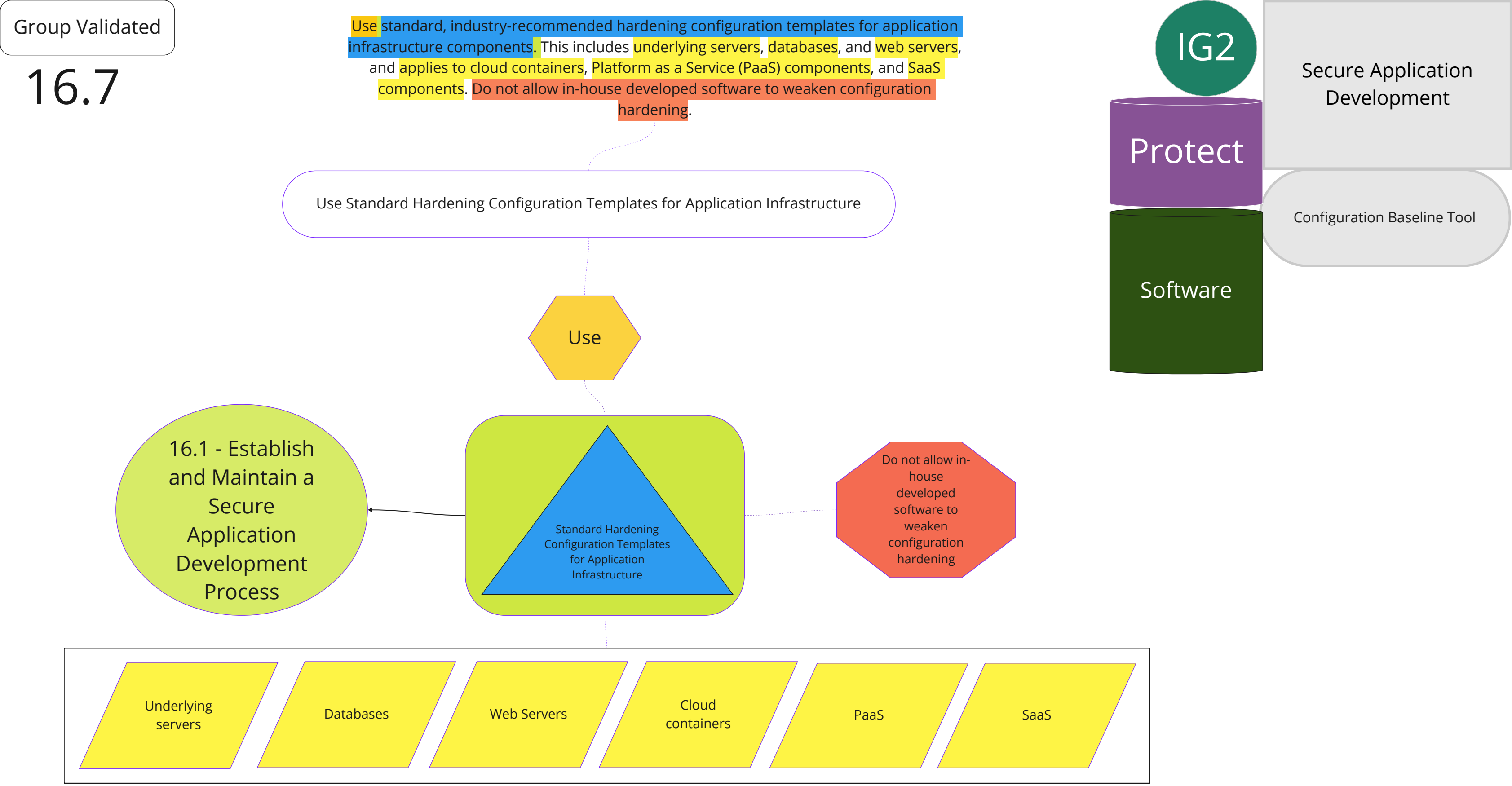
Review and update system and process annually

Systematic way of triaging vulnerabilities

Helps ensure the most severe bugs are fixed first

Facilitates prioritizing the order in which discovered vulnerabilities are fixed

Setting a minimum level of security acceptability for releasing code or applications



Group Validated

16.7

Use standard, industry-recommended hardening configuration templates for application infrastructure components. This includes underlying servers, databases, and web servers, and applies to cloud containers, Platform as a Service (PaaS) components, and SaaS components. Do not allow in-house developed software to weaken configuration hardening.

IG2

Secure Application Development

Protect

Configuration Baseline Tool

Software

Use Standard Hardening Configuration Templates for Application Infrastructure

Use

16.1 - Establish and Maintain a Secure Application Development Process

Standard Hardening Configuration Templates for Application Infrastructure

Do not allow in-house developed software to weaken configuration hardening

Underlying servers

Databases

Web Servers

Cloud containers

PaaS

SaaS

Group Validated

16.8

Maintain separate environments for production and non-production systems.

Process Oriented Safeguard

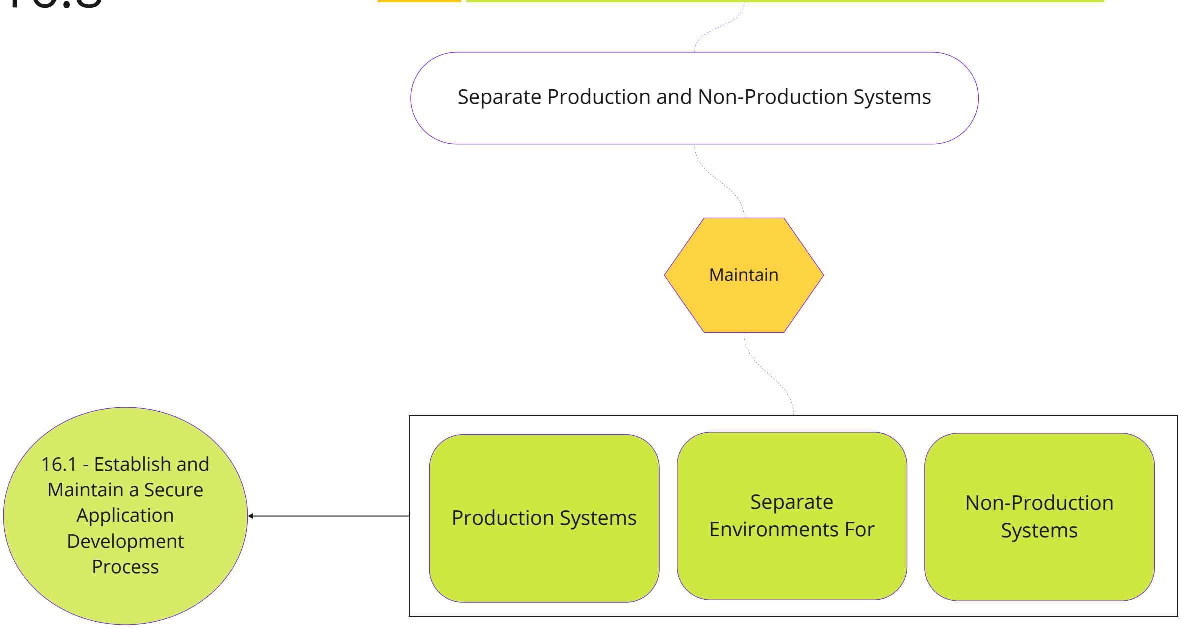
IG2

Secure Application Deveplopment

Protect

Secure Application Development Policy / Process

Network



Separate Production and Non-Production Systems

Maintain

Production Systems

Separate Environments For

Non-Production Systems

16.1 - Establish and Maintain a Secure Application Development Process

Group Validated

16.9

Ensure that all software development personnel receive training in writing secure code for their specific development environment and responsibilities. Training can include general security principles and application security standard practices. Conduct training at least annually and design in a way to promote security within the development team, and build a culture of security among the developers.

IG2

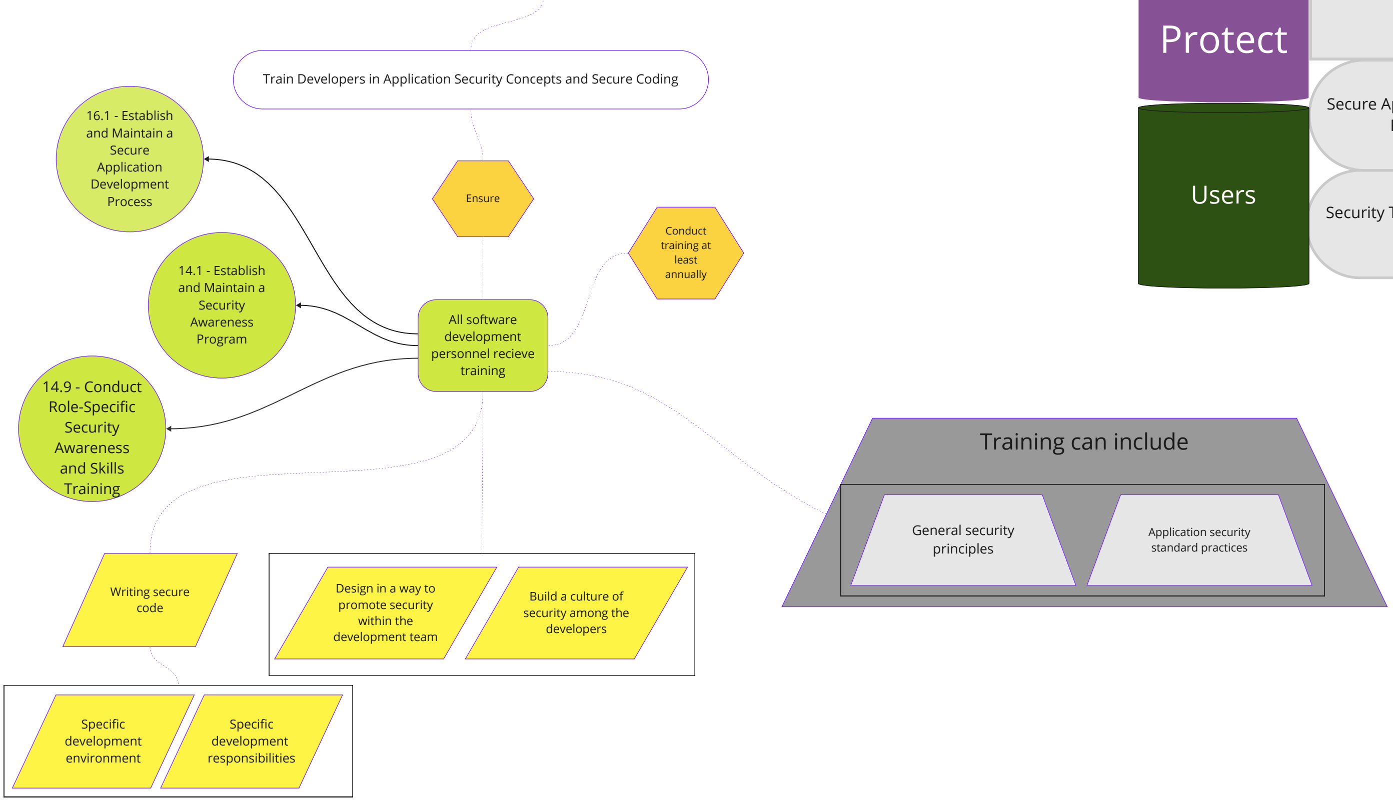
Protect

Users

Secure Application Development

Secure Application Development Policy / Process

Security Training and Awareness Tool(s)


