SOURCE CODE AUDIT SCENARIOS

HADESS

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Enable Vulnerabilities with Audit Vulnerabilities

Organizations must recognize that even vulnerabilities with `lower severity ratings` can be `critical` in a **chain** of attacks.

`Adversaries` often use a combination of low and medium severity vulnerabilities to create a pathway for more significant exploits. Therefore, it's essential to address these vulnerabilities promptly and incorporate them into regular security training and `adversary simulation exercises`.

By simulating attacks that exploit these vulnerabilities, organizations can better understand potential `attack vectors` and strengthen their defenses accordingly. This proactive approach is key to maintaining robust security in an ever-evolving threat landscape. 🛡️ ✨ 🔒

Code

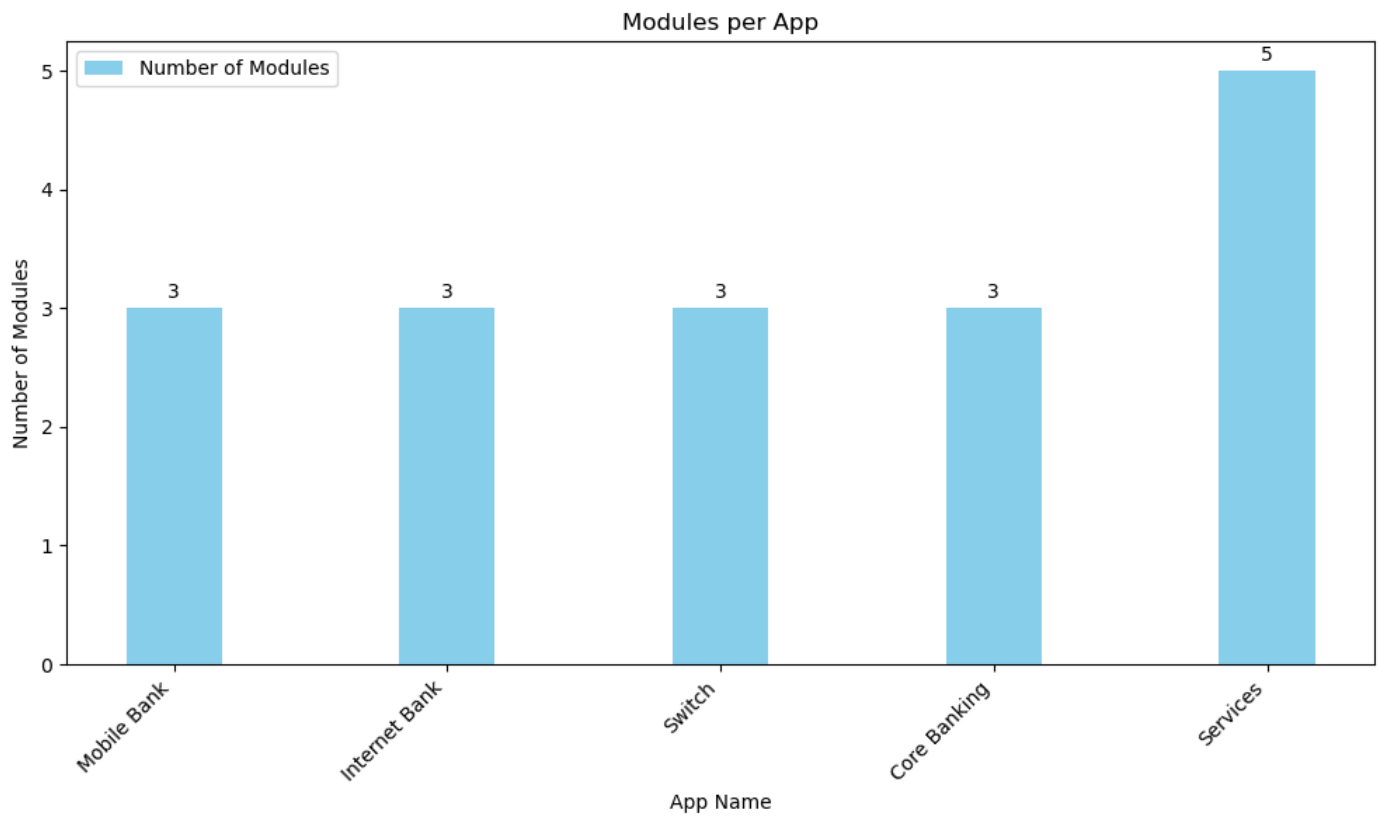
In [ ]:
```
print('CVE-2023-50785')
```

Server That Include Webapps With Modules

`fetch by apps`

In [ ]:
```
import urllib.request
import json
import matplotlib.pyplot as plt
import numpy as np

def fetch_apps(endpoint):
    try:
        with urllib.request.urlopen(endpoint) as response:
            if response.getcode() == 200:
                apps = json.loads(response.read())
                return apps
            else:
                print(f"Error: Unable to fetch apps. Status code: {response.getcode()}")
    except Exception as e:
        print(f"Error: {e}")

if __name__ == "__main__":
    endpoint = "http://127.0.0.1:8000/apps"
    apps = fetch_apps(endpoint)
    if apps:
        app_names = [app['name'] for app in apps]
        num_modules = [len(app['modules']) for app in apps]

        x = np.arange(len(app_names))
        width = 0.35

        fig, ax = plt.subplots(figsize=(10, 6))
        rects = ax.bar(x, num_modules, width, label='Number of Modules', color='skyblue'

        ax.set_xlabel('App Name')
        ax.set_ylabel('Number of Modules')
        ax.set_title('Modules per App')
        ax.set_xticks(x)
        ax.set_xticklabels(app_names, rotation=45, ha='right')
```

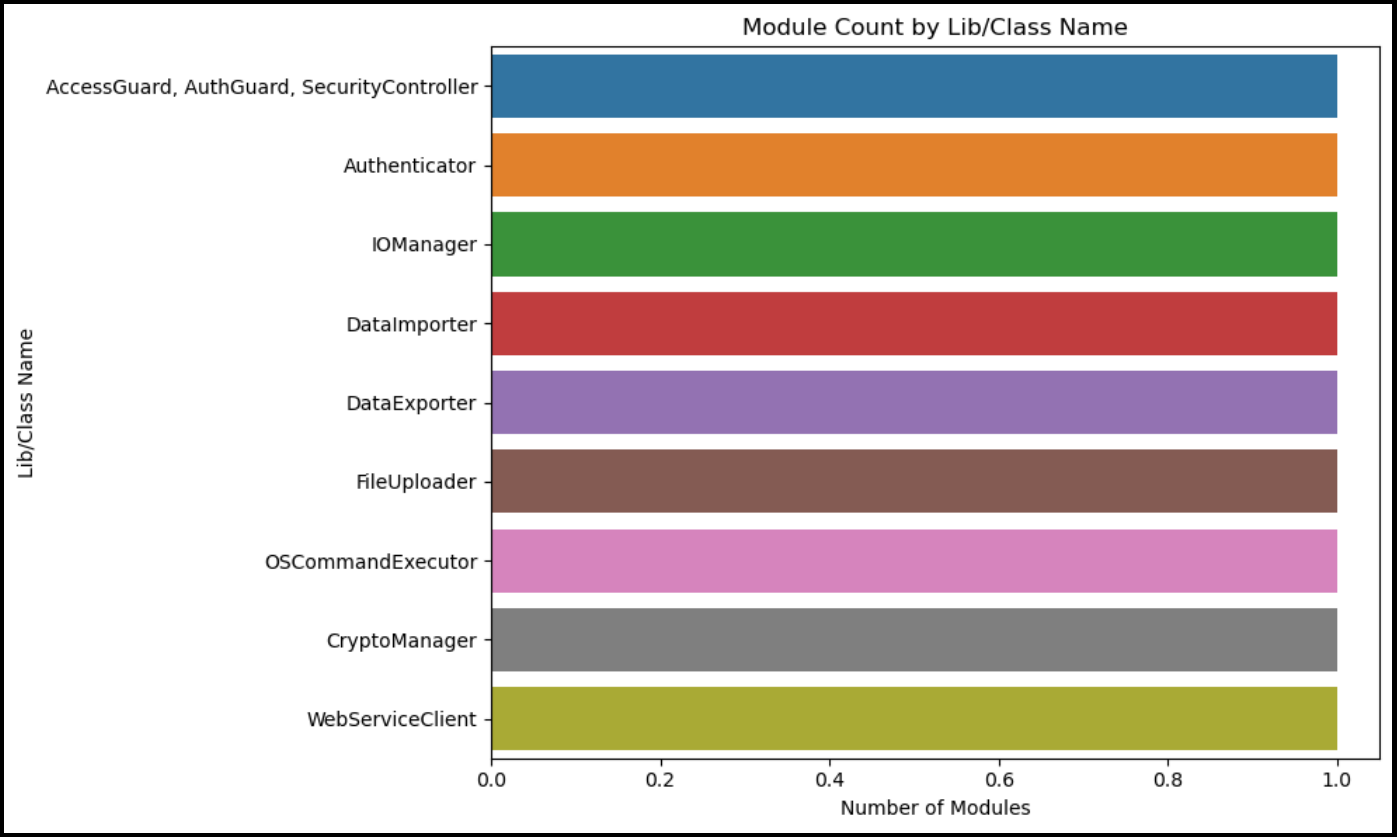
```
        ax.legend()

        def autolabel(rects):
            for rect in rects:
                height = rect.get_height()
                ax.annotate('{}'.format(height),
                            xy=(rect.get_x() + rect.get_width() / 2, height),
                            xytext=(0, 3),  # 3 points vertical offset
                            textcoords="offset points",
                            ha='center', va='bottom')

        autolabel(rects)

        plt.tight_layout()
        plt.show()
```



fetch by moduels

In [ ]:
```
import urllib.request
import json
import seaborn as sns
import matplotlib.pyplot as plt

def fetch_modules(endpoint):
    try:
        with urllib.request.urlopen(endpoint) as response:
            if response.getcode() == 200:
                modules = json.loads(response.read())
                return modules
            else:
                print(f"Error: Unable to fetch modules. Status code: {response.getcode()}")
    except Exception as e:
        print(f"Error: {e}")

if __name__ == "__main__":
    endpoint = "http://127.0.0.1:8000/modules"
    modules = fetch_modules(endpoint)
    if modules:
```

```
        module_names = [module['name'] for module in modules]
        module_ids = [module['id'] for module in modules]
        module_descriptions = [module['description'] for module in modules]
        module_architectures = [module['Lib_Class_Name'] for module in modules]

        plt.figure(figsize=(10, 6))
        sns.countplot(y=module_architectures)
        plt.title('Module Count by Lib/Class Name')
        plt.xlabel('Number of Modules')
        plt.ylabel('Lib/Class Name')
        plt.tight_layout()
        plt.show()
```



Vuln Audit Log In Server And Port

`fetch by vuln`

In [ ]:

```
import requests
from anytree import Node, RenderTree

def fetch_vulnerable_modules(endpoint):
    try:
        response = requests.get(endpoint)
        if response.status_code == 200:
            modules = response.json()
            return modules
        else:
            print(f"Error: Unable to fetch modules. Status code: {response.status_code}"
    except requests.exceptions.RequestException as e:
        print(f"Error: {e}")

def build_module_tree(modules):
    root = Node("Modules")
    for module in modules:
        module_name = module['name']
        module_node = Node(module_name, parent=root)
        for vuln in module['vulnerabilities']:
```

```
            vuln_title = vuln['title']
            vuln_node = Node(vuln_title, parent=module_node)
    return root

if __name__ == "__main__":
    endpoint = "http://127.0.0.1:5000/modules/vuln"
    modules = fetch_vulnerable_modules(endpoint)
    if modules:
        module_tree = build_module_tree(modules)
        print("Tree Diagram:")
        for pre, _, node in RenderTree(module_tree):
            print("%s%s" % (pre, node.name))
```

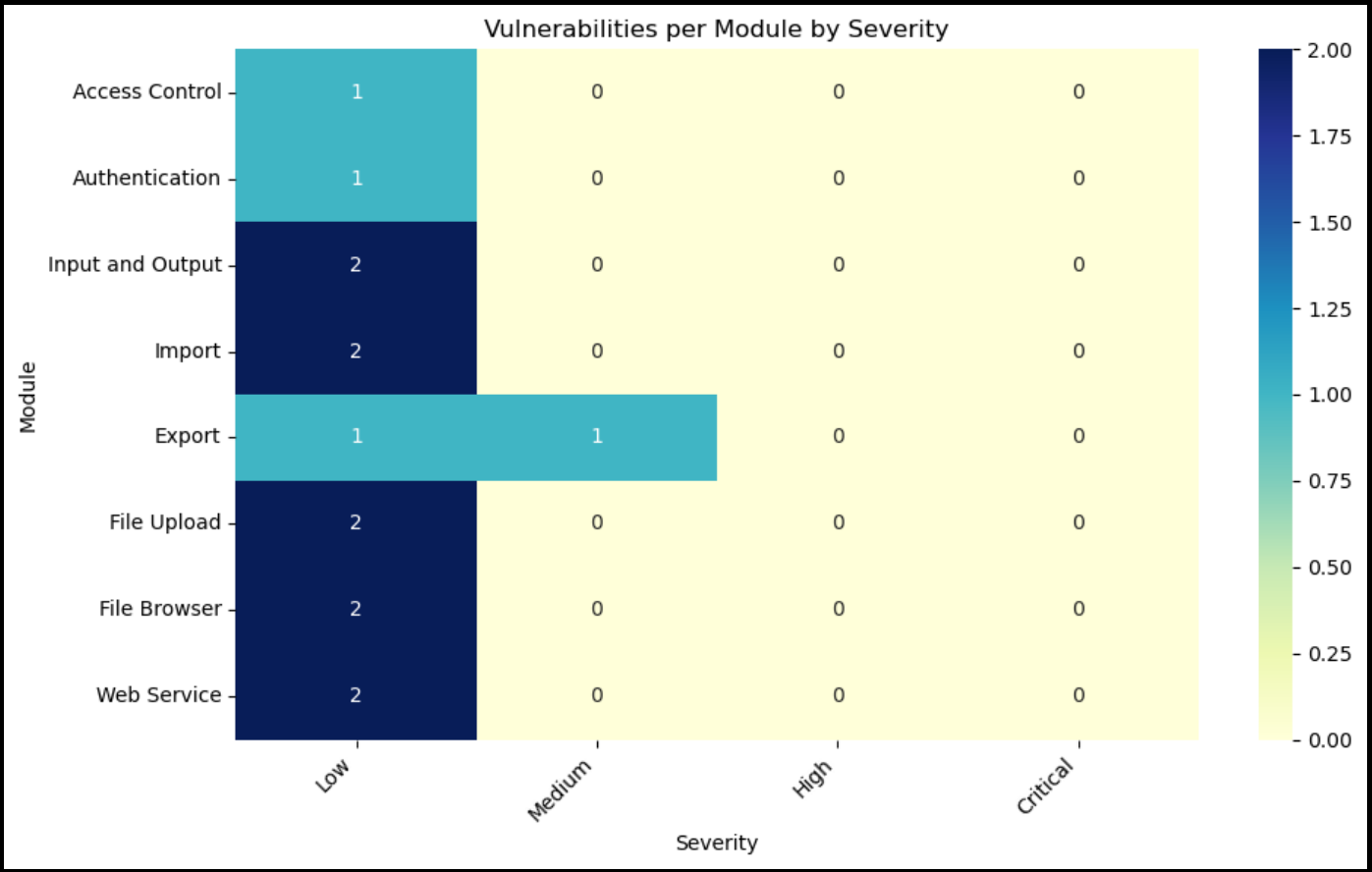
```
Tree Diagram:
Modules
├── Access Control
│   └── Brute Force
├── Authentication
│   └── Session Fixation
├── Input and Output
│   ├── Session Fixation
│   └── Cross-Site Scripting (XSS)
├── Import
│   ├── Insecure File Upload
│   └── Denial of Service (DoS)
├── Export
│   ├── Broken Access Control
│   └── Denial of Service (DoS)
├── File Upload
│   ├── Directory Traversal
│   └── Insecure File Upload
├── File Browser
│   ├── Remote Code Execution
│   └── Directory Traversal
└── Web Service
    ├── Session Fixation
    └── Insecure File Upload
```