Train Developers in Application Security Concepts and Secure Coding
Ensure
Conduct training at least annually
All software development personnel recieve training
16.1 - Establish and Maintain a Secure Application Development Process
14.1 - Establish and Maintain a Security Awareness Program
14.9 - Conduct Role-Specific Security Awareness and Skills Training
Writing secure code
Specific development environment
Specific development responsibilities
Design in a way to promote security within the development team
Build a culture of security among the developers
Training can include
General security principles
Application security standard practices

Group Validated

16.10

Apply secure design principles in application architectures. Secure design principles include the concept of least privilege and enforcing mediation to validate every operation that the user makes, promoting the concept of “never trust user input.” Examples include ensuring that explicit error checking is performed and documented for all input, including for size, data type, and acceptable ranges or formats. Secure design also means minimizing the application infrastructure attack surface, such as turning off unprotected ports and services, removing unnecessary programs and files, and renaming or removing default accounts.

Process Oriented Safeguard

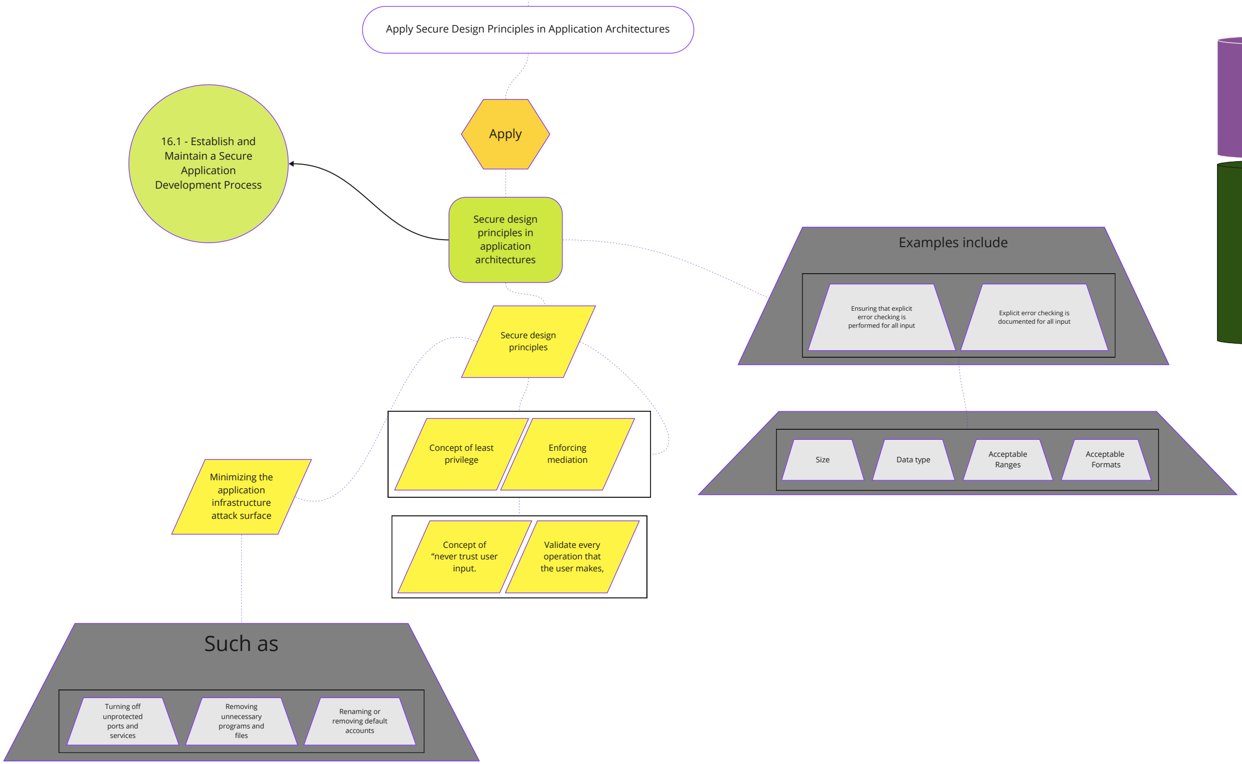
IG2

Secure Application Development

Protect

Secure Application Development Policy / Process

Software



Apply Secure Design Principles in Application Architectures

Apply

Secure design principles in application architectures

16.1 - Establish and Maintain a Secure Application Development Process

Secure design principles

Concept of least privilege

Enforcing mediation

Concept of “never trust user input.

Validate every operation that the user makes,

Minimizing the application infrastructure attack surface

Such as

Turning off unprotected ports and services

Removing unnecessary programs and files

Renaming or removing default accounts

Examples include

Ensuring that explicit error checking is performed for all input

Explicit error checking is documented for all input

Size

Data type

Acceptable Ranges

Acceptable Formats

Group Validated

16.11

Process Oriented Safeguard

IG2

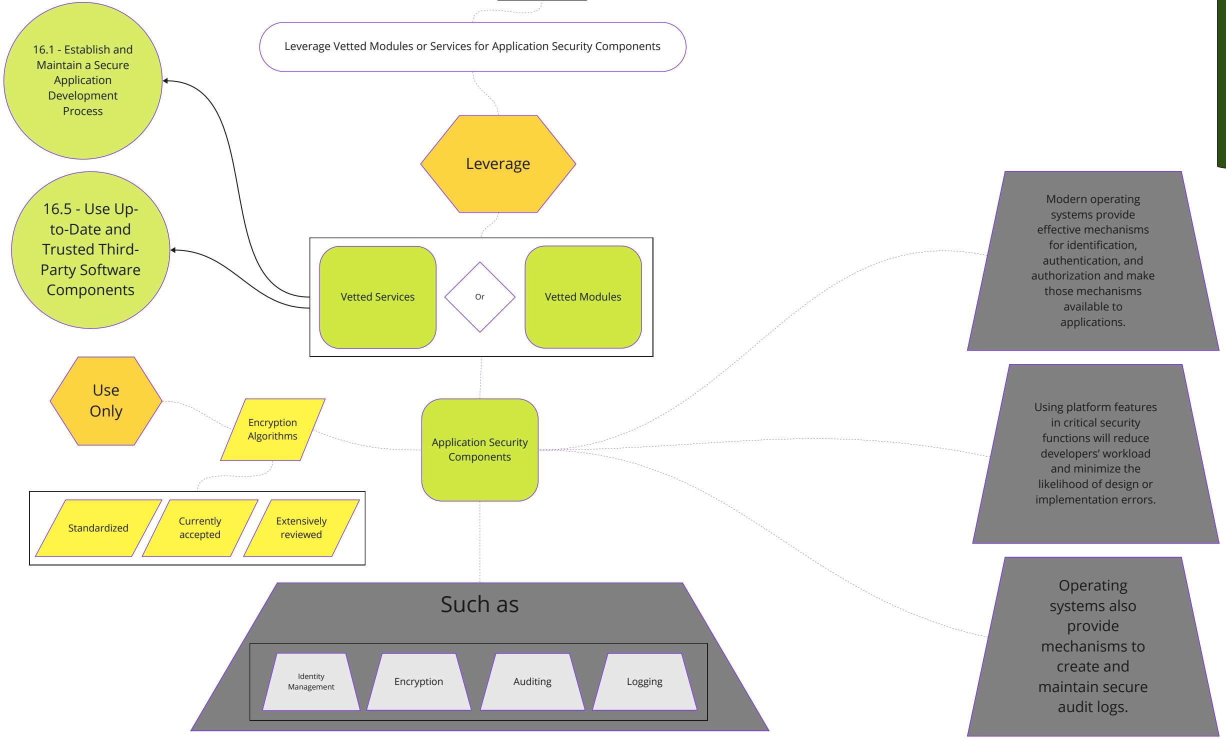
Secure Application Development

Identify

Software

Secure Application Development Policy / Process

Leverage vetted modules or services for application security components, such as identity management, encryption, and auditing and logging. Using platform features in critical security functions will reduce developers' workload and minimize the likelihood of design or implementation errors. Modern operating systems provide effective mechanisms for identification, authentication, and authorization and make those mechanisms available to applications. Use only standardized, currently accepted, and extensively reviewed encryption algorithms. Operating systems also provide mechanisms to create and maintain secure audit logs.



Leverage Vetted Modules or Services for Application Security Components

Leverage

Vetted Services

Or

Vetted Modules

16.1 - Establish and Maintain a Secure Application Development Process

16.5 - Use Up-to-Date and Trusted Third-Party Software Components

Use Only

Encryption Algorithms

Standardized

Currently accepted

Extensively reviewed

Application Security Components

Such as

Identity Management

Encryption

Auditing

Logging

Modern operating systems provide effective mechanisms for identification, authentication, and authorization and make those mechanisms available to applications.