Heatmap

In [ ]:

```
import requests
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd

def fetch_vulnerable_modules(endpoint):
    try:
        response = requests.get(endpoint)
        if response.status_code == 200:
            modules = response.json()
            return modules
        else:
            print(f"Error: Unable to fetch modules. Status code: {response.status_code}"
    except requests.exceptions.RequestException as e:
        print(f"Error: {e}")

def generate_heatmap(modules):
    module_names = [module['name'] for module in modules]
    vulnerabilities = []

    for module in modules:
        vuln_count = {'Low': 0, 'Medium': 0, 'High': 0, 'Critical': 0}
        for vuln in module['vulnerabilities']:
            vuln_count[vuln['severity']] += 1
```

```
        vulnerabilities.append(list(vuln_count.values()))

    # Create DataFrame for seaborn heatmap
    df = pd.DataFrame(vulnerabilities, columns=['Low', 'Medium', 'High', 'Critical'], in

    plt.figure(figsize=(10, 6))
    sns.heatmap(df, annot=True, cmap="YlGnBu", fmt="d")
    plt.title('Vulnerabilities per Module by Severity')
    plt.xlabel('Severity')
    plt.ylabel('Module')
    plt.xticks(rotation=45, ha='right')
    plt.tight_layout()
    plt.show()

if __name__ == "__main__":
    endpoint = "http://127.0.0.1:5000/modules/vuln"
    modules = fetch_vulnerable_modules(endpoint)
    if modules:
        generate_heatmap(modules)
```



Adversary By Vuln

`fetch vuln by module by techniques`

In [ ]:

```
import requests

def fetch_vulnerabilities():
    vulnerabilities_url = "http://127.0.0.1:5000/modules/vuln"
    response = requests.get(vulnerabilities_url)
    if response.status_code == 200:
        vulnerabilities = response.json()
        return vulnerabilities
    else:
        print("Error fetching vulnerabilities:", response.status_code)
        return None
```

```python
def fetch_techniques(vulnerability_title):
    techniques_url = f"http://127.0.0.1:10000/techniques/{vulnerability_title}"
    response = requests.get(techniques_url)
    if response.status_code == 200:
        techniques = response.json()
        return techniques
    else:
        print(f"Error fetching techniques for {vulnerability_title}:", response.status_c
        return None

def main():
    vulnerabilities = fetch_vulnerabilities()
    if vulnerabilities:
        for module in vulnerabilities:
            module_name = module['name']
            print(f"Module: {module_name}")
            vulnerabilities_list = module['vulnerabilities']
            for vulnerability in vulnerabilities_list:
                vulnerability_title = vulnerability['title']
                print(f"\tVulnerability Title: {vulnerability_title}")
                print("\tRelated Techniques:")
                techniques = fetch_techniques(vulnerability_title)
                if techniques:
                    for technique_id, technique_data in techniques.items():
                        print(f"\t - Technique ID: {technique_id}")
                        print(f"\t   Technique Name: {technique_data['name']}")
                        print(f"\t   Technique Name: {technique_data['description']}")
                else:
                    print("\tNo techniques found.")
                print()
            print()

if __name__ == "__main__":
    main()
```

Module: Access Control
	Vulnerability Title: Brute Force
	Related Techniques:
	 - Technique ID: T1110
	 Technique Name: Brute Force
	 Technique Name: Adversaries may use brute force techniques to gain access to accounts when passwords are unknown or when password hashes are obtained. Without knowledge of the password for an account or set of accounts, an adversary may systematically guess the password using a repetitive or iterative mechanism. Brute forcing passwords can take place via interaction with a service that will check the validity of those credentials or offline against previously acquired credential data, such as password hashes.
	 - Technique ID: T1187
	 Technique Name: Forced Authentication
	 Technique Name: Adversaries may gather credential material by invoking or forcing a user to automatically provide authentication information through a mechanism in which they can intercept.

Module: Authentication
	Vulnerability Title: Session Fixation
	Related Techniques:
	 - Technique ID: T1185
	 Technique Name: Browser Session Hijacking
	 Technique Name: Adversaries may take advantage of security vulnerabilities and inherent functionality in browser software to change content, modify user-behaviors, and intercept information as part of various browser session hijacking techniques.
	 - Technique ID: T1539
	 Technique Name: Steal Web Session Cookie
	 Technique Name: An adversary may steal web application or service session cookies and use them to gain access to web applications or Internet services as an authenticated user without needing credentials. Web applications and services often use session cookies as an authentication token after a user has authenticated to a website.
	 - Technique ID: T1563
	 Technique Name: Remote Service Session Hijacking
	 Technique Name: Adversaries may take control of preexisting sessions with remote services to move laterally in an environment. Users may use valid credentials to log into a service specifically designed to accept remote connections, such as telnet, SSH, and RDP. When a user logs into a service, a session will be established that will allow them to maintain a continuous interaction with that service.

Module: Input and Output
	Vulnerability Title: Session Fixation
	Related Techniques:
	 - Technique ID: T1185
	 Technique Name: Browser Session Hijacking
	 Technique Name: Adversaries may take advantage of security vulnerabilities and inherent functionality in browser software to change content, modify user-behaviors, and intercept information as part of various browser session hijacking techniques.
	 - Technique ID: T1539
	 Technique Name: Steal Web Session Cookie
	 Technique Name: An adversary may steal web application or service session cookies and use them to gain access to web applications or Internet services as an authenticated user without needing credentials. Web applications and services often use session cookies as an authentication token after a user has authenticated to a website.
	 - Technique ID: T1563
	 Technique Name: Remote Service Session Hijacking
	 Technique Name: Adversaries may take control of preexisting sessions with remote services to move laterally in an environment. Users may use valid credentials to log into a service specifically designed to accept remote connections, such as telnet, SSH, and RDP. When a user logs into a service, a session will be established that will allow them to maintain a continuous interaction with that service.

	Vulnerability Title: Cross-Site Scripting (XSS)

Related Techniques:
- Technique ID: T1059
Technique Name: Command and Scripting Interpreter
Technique Name: Adversaries may abuse command and script interpreters to execute commands, scripts, or binaries. These interfaces and languages provide ways of interacting with computer systems and are a common feature across many different platforms. Most systems come with some built-in command-line interface and scripting capabilities, for example, macOS and Linux distributions include some flavor of Unix Shell while Windows installations include the Windows Command Shell and PowerShell.

Module: Import
Vulnerability Title: Insecure File Upload
Related Techniques:
- Technique ID: T1027
Technique Name: Obfuscated Files or Information
Technique Name: Adversaries may attempt to make an executable or file difficult to discover or analyze by encrypting, encoding, or otherwise obfuscating its contents on the system or in transit. This is common behavior that can be used across different platforms and the network to evade defenses.
- Technique ID: T1083
Technique Name: File and Directory Discovery
Technique Name: Adversaries may enumerate files and directories or may search in specific locations of a host or network share for certain information within a file system. Adversaries may use the information from File and Directory Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
- Technique ID: T1140
Technique Name: Deobfuscate/Decode Files or Information
Technique Name: Adversaries may use Obfuscated Files or Information to hide artifacts of an intrusion from analysis. They may require separate mechanisms to decode or deobfuscate that information depending on how they intend to use it. Methods for doing that include built-in functionality of malware or by using utilities present on the system.
- Technique ID: T1222
Technique Name: File and Directory Permissions Modification
Technique Name: Adversaries may modify file or directory permissions/attributes to evade access control lists (ACLs) and access protected files. File and directory permissions are commonly managed by ACLs configured by the file or directory owner, or users with the appropriate permissions. File and directory ACL implementations vary by platform, but generally explicitly designate which users or groups can perform which actions (read, write, execute, etc.).
- Technique ID: T1647
Technique Name: Plist File Modification
Technique Name: Adversaries may modify property list files (plist files) to enable other malicious activity, while also potentially evading and bypassing system defenses. macOS applications use plist files, such as the info.plist file, to store properties and configuration settings that inform the operating system how to handle the application at runtime. Plist files are structured metadata in key-value pairs formatted in XML based on Apple's Core Foundation DTD. Plist files can be saved in text or binary format.

Vulnerability Title: Denial of Service (DoS)
Related Techniques:
- Technique ID: T1007
Technique Name: System Service Discovery
Technique Name: Adversaries may try to gather information about registered local system services. Adversaries may obtain information about services using tools as well as OS utility commands such as sc query, tasklist /svc, systemctl --type=service, and net start.
- Technique ID: T1021
Technique Name: Remote Services
Technique Name: Adversaries may use Valid Accounts to log into a service that accepts remote connections, such as telnet, SSH, and VNC. The adversary may then perform actions as the logged-on user.

- Technique ID: T1046
  Technique Name: Network Service Discovery
  Technique Name: Adversaries may attempt to get a listing of services running on remote hosts and local network infrastructure devices, including those that may be vulnerable to remote software exploitation. Common methods to acquire this information include port and/or vulnerability scans using tools that are brought onto a system.
- Technique ID: T1072
  Technique Name: Software Deployment Tools
  Technique Name: Adversaries may gain access to and use third-party software suites installed within an enterprise network, such as administration, monitoring, and deployment systems, to move laterally through the network. Third-party applications and software deployment systems may be in use in the network environment for administration purposes (e.g., SCCM, HBSS, Altiris, etc.).
- Technique ID: T1102
  Technique Name: Web Service
  Technique Name: Adversaries may use an existing, legitimate external Web service as a means for relaying data to/from a compromised system. Popular websites and social media acting as a mechanism for C2 may give a significant amount of cover due to the likelihood that hosts within a network are already communicating with them prior to a compromise. Using common services, such as those offered by Google or Twitter, makes it easier for adversaries to hide in expected noise. Web service providers commonly use SSL/TLS encryption, giving adversaries an added level of protection.
- Technique ID: T1133
  Technique Name: External Remote Services
  Technique Name: Adversaries may leverage external-facing remote services to initially access and/or persist within a network. Remote services such as VPNs, Citrix, and other access mechanisms allow users to connect to internal enterprise network resources from external locations. There are often remote service gateways that manage connections and credential authentication for these services. Services such as Windows Remote Management and VNC can also be used externally.
- Technique ID: T1137
  Technique Name: Office Application Startup
  Technique Name: Adversaries may leverage Microsoft Office-based applications for persistence between startups. Microsoft Office is a fairly common application suite on Windows-based operating systems within an enterprise network. There are multiple mechanisms that can be used with Office for persistence when an Office-based application is started; this can include the use of Office Template Macros and add-ins.
- Technique ID: T1210
  Technique Name: Exploitation of Remote Services
  Technique Name: Adversaries may exploit remote services to gain unauthorized access to internal systems once inside of a network. Exploitation of a software vulnerability occurs when an adversary takes advantage of a programming error in a program, service, or within the operating system software or kernel itself to execute adversary-controlled code. A common goal for post-compromise exploitation of remote services is for lateral movement to enable access to a remote system.
- Technique ID: T1219
  Technique Name: Remote Access Software
  Technique Name: An adversary may use legitimate desktop support and remote access software to establish an interactive command and control channel to target systems within networks. These services, such as VNC, Team Viewer, AnyDesk, ScreenConnect, LogMein, AmmyyAdmin, and other remote monitoring and management (RMM) tools, are commonly used as legitimate technical support software and may be allowed by application control within a target environment.
- Technique ID: T1489
  Technique Name: Service Stop
  Technique Name: Adversaries may stop or disable services on a system to render those services unavailable to legitimate users. Stopping critical services or processes can inhibit or stop response to an incident or aid in the adversary's overall objectives to cause damage to the environment.
- Technique ID: T1498
  Technique Name: Network Denial of Service
  Technique Name: Adversaries may perform Network Denial of Service (DoS) attacks to degrade or block the availability of targeted resources to users. Network DoS can be performed by exhausting the network bandwidth services rely on. Example resources inc

lude specific websites, email services, DNS, and web-based applications. Adversaries hav
e been observed conducting network DoS attacks for political purposes and to support oth
er malicious activities, including distraction, hacktivism, and extortion.
        - Technique ID: T1499
          Technique Name: Endpoint Denial of Service
          Technique Name: Adversaries may perform Endpoint Denial of Service (DoS) atta
cks to degrade or block the availability of services to users. Endpoint DoS can be perfo
rmed by exhausting the system resources those services are hosted on or exploiting the s
ystem to cause a persistent crash condition. Example services include websites, email se
rvices, DNS, and web-based applications. Adversaries have been observed conducting DoS a
ttacks for political purposes and to support other malicious activities, including distr
action, hacktivism, and extortion.
        - Technique ID: T1505
          Technique Name: Server Software Component
          Technique Name: Adversaries may abuse legitimate extensible development featu
res of servers to establish persistent access to systems. Enterprise server applications
may include features that allow developers to write and install software or scripts to e
xtend the functionality of the main application. Adversaries may install malicious compo
nents to extend and abuse server applications.
        - Technique ID: T1518
          Technique Name: Software Discovery
          Technique Name: Adversaries may attempt to get a listing of software and soft
ware versions that are installed on a system or in a cloud environment. Adversaries may
use the information from Software Discovery during automated discovery to shape follow-o
n behaviors, including whether or not the adversary fully infects the target and/or atte
mpts specific actions.
        - Technique ID: T1526
          Technique Name: Cloud Service Discovery
          Technique Name: An adversary may attempt to enumerate the cloud services runn
ing on a system after gaining access. These methods can differ from platform-as-a-servic
e (PaaS), to infrastructure-as-a-service (IaaS), or software-as-a-service (SaaS). Many s
ervices exist throughout the various cloud providers and can include Continuous Integrat
ion and Continuous Delivery (CI/CD), Lambda Functions, Azure AD, etc. They may also incl
ude security services, such as AWS GuardDuty and Microsoft Defender for Cloud, and loggi
ng services, such as AWS CloudTrail and Google Cloud Audit Logs.
        - Technique ID: T1538
          Technique Name: Cloud Service Dashboard
          Technique Name: An adversary may use a cloud service dashboard GUI with stole
n credentials to gain useful information from an operational cloud environment, such as
specific services, resources, and features. For example, the GCP Command Center can be u
sed to view all assets, findings of potential security risks, and to run additional quer
ies, such as finding public IP addresses and open ports.
        - Technique ID: T1554
          Technique Name: Compromise Client Software Binary
          Technique Name: Adversaries may modify client software binaries to establish
persistent access to systems. Client software enables users to access services provided
by a server. Common client software types are SSH clients, FTP clients, email clients, a
nd web browsers.
        - Technique ID: T1563
          Technique Name: Remote Service Session Hijacking
          Technique Name: Adversaries may take control of preexisting sessions with rem
ote services to move laterally in an environment. Users may use valid credentials to log
into a service specifically designed to accept remote connections, such as telnet, SSH,
and RDP. When a user logs into a service, a session will be established that will allow
them to maintain a continuous interaction with that service.
        - Technique ID: T1567
          Technique Name: Exfiltration Over Web Service
          Technique Name: Adversaries may use an existing, legitimate external Web serv
ice to exfiltrate data rather than their primary command and control channel. Popular We
b services acting as an exfiltration mechanism may give a significant amount of cover du
e to the likelihood that hosts within a network are already communicating with them prio
r to compromise. Firewall rules may also already exist to permit traffic to these servic
es.
        - Technique ID: T1569

Technique Name: System Services
Technique Name: Adversaries may abuse system services or daemons to execute commands or programs. Adversaries can execute malicious content by interacting with or creating services either locally or remotely. Many services are set to run at boot, which can aid in achieving persistence (Create or Modify System Process), but adversaries can also abuse services for one-time or temporary execution.