Using platform features in critical security functions will reduce developers' workload and minimize the likelihood of design or implementation errors.

Operating systems also provide mechanisms to create and maintain secure audit logs.

Group Validated

16.12

Apply static and dynamic analysis tools within the application life cycle to verify that secure coding practices are being followed.

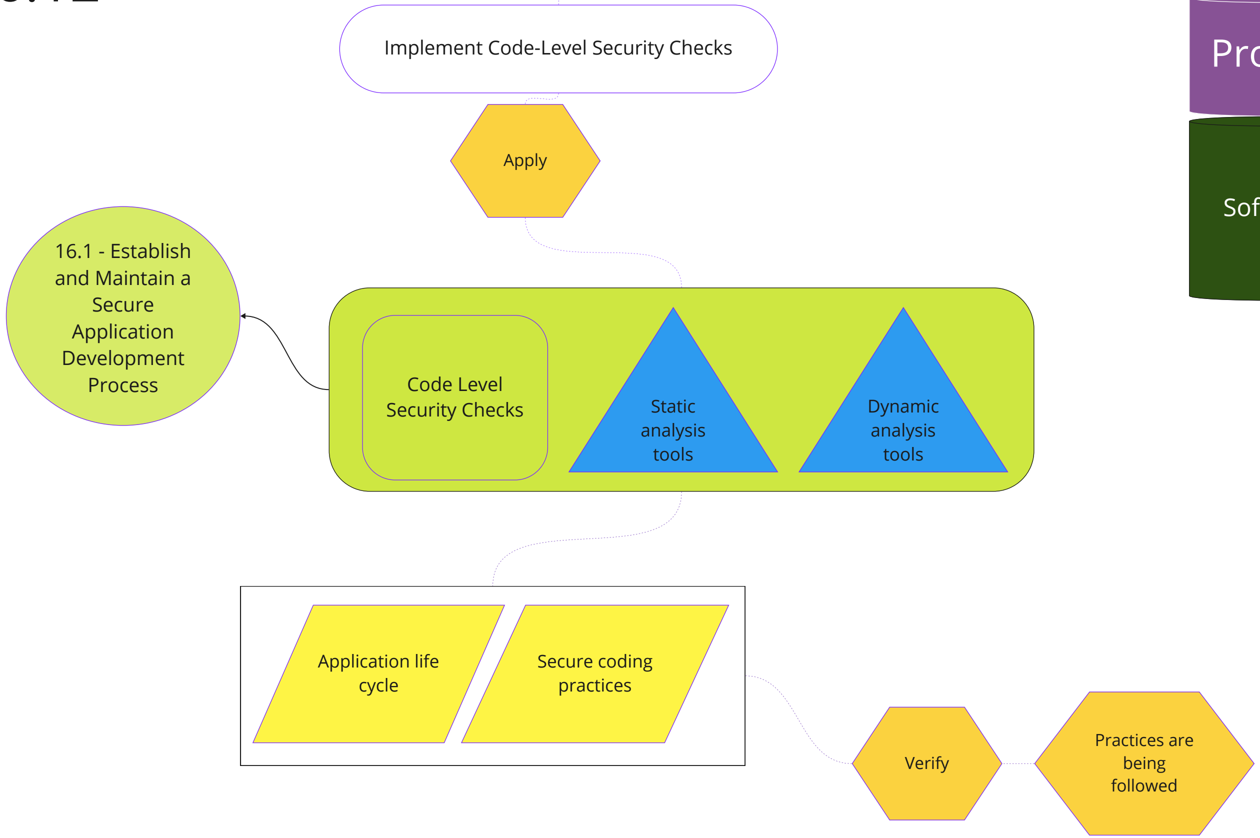
IG3

Secure Application Development

Protect

Code Analysis Tool

Software



Implement Code-Level Security Checks

Apply

16.1 - Establish and Maintain a Secure Application Development Process

Code Level Security Checks

Static analysis tools

Dynamic analysis tools

Application life cycle

Secure coding practices

Verify

Practices are being followed

Group Validated

16.13

IG3

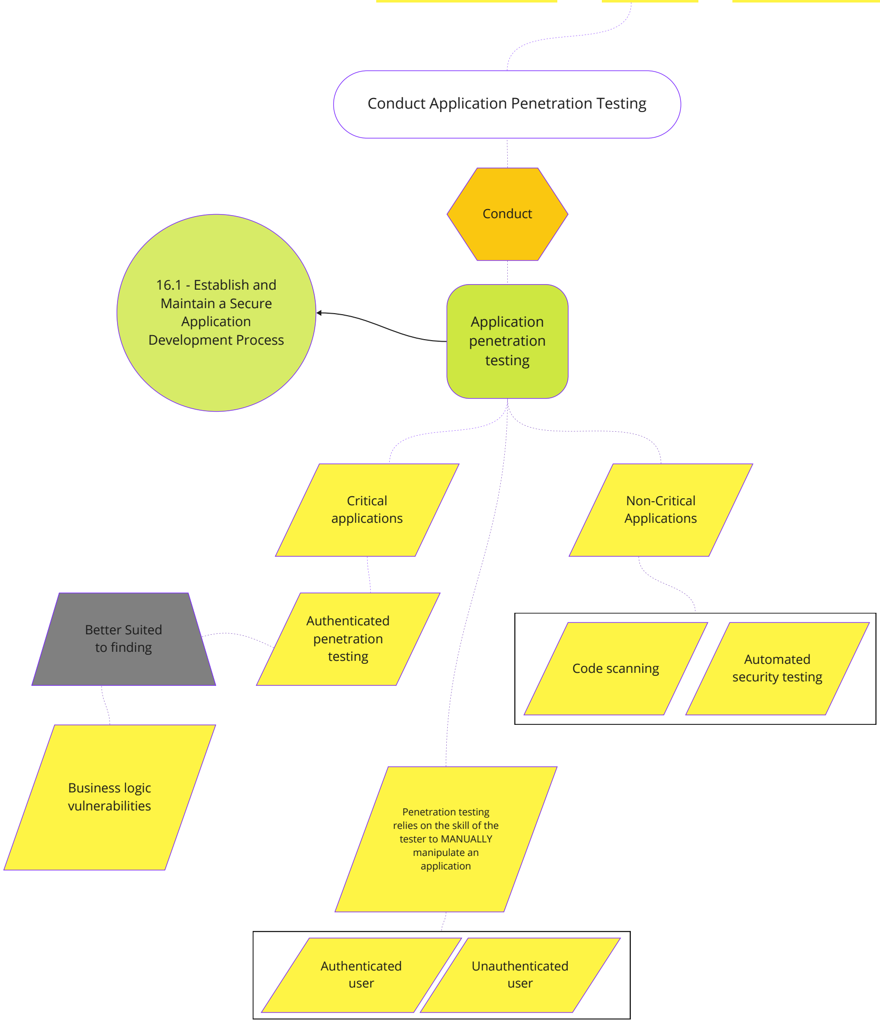
Detect

Software

Secure Application Development

Application Security Testing

Conduct application penetration testing. For critical applications, authenticated penetration testing is better suited to finding business logic vulnerabilities than code scanning and automated security testing. Penetration testing relies on the skill of the tester to manually manipulate an application as an authenticated and unauthenticated user.



Conduct Application Penetration Testing

Conduct

Application penetration testing

16.1 - Establish and Maintain a Secure Application Development Process

Critical applications

Non-Critical Applications

Authenticated penetration testing

Better Suited to finding

Business logic vulnerabilities

Code scanning

Automated security testing

Penetration testing relies on the skill of the tester to MANUALLY manipulate an application

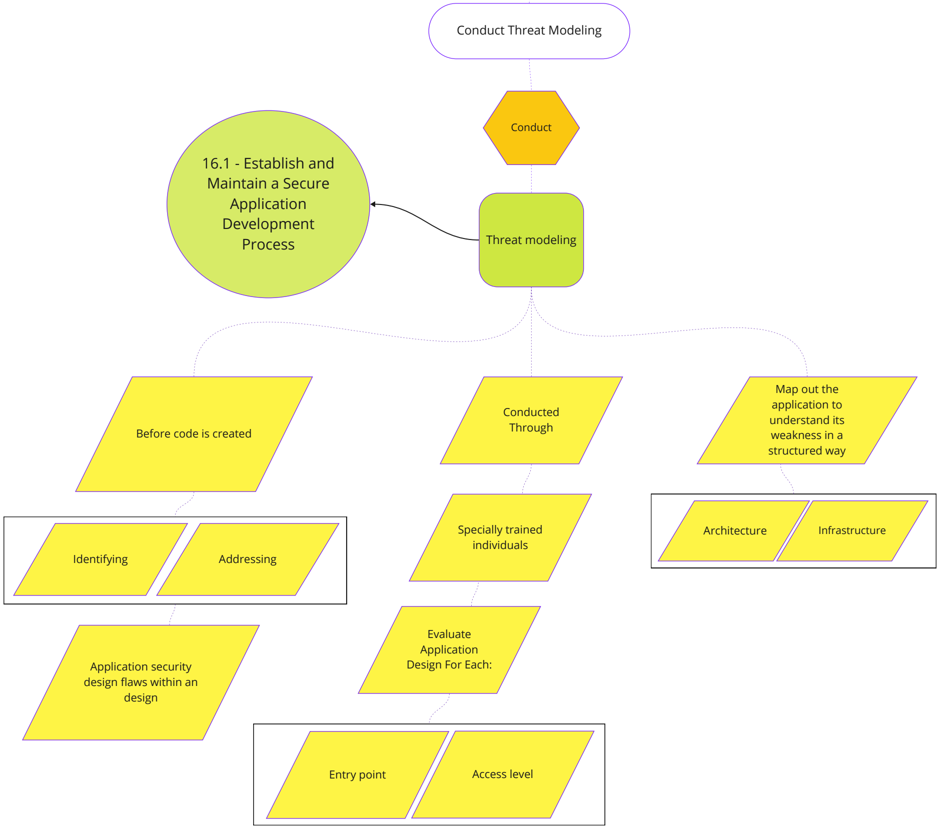
Authenticated user

Unauthenticated user

Group Validated

16.14

Conduct threat modeling. Threat modeling is the process of identifying and addressing application security design flaws within a design, before code is created. It is conducted through specially trained individuals who evaluate the application design and gauge security risks for each entry point and access level. The goal is to map out the application, architecture, and infrastructure in a structured way to understand its weaknesses.