Module: Export
Vulnerability Title: Broken Access Control
Related Techniques:
- Technique ID: T1006
Technique Name: Direct Volume Access
Technique Name: Adversaries may directly access a volume to bypass file access controls and file system monitoring. Windows allows programs to have direct access to logical volumes. Programs with direct access may read and write files directly from the drive by analyzing file system data structures. This technique may bypass Windows file access controls as well as file system monitoring tools.
- Technique ID: T1134
Technique Name: Access Token Manipulation
Technique Name: Adversaries may modify access tokens to operate under a different user or system security context to perform actions and bypass access controls. Windows uses access tokens to determine the ownership of a running process. A user can manipulate access tokens to make a running process appear as though it is the child of a different process or belongs to someone other than the user that started the process. When this occurs, the process also takes on the security context associated with the new token.
- Technique ID: T1207
Technique Name: Rogue Domain Controller
Technique Name: Adversaries may register a rogue Domain Controller to enable manipulation of Active Directory data. DCShadow may be used to create a rogue Domain Controller (DC). DCShadow is a method of manipulating Active Directory (AD) data, including objects and schemas, by registering (or reusing an inactive registration) and simulating the behavior of a DC. Once registered, a rogue DC may be able to inject and replicate changes into AD infrastructure for any domain object, including credentials and keys.
- Technique ID: T1212
Technique Name: Exploitation for Credential Access
Technique Name: Adversaries may exploit software vulnerabilities in an attempt to collect credentials. Exploitation of a software vulnerability occurs when an adversary takes advantage of a programming error in a program, service, or within the operating system software or kernel itself to execute adversary-controlled code.
- Technique ID: T1219
Technique Name: Remote Access Software
Technique Name: An adversary may use legitimate desktop support and remote access software to establish an interactive command and control channel to target systems within networks. These services, such as VNC, Team Viewer, AnyDesk, ScreenConnect, LogMein, AmmyyAdmin, and other remote monitoring and management (RMM) tools, are commonly used as legitimate technical support software and may be allowed by application control within a target environment.
- Technique ID: T1528
Technique Name: Steal Application Access Token
Technique Name: Adversaries can steal application access tokens as a means of acquiring credentials to access remote systems and resources.
- Technique ID: T1531
Technique Name: Account Access Removal
Technique Name: Adversaries may interrupt availability of system and network resources by inhibiting access to accounts utilized by legitimate users. Accounts may be deleted, locked, or manipulated (ex: changed credentials) to remove access to accounts. Adversaries may also subsequently log off and/or perform a System Shutdown/Reboot to set malicious changes into place.
- Technique ID: T1548
Technique Name: Abuse Elevation Control Mechanism
Technique Name: Adversaries may circumvent mechanisms designed to control elevate privileges to gain higher-level permissions. Most modern systems contain native ele

vation control mechanisms that are intended to limit privileges that a user can perform on a machine. Authorization has to be granted to specific users in order to perform tasks that can be considered of higher risk. An adversary can perform several methods to take advantage of built-in control mechanisms in order to escalate privileges on a system.
- Technique ID: T1553
  Technique Name: Subvert Trust Controls
  Technique Name: Adversaries may undermine security controls that will either warn users of untrusted activity or prevent execution of untrusted programs. Operating systems and security products may contain mechanisms to identify programs or websites as possessing some level of trust. Examples of such features would include a program being allowed to run because it is signed by a valid code signing certificate, a program prompting the user with a warning because it has an attribute set from being downloaded from the Internet, or getting an indication that you are about to connect to an untrusted site.
- Technique ID: T1650
  Technique Name: Acquire Access
  Technique Name: Adversaries may purchase or otherwise acquire an existing access to a target system or network. A variety of online services and initial access broker networks are available to sell access to previously compromised systems. In some cases, adversary groups may form partnerships to share compromised systems with each other.

Vulnerability Title: Denial of Service (DoS)
Related Techniques:
- Technique ID: T1007
  Technique Name: System Service Discovery
  Technique Name: Adversaries may try to gather information about registered local system services. Adversaries may obtain information about services using tools as well as OS utility commands such as sc query, tasklist /svc, systemctl --type=service, and net start.
- Technique ID: T1021
  Technique Name: Remote Services
  Technique Name: Adversaries may use Valid Accounts to log into a service that accepts remote connections, such as telnet, SSH, and VNC. The adversary may then perform actions as the logged-on user.
- Technique ID: T1046
  Technique Name: Network Service Discovery
  Technique Name: Adversaries may attempt to get a listing of services running on remote hosts and local network infrastructure devices, including those that may be vulnerable to remote software exploitation. Common methods to acquire this information include port and/or vulnerability scans using tools that are brought onto a system.
- Technique ID: T1072
  Technique Name: Software Deployment Tools
  Technique Name: Adversaries may gain access to and use third-party software suites installed within an enterprise network, such as administration, monitoring, and deployment systems, to move laterally through the network. Third-party applications and software deployment systems may be in use in the network environment for administration purposes (e.g., SCCM, HBSS, Altiris, etc.).
- Technique ID: T1102
  Technique Name: Web Service
  Technique Name: Adversaries may use an existing, legitimate external Web service as a means for relaying data to/from a compromised system. Popular websites and social media acting as a mechanism for C2 may give a significant amount of cover due to the likelihood that hosts within a network are already communicating with them prior to a compromise. Using common services, such as those offered by Google or Twitter, makes it easier for adversaries to hide in expected noise. Web service providers commonly use SSL/TLS encryption, giving adversaries an added level of protection.
- Technique ID: T1133
  Technique Name: External Remote Services
  Technique Name: Adversaries may leverage external-facing remote services to initially access and/or persist within a network. Remote services such as VPNs, Citrix, and other access mechanisms allow users to connect to internal enterprise network resources from external locations. There are often remote service gateways that manage connections and credential authentication for these services. Services such as Windows Remote Management and VNC can also be used externally.

- Technique ID: T1137
  Technique Name: Office Application Startup
  Technique Name: Adversaries may leverage Microsoft Office-based applications for persistence between startups. Microsoft Office is a fairly common application suite on Windows-based operating systems within an enterprise network. There are multiple mechanisms that can be used with Office for persistence when an Office-based application is started; this can include the use of Office Template Macros and add-ins.
- Technique ID: T1210
  Technique Name: Exploitation of Remote Services
  Technique Name: Adversaries may exploit remote services to gain unauthorized access to internal systems once inside of a network. Exploitation of a software vulnerability occurs when an adversary takes advantage of a programming error in a program, service, or within the operating system software or kernel itself to execute adversary-controlled code. A common goal for post-compromise exploitation of remote services is for lateral movement to enable access to a remote system.
- Technique ID: T1219
  Technique Name: Remote Access Software
  Technique Name: An adversary may use legitimate desktop support and remote access software to establish an interactive command and control channel to target systems within networks. These services, such as VNC, Team Viewer, AnyDesk, ScreenConnect, LogMein, AmmyyAdmin, and other remote monitoring and management (RMM) tools, are commonly used as legitimate technical support software and may be allowed by application control within a target environment.
- Technique ID: T1489
  Technique Name: Service Stop
  Technique Name: Adversaries may stop or disable services on a system to render those services unavailable to legitimate users. Stopping critical services or processes can inhibit or stop response to an incident or aid in the adversary's overall objectives to cause damage to the environment.
- Technique ID: T1498
  Technique Name: Network Denial of Service
  Technique Name: Adversaries may perform Network Denial of Service (DoS) attacks to degrade or block the availability of targeted resources to users. Network DoS can be performed by exhausting the network bandwidth services rely on. Example resources include specific websites, email services, DNS, and web-based applications. Adversaries have been observed conducting network DoS attacks for political purposes and to support other malicious activities, including distraction, hacktivism, and extortion.
- Technique ID: T1499
  Technique Name: Endpoint Denial of Service
  Technique Name: Adversaries may perform Endpoint Denial of Service (DoS) attacks to degrade or block the availability of services to users. Endpoint DoS can be performed by exhausting the system resources those services are hosted on or exploiting the system to cause a persistent crash condition. Example services include websites, email services, DNS, and web-based applications. Adversaries have been observed conducting DoS attacks for political purposes and to support other malicious activities, including distraction, hacktivism, and extortion.
- Technique ID: T1505
  Technique Name: Server Software Component
  Technique Name: Adversaries may abuse legitimate extensible development features of servers to establish persistent access to systems. Enterprise server applications may include features that allow developers to write and install software or scripts to extend the functionality of the main application. Adversaries may install malicious components to extend and abuse server applications.
- Technique ID: T1518
  Technique Name: Software Discovery
  Technique Name: Adversaries may attempt to get a listing of software and software versions that are installed on a system or in a cloud environment. Adversaries may use the information from Software Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
- Technique ID: T1526
  Technique Name: Cloud Service Discovery
  Technique Name: An adversary may attempt to enumerate the cloud services running on a system after gaining access. These methods can differ from platform-as-a-servic