Conduct Threat Modeling

Conduct

Threat modeling

16.1 - Establish and Maintain a Secure Application Development Process

Before code is created

Identifying

Addressing

Application security design flaws within an design

Conducted Through

Specially trained individuals

Evaluate Application Design For Each:

Entry point

Access level

Map out the application to understand its weakness in a structured way

Architecture

Infrastructure

Process Oriented Safeguard

IG3

Protect

Software

Secure Application Development

Secure Application Development Policy / Process

CONTROL 17

Incident Response Management

Safeguards: 9	IG1: 3/9	IG2: 8/9	IG3: 9/9

Overview

Establish a program to develop and maintain an incident response capability (e.g., policies, plans, procedures, defined roles, training, and communications) to prepare, detect, and quickly respond to an attack.

Group Validated

17.1

Designate one key person, and at least one backup, who will manage the enterprise’s incident handling process. Management personnel are responsible for the coordination and documentation of incident response and recovery efforts and can consist of employees internal to the enterprise, service providers, or a hybrid approach. If using a service provider, designate at least one person internal to the enterprise to oversee any third-party work. Review annually, or when significant enterprise changes occur that could impact this Safeguard.

Process Oriented Safeguard

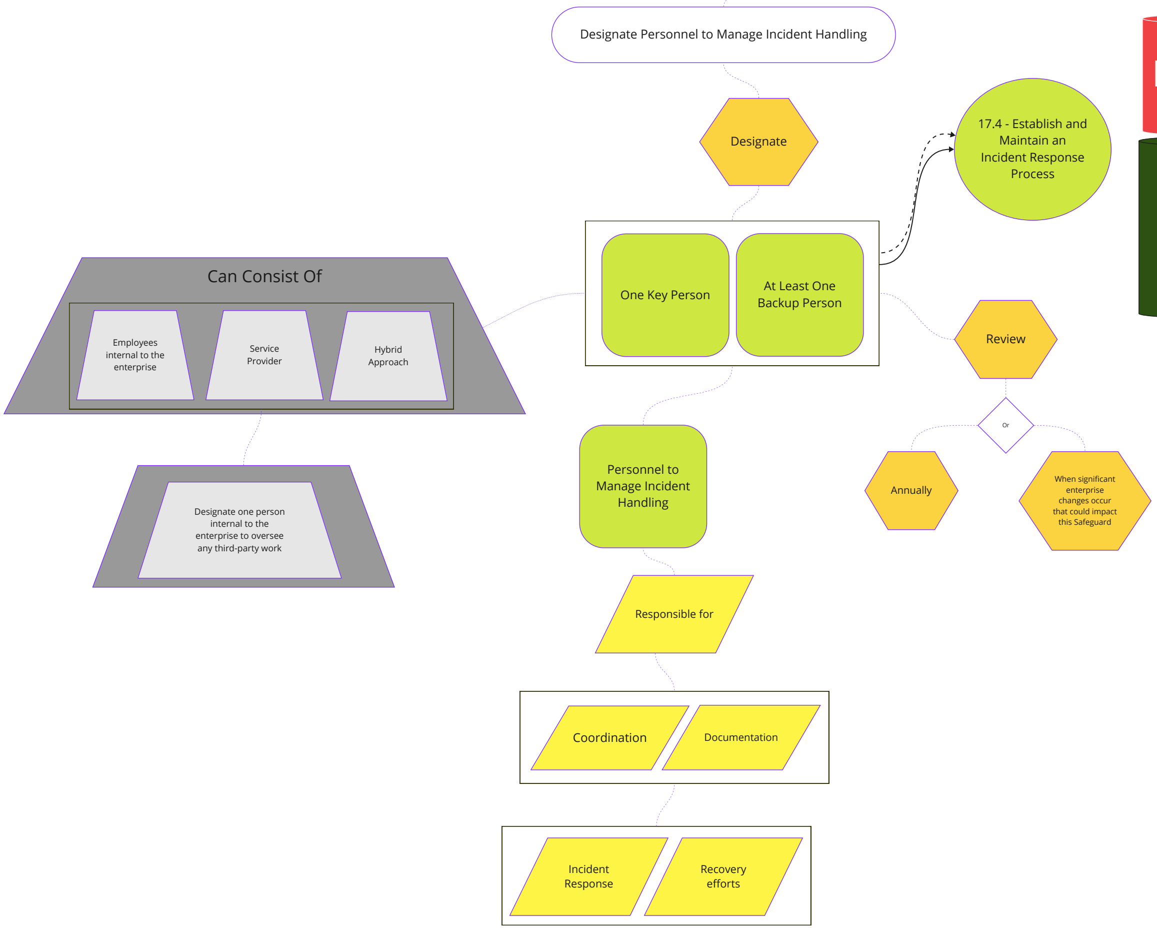
IG1

Incident Response

Respond

Incident Response Planning

Users



Designate Personnel to Manage Incident Handling

Designate

One Key Person

At Least One Backup Person

17.4 - Establish and Maintain an Incident Response Process

Can Consist Of

Employees internal to the enterprise

Service Provider

Hybrid Approach

Designate one person internal to the enterprise to oversee any third-party work

Review

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

Personnel to Manage Incident Handling

Responsible for

Coordination

Documentation

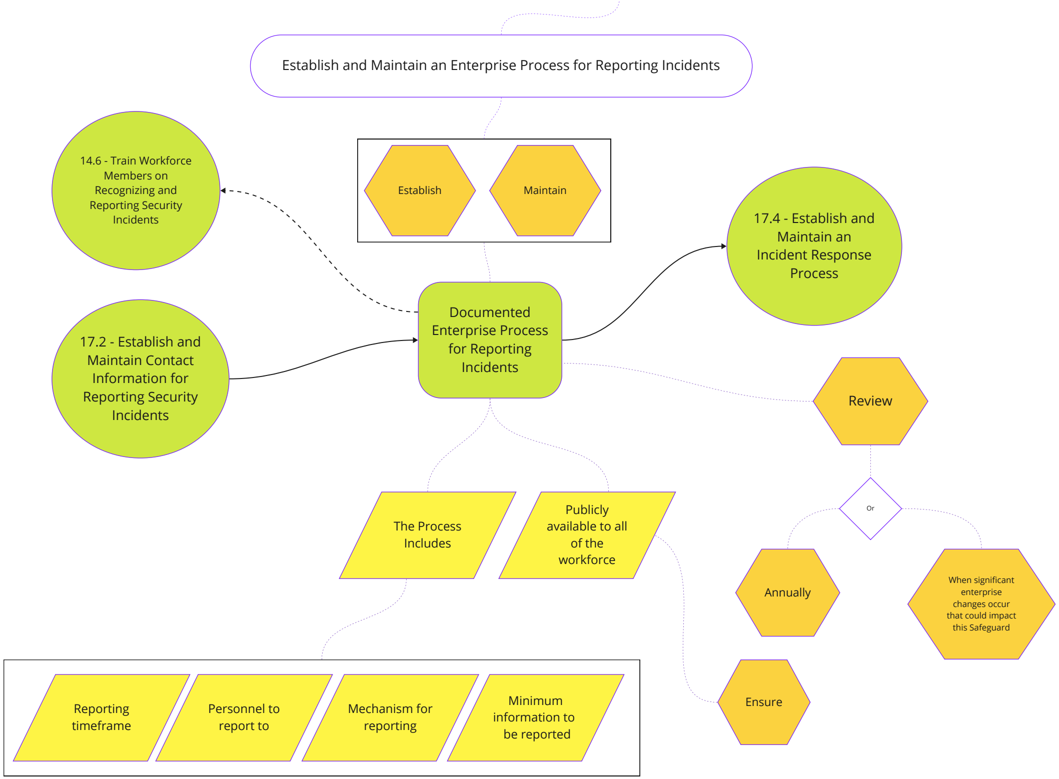
Incident Response

Recovery efforts

Group Validated

17.3

Establish and maintain an documented enterprise process for the workforce to report security incidents. The process includes reporting timeframe, personnel to report to, mechanism for reporting, and the minimum information to be reported. Ensure the process is publicly available to all of the workforce. Review annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain an Enterprise Process for Reporting Incidents
Establish
Maintain
14.6 - Train Workforce Members on Recognizing and Reporting Security Incidents
17.4 - Establish and Maintain an Incident Response Process
Documented Enterprise Process for Reporting Incidents
17.2 - Establish and Maintain Contact Information for Reporting Security Incidents
Review
Or
The Process Includes
Publicly available to all of the workforce
Annually
When significant enterprise changes occur that could impact this Safeguard
Reporting timeframe
Personnel to report to
Mechanism for reporting
Minimum information to be reported
Ensure