e (PaaS), to infrastructure-as-a-service (IaaS), or software-as-a-service (SaaS). Many s
ervices exist throughout the various cloud providers and can include Continuous Integrat
ion and Continuous Delivery (CI/CD), Lambda Functions, Azure AD, etc. They may also incl
ude security services, such as AWS GuardDuty and Microsoft Defender for Cloud, and loggi
ng services, such as AWS CloudTrail and Google Cloud Audit Logs.
        - Technique ID: T1538
          Technique Name: Cloud Service Dashboard
          Technique Name: An adversary may use a cloud service dashboard GUI with stole
n credentials to gain useful information from an operational cloud environment, such as
specific services, resources, and features. For example, the GCP Command Center can be u
sed to view all assets, findings of potential security risks, and to run additional quer
ies, such as finding public IP addresses and open ports.
        - Technique ID: T1554
          Technique Name: Compromise Client Software Binary
          Technique Name: Adversaries may modify client software binaries to establish
persistent access to systems. Client software enables users to access services provided
by a server. Common client software types are SSH clients, FTP clients, email clients, a
nd web browsers.
        - Technique ID: T1563
          Technique Name: Remote Service Session Hijacking
          Technique Name: Adversaries may take control of preexisting sessions with rem
ote services to move laterally in an environment. Users may use valid credentials to log
into a service specifically designed to accept remote connections, such as telnet, SSH,
and RDP. When a user logs into a service, a session will be established that will allow
them to maintain a continuous interaction with that service.
        - Technique ID: T1567
          Technique Name: Exfiltration Over Web Service
          Technique Name: Adversaries may use an existing, legitimate external Web serv
ice to exfiltrate data rather than their primary command and control channel. Popular We
b services acting as an exfiltration mechanism may give a significant amount of cover du
e to the likelihood that hosts within a network are already communicating with them prio
r to compromise. Firewall rules may also already exist to permit traffic to these servic
es.
        - Technique ID: T1569
          Technique Name: System Services
          Technique Name: Adversaries may abuse system services or daemons to execute c
ommands or programs. Adversaries can execute malicious content by interacting with or cr
eating services either locally or remotely. Many services are set to run at boot, which
can aid in achieving persistence (Create or Modify System Process), but adversaries can
also abuse services for one-time or temporary execution.

Module: File Upload
       Vulnerability Title: Directory Traversal
       Related Techniques:
        - Technique ID: T1083
          Technique Name: File and Directory Discovery
          Technique Name: Adversaries may enumerate files and directories or may search
in specific locations of a host or network share for certain information within a file s
ystem. Adversaries may use the information from File and Directory Discovery during auto
mated discovery to shape follow-on behaviors, including whether or not the adversary ful
ly infects the target and/or attempts specific actions.
        - Technique ID: T1222
          Technique Name: File and Directory Permissions Modification
          Technique Name: Adversaries may modify file or directory permissions/attribut
es to evade access control lists (ACLs) and access protected files. File and directory p
ermissions are commonly managed by ACLs configured by the file or directory owner, or us
ers with the appropriate permissions. File and directory ACL implementations vary by pla
tform, but generally explicitly designate which users or groups can perform which action
s (read, write, execute, etc.).

       Vulnerability Title: Insecure File Upload
       Related Techniques:
        - Technique ID: T1027

Technique Name: Obfuscated Files or Information
Technique Name: Adversaries may attempt to make an executable or file difficult to discover or analyze by encrypting, encoding, or otherwise obfuscating its contents on the system or in transit. This is common behavior that can be used across different platforms and the network to evade defenses.
- Technique ID: T1083
Technique Name: File and Directory Discovery
Technique Name: Adversaries may enumerate files and directories or may search in specific locations of a host or network share for certain information within a file system. Adversaries may use the information from File and Directory Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
- Technique ID: T1140
Technique Name: Deobfuscate/Decode Files or Information
Technique Name: Adversaries may use Obfuscated Files or Information to hide artifacts of an intrusion from analysis. They may require separate mechanisms to decode or deobfuscate that information depending on how they intend to use it. Methods for doing that include built-in functionality of malware or by using utilities present on the system.
- Technique ID: T1222
Technique Name: File and Directory Permissions Modification
Technique Name: Adversaries may modify file or directory permissions/attributes to evade access control lists (ACLs) and access protected files. File and directory permissions are commonly managed by ACLs configured by the file or directory owner, or users with the appropriate permissions. File and directory ACL implementations vary by platform, but generally explicitly designate which users or groups can perform which actions (read, write, execute, etc.).
- Technique ID: T1647
Technique Name: Plist File Modification
Technique Name: Adversaries may modify property list files (plist files) to enable other malicious activity, while also potentially evading and bypassing system defenses. macOS applications use plist files, such as the info.plist file, to store properties and configuration settings that inform the operating system how to handle the application at runtime. Plist files are structured metadata in key-value pairs formatted in XML based on Apple's Core Foundation DTD. Plist files can be saved in text or binary format.

Module: File Browser
Vulnerability Title: Remote Code Execution
Related Techniques:
- Technique ID: T1018
Technique Name: Remote System Discovery
Technique Name: Adversaries may attempt to get a listing of other systems by IP address, hostname, or other logical identifier on a network that may be used for Lateral Movement from the current system. Functionality could exist within remote access tools to enable this, but utilities available on the operating system could also be used such as Ping or net view using Net.
- Technique ID: T1021
Technique Name: Remote Services
Technique Name: Adversaries may use Valid Accounts to log into a service that accepts remote connections, such as telnet, SSH, and VNC. The adversary may then perform actions as the logged-on user.
- Technique ID: T1127
Technique Name: Trusted Developer Utilities Proxy Execution
Technique Name: Adversaries may take advantage of trusted developer utilities to proxy execution of malicious payloads. There are many utilities used for software development related tasks that can be used to execute code in various forms to assist in development, debugging, and reverse engineering. These utilities may often be signed with legitimate certificates that allow them to execute on a system and proxy execution of malicious code through a trusted process that effectively bypasses application control solutions.
- Technique ID: T1133
Technique Name: External Remote Services
Technique Name: Adversaries may leverage external-facing remote services to i

nitially access and/or persist within a network. Remote services such as VPNs, Citrix, a
nd other access mechanisms allow users to connect to internal enterprise network resourc
es from external locations. There are often remote service gateways that manage connecti
ons and credential authentication for these services. Services such as Windows Remote Ma
nagement and VNC can also be used externally.
        - Technique ID: T1140
          Technique Name: Deobfuscate/Decode Files or Information
          Technique Name: Adversaries may use Obfuscated Files or Information to hide a
rtifacts of an intrusion from analysis. They may require separate mechanisms to decode o
r deobfuscate that information depending on how they intend to use it. Methods for doing
that include built-in functionality of malware or by using utilities present on the syst
em.
        - Technique ID: T1202
          Technique Name: Indirect Command Execution
          Technique Name: Adversaries may abuse utilities that allow for command execut
ion to bypass security restrictions that limit the use of command-line interpreters. Var
ious Windows utilities may be used to execute commands, possibly without invoking cmd. F
or example, Forfiles, the Program Compatibility Assistant (pcalua.exe), components of th
e Windows Subsystem for Linux (WSL), as well as other utilities may invoke the execution
of programs and commands from a Command and Scripting Interpreter, Run window, or via sc
ripts.
        - Technique ID: T1203
          Technique Name: Exploitation for Client Execution
          Technique Name: Adversaries may exploit software vulnerabilities in client ap
plications to execute code. Vulnerabilities can exist in software due to unsecure coding
practices that can lead to unanticipated behavior. Adversaries can take advantage of cer
tain vulnerabilities through targeted exploitation for the purpose of arbitrary code exe
cution. Oftentimes the most valuable exploits to an offensive toolkit are those that can
be used to obtain code execution on a remote system because they can be used to gain acc
ess to that system. Users will expect to see files related to the applications they comm
only used to do work, so they are a useful target for exploit research and development b
ecause of their high utility.
        - Technique ID: T1204
          Technique Name: User Execution
          Technique Name: An adversary may rely upon specific actions by a user in orde
r to gain execution. Users may be subjected to social engineering to get them to execute
malicious code by, for example, opening a malicious document file or link. These user ac
tions will typically be observed as follow-on behavior from forms of Phishing.
        - Technique ID: T1210
          Technique Name: Exploitation of Remote Services
          Technique Name: Adversaries may exploit remote services to gain unauthorized
access to internal systems once inside of a network. Exploitation of a software vulnerab
ility occurs when an adversary takes advantage of a programming error in a program, serv
ice, or within the operating system software or kernel itself to execute adversary-contr
olled code. A common goal for post-compromise exploitation of remote services is for lat
eral movement to enable access to a remote system.
        - Technique ID: T1216
          Technique Name: System Script Proxy Execution
          Technique Name: Adversaries may use trusted scripts, often signed with certif
icates, to proxy the execution of malicious files. Several Microsoft signed scripts that
have been downloaded from Microsoft or are default on Windows installations can be used
to proxy execution of other files. This behavior may be abused by adversaries to execute
malicious files that could bypass application control and signature validation on system
s.
        - Technique ID: T1218
          Technique Name: System Binary Proxy Execution
          Technique Name: Adversaries may bypass process and/or signature-based defense
s by proxying execution of malicious content with signed, or otherwise trusted, binarie
s. Binaries used in this technique are often Microsoft-signed files, indicating that the
y have been either downloaded from Microsoft or are already native in the operating syst
em. Binaries signed with trusted digital certificates can typically execute on Windows s
ystems protected by digital signature validation. Several Microsoft signed binaries that
are default on Windows installations can be used to proxy execution of other files or co
mmands.

- Technique ID: T1219
  Technique Name: Remote Access Software
  Technique Name: An adversary may use legitimate desktop support and remote access software to establish an interactive command and control channel to target systems within networks. These services, such as VNC, Team Viewer, AnyDesk, ScreenConnect, LogMein, AmmyyAdmin, and other remote monitoring and management (RMM) tools, are commonly used as legitimate technical support software and may be allowed by application control within a target environment.
- Technique ID: T1480
  Technique Name: Execution Guardrails
  Technique Name: Adversaries may use execution guardrails to constrain execution or actions based on adversary supplied and environment specific conditions that are expected to be present on the target. Guardrails ensure that a payload only executes against an intended target and reduces collateral damage from an adversary’s campaign. Values an adversary can provide about a target system or environment to use as guardrails may include specific network share names, attached physical devices, files, joined Active Directory (AD) domains, and local/external IP addresses.
- Technique ID: T1546
  Technique Name: Event Triggered Execution
  Technique Name: Adversaries may establish persistence and/or elevate privileges using system mechanisms that trigger execution based on specific events. Various operating systems have means to monitor and subscribe to events such as logons or other user activity such as running specific applications/binaries. Cloud environments may also support various functions and services that monitor and can be invoked in response to specific cloud events.
- Technique ID: T1547
  Technique Name: Boot or Logon Autostart Execution
  Technique Name: Adversaries may configure system settings to automatically execute a program during system boot or logon to maintain persistence or gain higher-level privileges on compromised systems. Operating systems may have mechanisms for automatically running a program on system boot or account logon. These mechanisms may include automatically executing programs that are placed in specially designated directories or are referenced by repositories that store configuration information, such as the Windows Registry. An adversary may achieve the same goal by modifying or extending features of the kernel.
- Technique ID: T1563
  Technique Name: Remote Service Session Hijacking
  Technique Name: Adversaries may take control of preexisting sessions with remote services to move laterally in an environment. Users may use valid credentials to log into a service specifically designed to accept remote connections, such as telnet, SSH, and RDP. When a user logs into a service, a session will be established that will allow them to maintain a continuous interaction with that service.
- Technique ID: T1574
  Technique Name: Hijack Execution Flow
  Technique Name: Adversaries may execute their own malicious payloads by hijacking the way operating systems run programs. Hijacking execution flow can be for the purposes of persistence, since this hijacked execution may reoccur over time. Adversaries may also use these mechanisms to elevate privileges or evade defenses, such as application control or other restrictions on execution.
- Technique ID: T1620
  Technique Name: Reflective Code Loading
  Technique Name: Adversaries may reflectively load code into a process in order to conceal the execution of malicious payloads. Reflective loading involves allocating then executing payloads directly within the memory of the process, vice creating a thread or process backed by a file path on disk. Reflectively loaded payloads may be compiled binaries, anonymous files (only present in RAM), or just snubs of fileless executable code (ex: position-independent shellcode).
- Technique ID: T1648
  Technique Name: Serverless Execution
  Technique Name: Adversaries may abuse serverless computing, integration, and automation services to execute arbitrary code in cloud environments. Many cloud providers offer a variety of serverless resources, including compute engines, application integration services, and web servers.

Vulnerability Title: Directory Traversal
Related Techniques:
- Technique ID: T1083
Technique Name: File and Directory Discovery
Technique Name: Adversaries may enumerate files and directories or may search in specific locations of a host or network share for certain information within a file system. Adversaries may use the information from File and Directory Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
- Technique ID: T1222
Technique Name: File and Directory Permissions Modification
Technique Name: Adversaries may modify file or directory permissions/attributes to evade access control lists (ACLs) and access protected files. File and directory permissions are commonly managed by ACLs configured by the file or directory owner, or users with the appropriate permissions. File and directory ACL implementations vary by platform, but generally explicitly designate which users or groups can perform which actions (read, write, execute, etc.).

Module: Web Service
Vulnerability Title: Session Fixation
Related Techniques:
- Technique ID: T1185
Technique Name: Browser Session Hijacking
Technique Name: Adversaries may take advantage of security vulnerabilities and inherent functionality in browser software to change content, modify user-behaviors, and intercept information as part of various browser session hijacking techniques.
- Technique ID: T1539
Technique Name: Steal Web Session Cookie
Technique Name: An adversary may steal web application or service session cookies and use them to gain access to web applications or Internet services as an authenticated user without needing credentials. Web applications and services often use session cookies as an authentication token after a user has authenticated to a website.
- Technique ID: T1563
Technique Name: Remote Service Session Hijacking
Technique Name: Adversaries may take control of preexisting sessions with remote services to move laterally in an environment. Users may use valid credentials to log into a service specifically designed to accept remote connections, such as telnet, SSH, and RDP. When a user logs into a service, a session will be established that will allow them to maintain a continuous interaction with that service.

Vulnerability Title: Insecure File Upload
Related Techniques:
- Technique ID: T1027
Technique Name: Obfuscated Files or Information
Technique Name: Adversaries may attempt to make an executable or file difficult to discover or analyze by encrypting, encoding, or otherwise obfuscating its contents on the system or in transit. This is common behavior that can be used across different platforms and the network to evade defenses.
- Technique ID: T1083
Technique Name: File and Directory Discovery
Technique Name: Adversaries may enumerate files and directories or may search in specific locations of a host or network share for certain information within a file system. Adversaries may use the information from File and Directory Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
- Technique ID: T1140
Technique Name: Deobfuscate/Decode Files or Information
Technique Name: Adversaries may use Obfuscated Files or Information to hide artifacts of an intrusion from analysis. They may require separate mechanisms to decode or deobfuscate that information depending on how they intend to use it. Methods for doing that include built-in functionality of malware or by using utilities present on the system.
- Technique ID: T1222