Process Oriented Safeguard

IG1

Incident Response

Govern

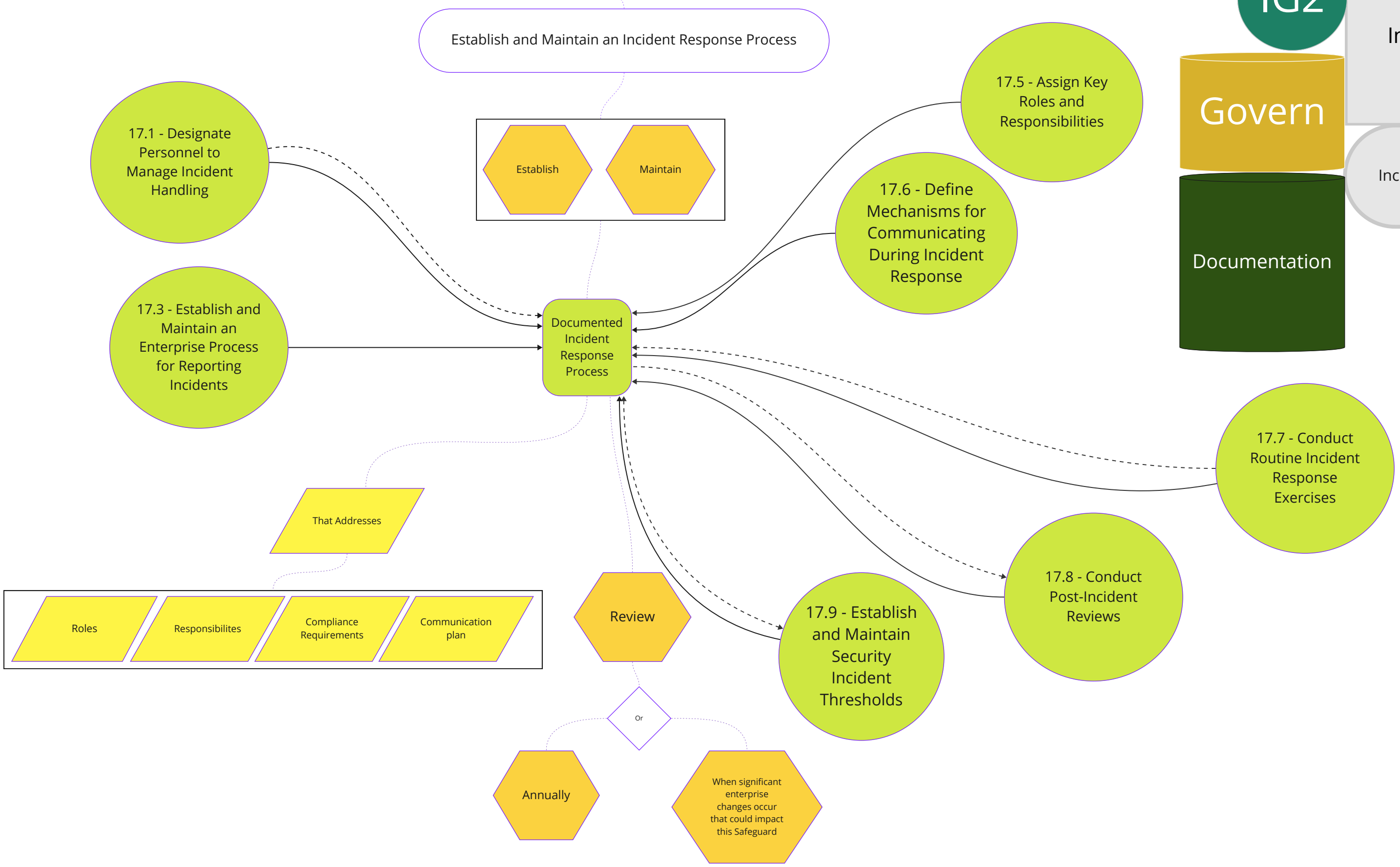
Incident Response Planning

Documentation

Group Validated

17.4

Establish and maintain a documented incident response process that addresses roles and responsibilities, compliance requirements, and a communication plan. Review annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain an Incident Response Process

Establish

Maintain

17.1 - Designate Personnel to Manage Incident Handling

17.3 - Establish and Maintain an Enterprise Process for Reporting Incidents

Documented Incident Response Process

17.5 - Assign Key Roles and Responsibilities

17.6 - Define Mechanisms for Communicating During Incident Response

17.7 - Conduct Routine Incident Response Exercises

17.8 - Conduct Post-Incident Reviews

17.9 - Establish and Maintain Security Incident Thresholds

That Addresses

Roles

Responsibilites

Compliance Requirements

Communication plan

Review

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

Process Oriented Safeguard

IG2

Incident Response

Govern

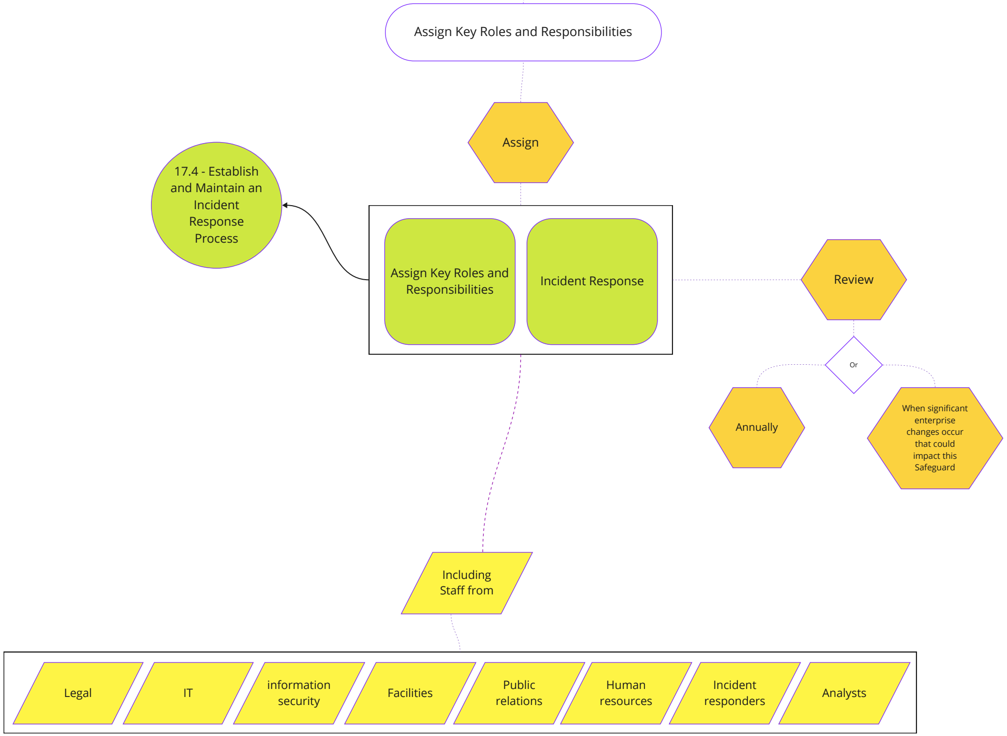
Documentation

Incident Response Planning

Group Validated

17.5

Assign key roles and responsibilities for incident response, including staff from legal, IT, information security, facilities, public relations, human resources, incident responders, and analysts. Review annually, or when significant enterprise changes occur that could impact this Safeguard.



Assign Key Roles and Responsibilities

Assign

17.4 - Establish and Maintain an Incident Response Process

Assign Key Roles and Responsibilities

Incident Response

Review

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

Including Staff from

Legal

IT

information security

Facilities

Public relations

Human resources

Incident responders

Analysts

Process Oriented Safeguard

IG2

Incident Response

Respond

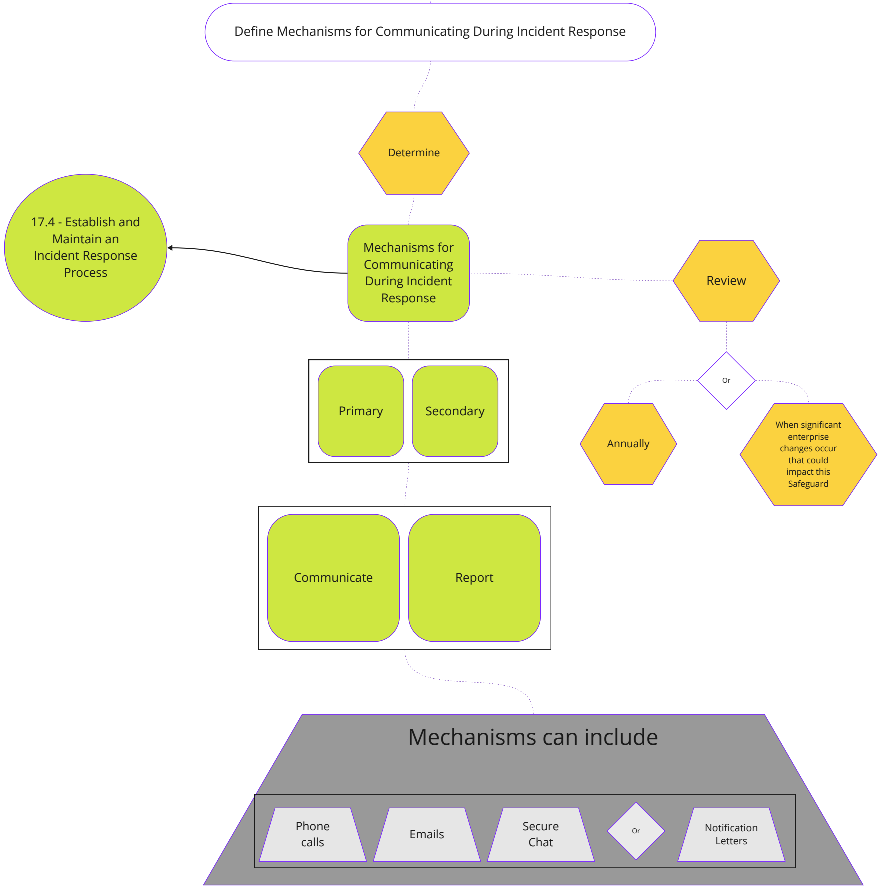
Incident Response Planning

Users

Group Validated

17.6

Determine which primary and secondary mechanisms will be used to communicate and report during a security incident. Mechanisms can include phone calls, emails, secure chat or notification letters. Keep in mind that certain mechanisms, such as emails, can be affected during a security incident. Review annually, or when significant enterprise changes occur that could impact this Safeguard.



Define Mechanisms for Communicating During Incident Response

Determine

Mechanisms for Communicating During Incident Response

17.4 - Establish and Maintain an Incident Response Process

Primary

Secondary

Communicate

Report

Review

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

Mechanisms can include

Phone calls

Emails

Secure Chat

Or

Notification Letters

Process Oriented Safeguard

IG2

Incident Response

Respond

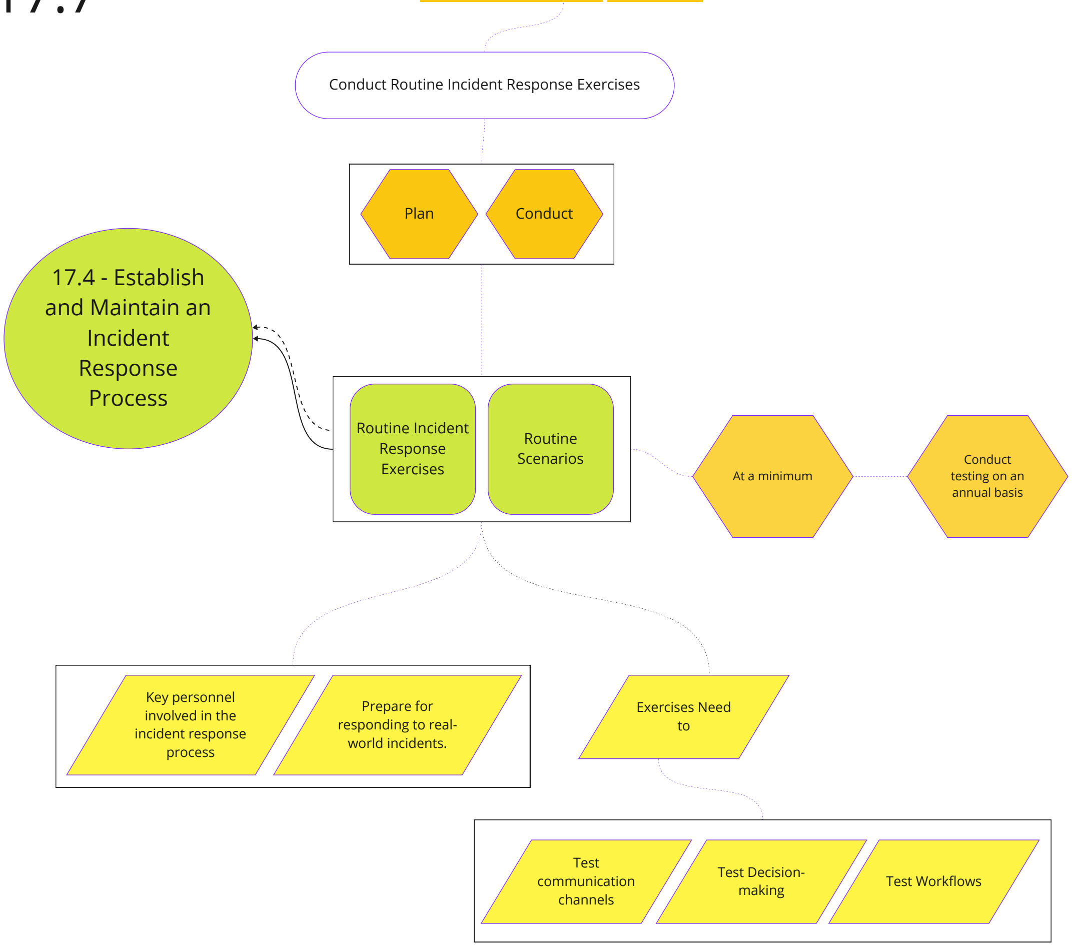
Users

Incident Response Planning

Group Validated

17.7

Plan and conduct routine incident response exercises and scenarios for key personnel involved in the incident response process to prepare for responding to real-world incidents. Exercises need to test communication channels, decision-making, and workflows. Conduct testing on an annual basis, at a minimum.



Conduct Routine Incident Response Exercises

Plan

Conduct

17.4 - Establish and Maintain an Incident Response Process

Routine Incident Response Exercises

Routine Scenarios

At a minimum

Conduct testing on an annual basis

Key personnel involved in the incident response process

Prepare for responding to real-world incidents.

Exercises Need to

Test communication channels

Test Decision-making

Test Workflows

Process Oriented Safeguard

IG2

Incident Response

Recover

Incident Response Planning

Users

Group Validated

17.8

Conduct post-incident reviews. Post-incident reviews help prevent incident recurrence through identifying lessons learned and follow-up action.

Process Oriented Safeguard

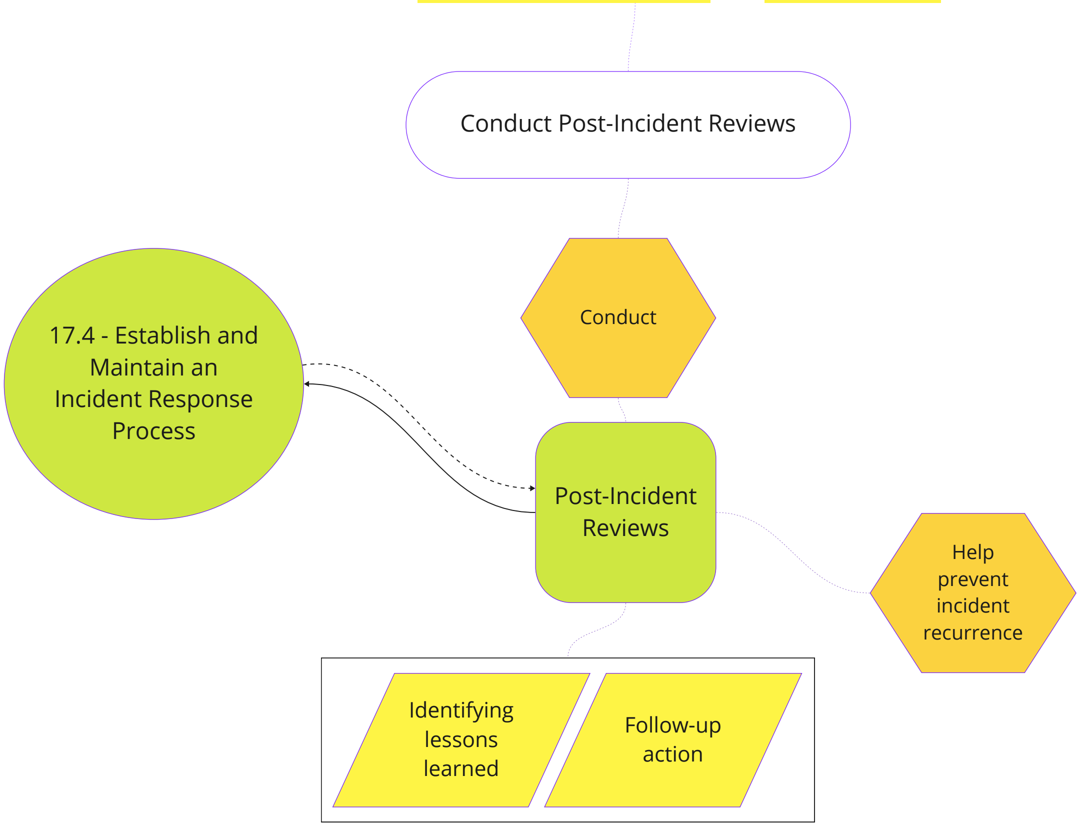
IG2

Recover

Users

Incident Response

Incident Response Planning



Conduct Post-Incident Reviews

Conduct

Post-Incident Reviews

17.4 - Establish and Maintain an Incident Response Process

Help prevent incident recurrence

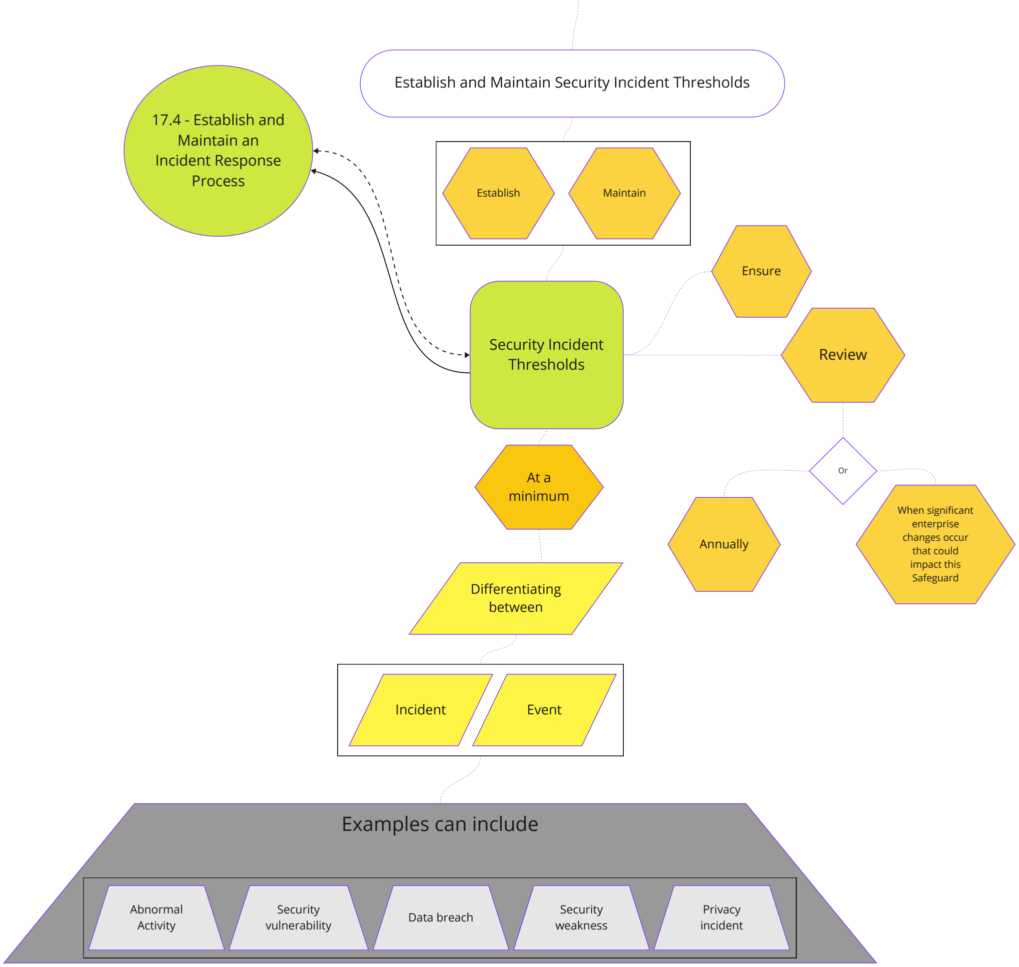
Identifying lessons learned

Follow-up action

Group Validated

17.9

Establish and maintain security incident thresholds, including, at a minimum, differentiating between an incident and an event. Examples can include: abnormal activity, security vulnerability, security weakness, data breach, privacy incident, etc. Review annually, or when significant enterprise changes occur that could impact this Safeguard.



Establish and Maintain Security Incident Thresholds

Establish

Maintain

17.4 - Establish and Maintain an Incident Response Process

Security Incident Thresholds

Ensure

Review

Or

Annually

When significant enterprise changes occur that could impact this Safeguard

At a minimum

Differentiating between

Incident

Event

Examples can include

Abnormal Activity

Security vulnerability

Data breach

Security weakness

Privacy incident

Process Oriented Safeguard

IG3

Incident Response

Recover

Documentation

Incident Response Planning

CONTROL 18

Penetration Testing

Safeguards: 5		IG1: 0/5	IG2: 3/5	IG3: 5/5

Overview

Test the effectiveness and resiliency of enterprise assets through identifying and exploiting weaknesses in controls (people, processes, and technology), and simulating the objectives and actions of an attacker.

Group Validated

18.1

Establish and maintain a penetration testing program appropriate to the size, complexity, industry, and maturity of the enterprise. Penetration testing program characteristics include scope, such as network, web application, Application Programming Interface (API), hosted services, and physical premise controls; frequency; limitations, such as acceptable hours, and excluded attack types; point of contact information; remediation, such as how findings will be routed internally; and retrospective requirements.

Process Oriented Safeguard

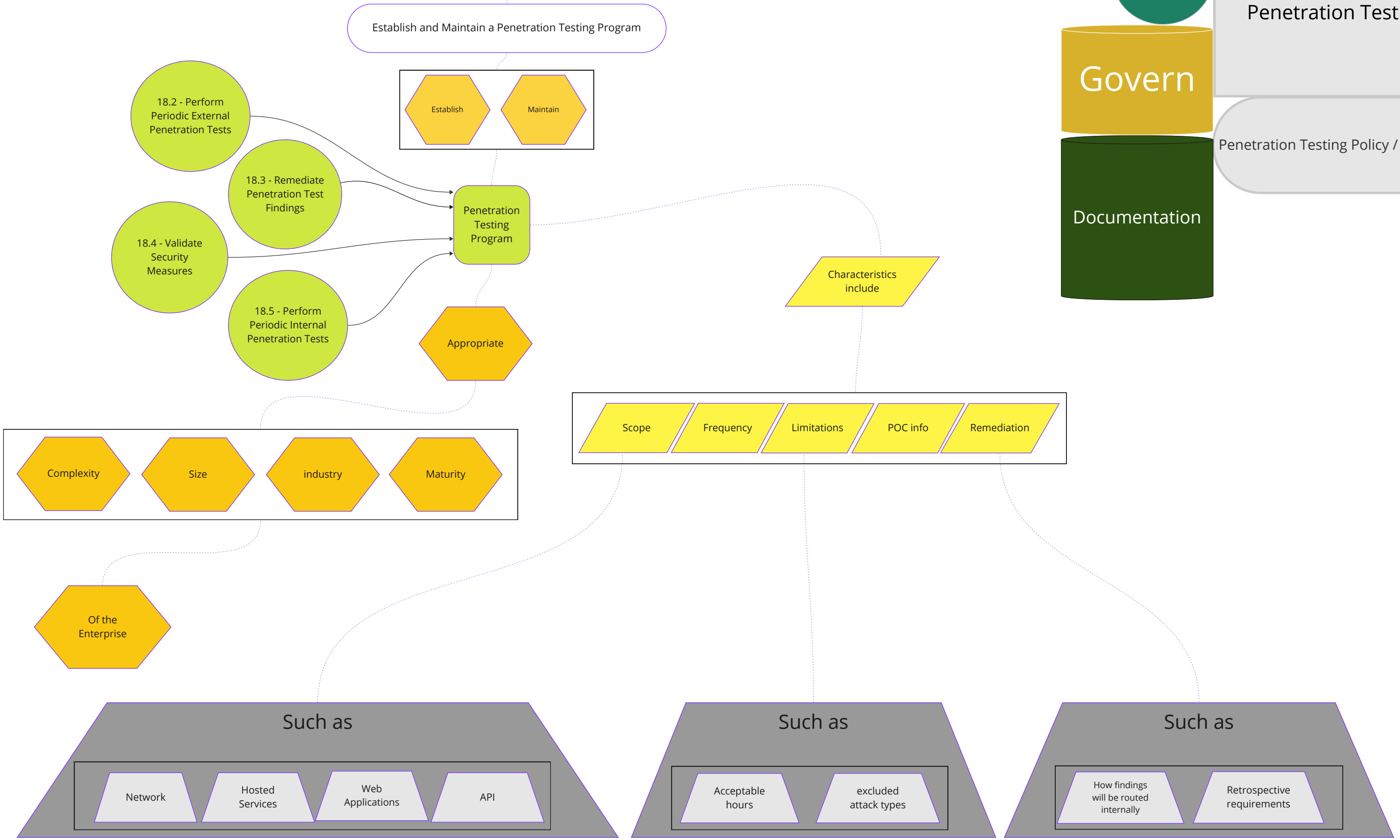
IG2

Penetration Testing

Govern

Penetration Testing Policy / Process

Documentation



Establish and Maintain a Penetration Testing Program

Establish

Maintain

18.2 - Perform Periodic External Penetration Tests

18.3 - Remediate Penetration Test Findings

18.4 - Validate Security Measures

18.5 - Perform Periodic Internal Penetration Tests

Penetration Testing Program

Appropriate

Complexity

Size

industry

Maturity

Of the Enterprise

Characteristics include

Scope

Frequency

Limitations

POC info

Remediation

Such as

Network

Hosted Services

Web Applications

API

Such as

Acceptable hours

excluded attack types

Such as

How findings will be routed internally

Retrospective requirements

Group Validated

18.2

Perform periodic external penetration tests based on program requirements, no less than annually. External penetration testing must include enterprise and environmental reconnaissance to detect exploitable information. Penetration testing requires specialized skills and experience and must be conducted through a qualified party. The testing may be clear box or opaque box.

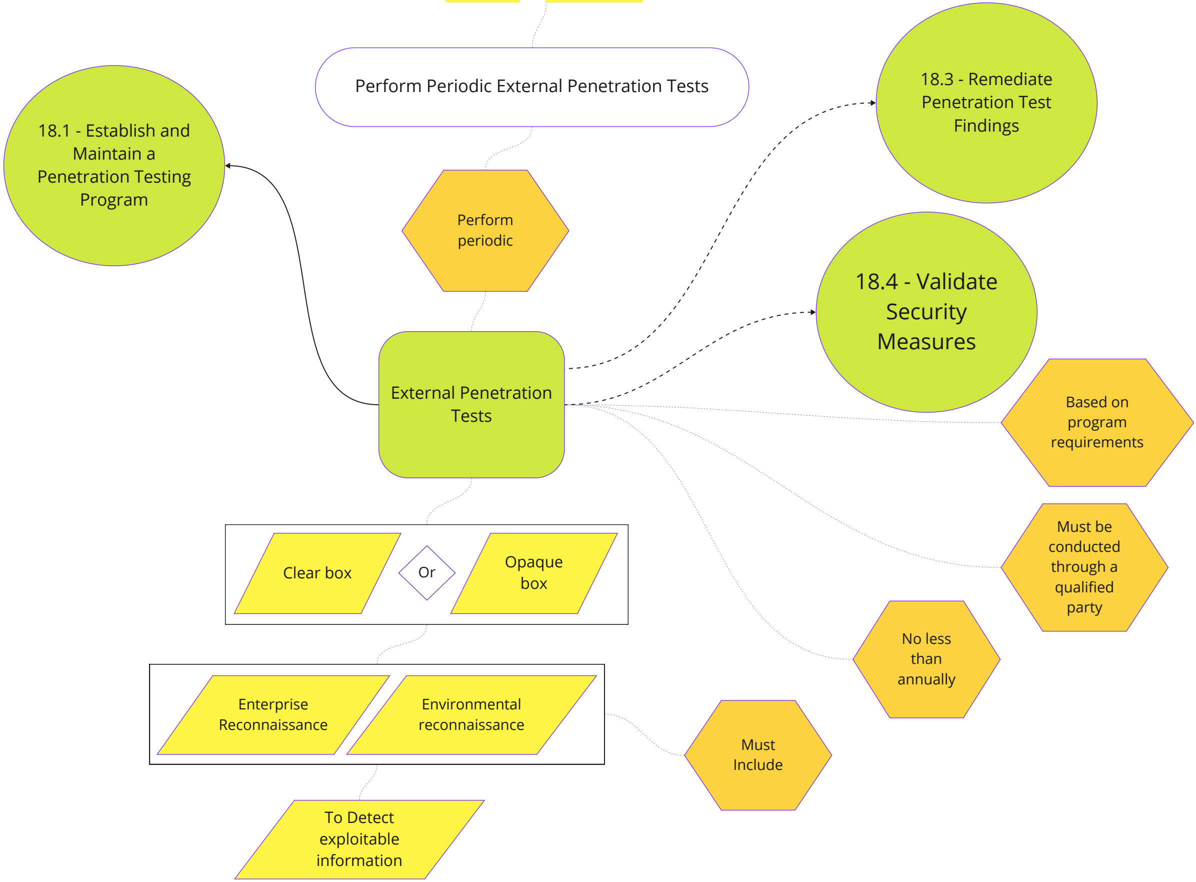
IG2

Penetration Testing

Detect

Network

Penetration Testing Policy / Process



Perform Periodic External Penetration Tests

Perform periodic

External Penetration Tests

18.1 - Establish and Maintain a Penetration Testing Program

18.3 - Remediate Penetration Test Findings

18.4 - Validate Security Measures

Based on program requirements

Must be conducted through a qualified party

No less than annually

Must Include

Clear box

Or

Opaque box

Enterprise Reconnaissance

Environmental reconnaissance

To Detect exploitable information

Group Validated

18.3

Remediate penetration test findings based on the enterprise’s documented vulnerability remediation process. This should include determining a timeline and level of effort based on the impact and prioritization of each identified finding.

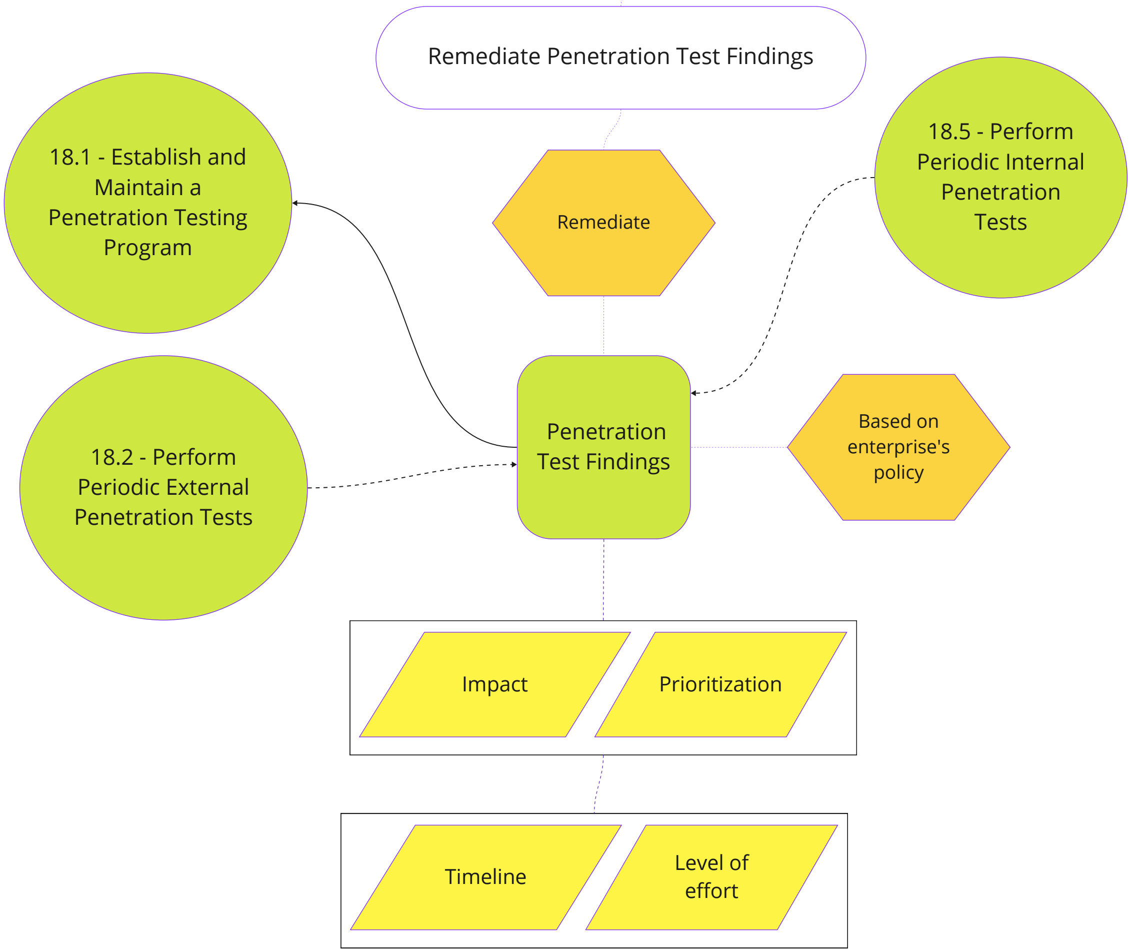
IG2

Penetration Testing

Protect

Penetration Testing Policy / Process

Network



Remediate Penetration Test Findings

18.1 - Establish and Maintain a Penetration Testing Program

Remediate

18.5 - Perform Periodic Internal Penetration Tests

Penetration Test Findings

Based on enterprise's policy

18.2 - Perform Periodic External Penetration Tests

Impact

Prioritization

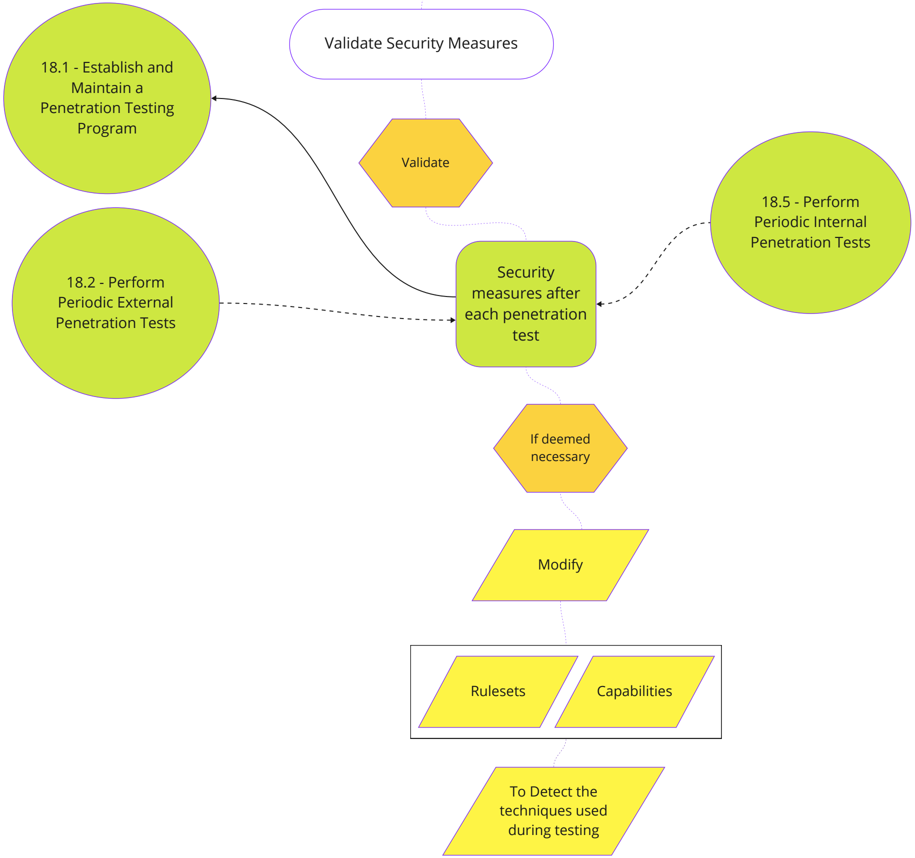
Timeline

Level of effort

Group Validated

18.4

Validate security measures after each penetration test. If deemed necessary, modify rulesets and capabilities to detect the techniques used during testing.



Validate Security Measures

Validate

Security measures after each penetration test

18.1 - Establish and Maintain a Penetration Testing Program

18.2 - Perform Periodic External Penetration Tests

18.5 - Perform Periodic Internal Penetration Tests

If deemed necessary

Modify

Rulesets

Capabilities

To Detect the techniques used during testing

Process Oriented Safeguard

IG3

Penetration Testing

Protect

Network

Penetration Testing Policy / Process

Group Validated

18.5

Perform periodic internal penetration tests based on program requirements, no less than annually. The testing may be clear box or opaque box.

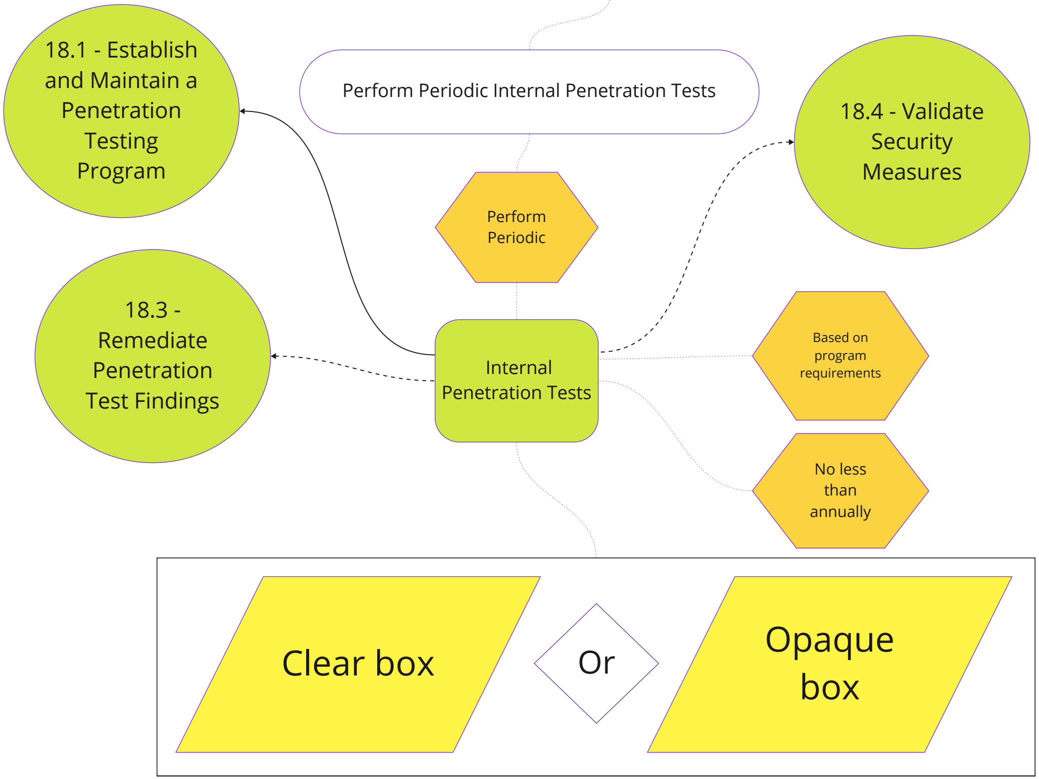
IG3

Penetration Testing

Detect

Network

Penetration Testing Policy / Process



Perform Periodic Internal Penetration Tests

18.1 - Establish and Maintain a Penetration Testing Program

Perform Periodic

18.4 - Validate Security Measures

18.3 - Remediate Penetration Test Findings

Internal Penetration Tests

Based on program requirements

No less than annually

Clear box

Or

Opaque box