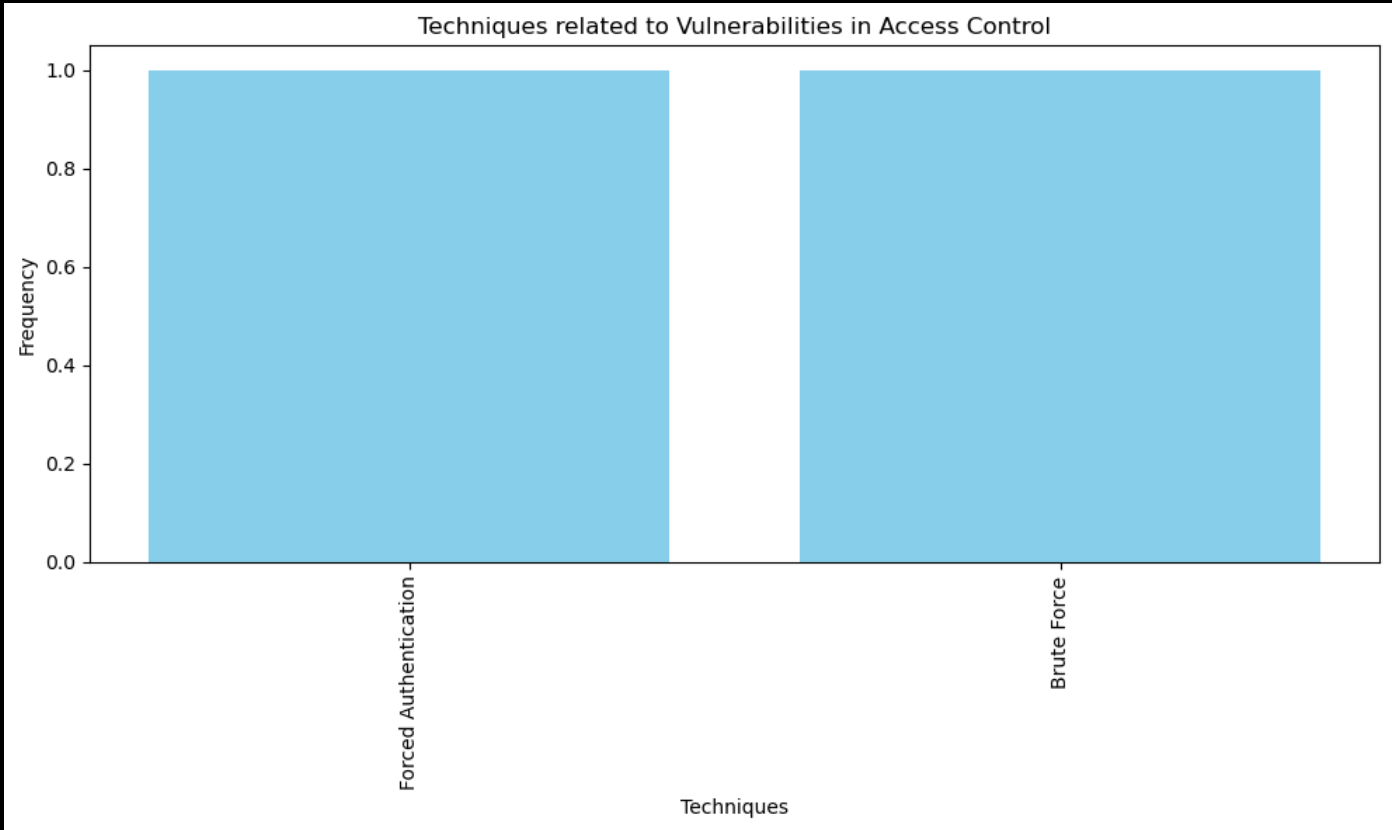
```
            Technique Name: File and Directory Permissions Modification
            Technique Name: Adversaries may modify file or directory permissions/attribut
es to evade access control lists (ACLs) and access protected files. File and directory p
ermissions are commonly managed by ACLs configured by the file or directory owner, or us
ers with the appropriate permissions. File and directory ACL implementations vary by pla
tform, but generally explicitly designate which users or groups can perform which action
s (read, write, execute, etc.).
          - Technique ID: T1647
            Technique Name: Plist File Modification
            Technique Name: Adversaries may modify property list files (plist files) to e
nable other malicious activity, while also potentially evading and bypassing system defe
nses. macOS applications use plist files, such as the info.plist file, to store properti
es and configuration settings that inform the operating system how to handle the applica
tion at runtime. Plist files are structured metadata in key-value pairs formatted in XML
based on Apple's Core Foundation DTD. Plist files can be saved in text or binary format.
```

In [ ]:

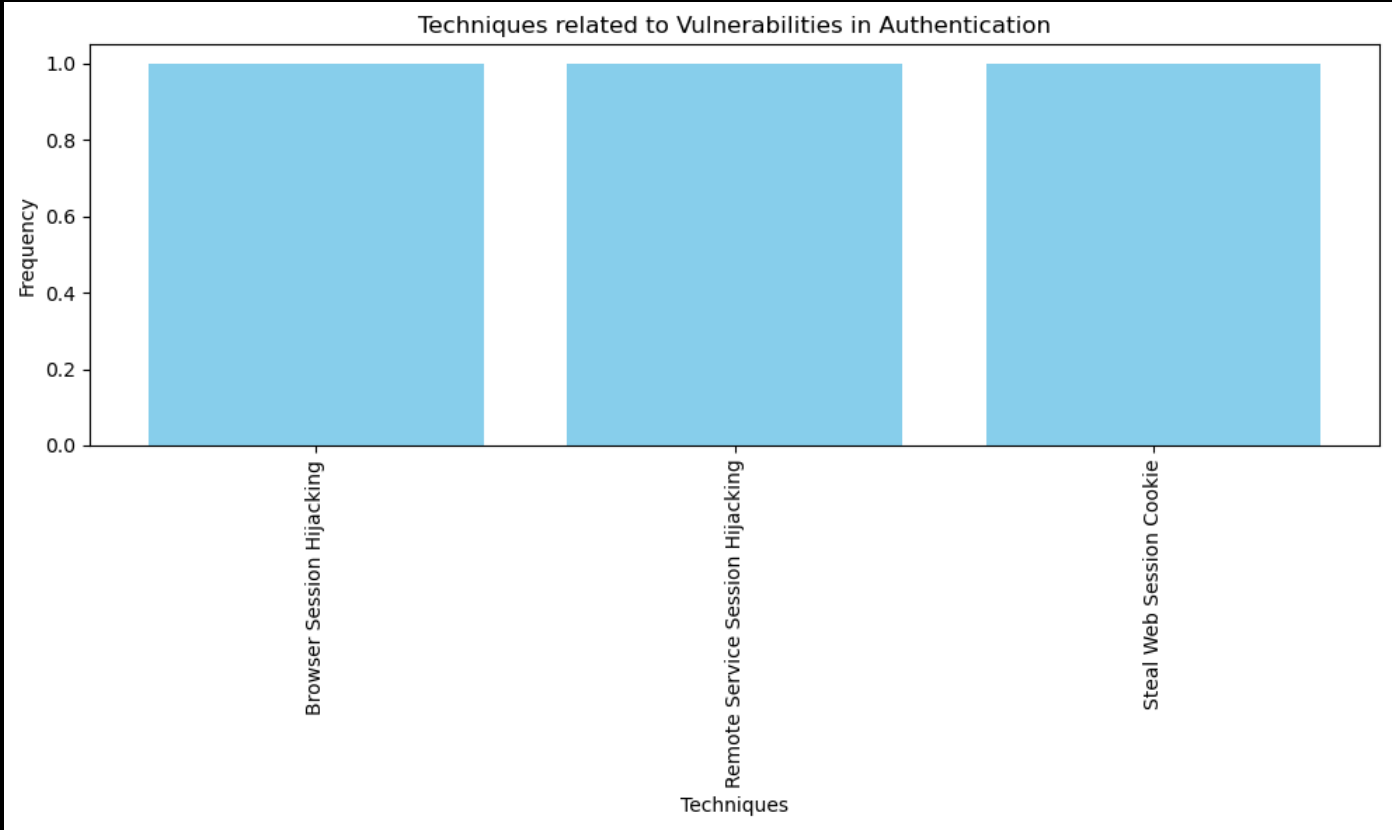
```python
import requests
import matplotlib.pyplot as plt

def fetch_vulnerabilities():
    vulnerabilities_url = "http://127.0.0.1:5000/modules/vuln"
    response = requests.get(vulnerabilities_url)
    if response.status_code == 200:
        vulnerabilities = response.json()
        return vulnerabilities
    else:
        print("Error fetching vulnerabilities:", response.status_code)
        return None

def fetch_techniques(vulnerability_title):
    techniques_url = f"http://127.0.0.1:10000/techniques/{vulnerability_title}"
    response = requests.get(techniques_url)
    if response.status_code == 200:
        techniques = response.json()
        return techniques
    else:
        print(f"Error fetching techniques for {vulnerability_title}:", response.status_c
        return None

def main():
    vulnerabilities = fetch_vulnerabilities()
    if vulnerabilities:
        for module in vulnerabilities:
            module_name = module['name']
            print(f"Module: {module_name}")
            vulnerabilities_list = module['vulnerabilities']
            technique_names = []

            # Aggregate techniques for all vulnerabilities in the module
            for vulnerability in vulnerabilities_list:
                vulnerability_title = vulnerability['title']
                techniques = fetch_techniques(vulnerability_title)
                if techniques:
                    for _, technique_data in techniques.items():
                        technique_names.append(technique_data['name'])

            # Count unique techniques
            unique_techniques = list(set(technique_names))
            technique_counts = [technique_names.count(tech) for tech in unique_technique

            # Create bar plot
            plt.figure(figsize=(10, 6))
```

```
            plt.bar(unique_techniques, technique_counts, color='skyblue')
            plt.xlabel('Techniques')
            plt.ylabel('Frequency')
            plt.title(f'Techniques related to Vulnerabilities in {module_name}')
            plt.xticks(rotation=90)
            plt.tight_layout()
            plt.show()

if __name__ == "__main__":
    main()
```

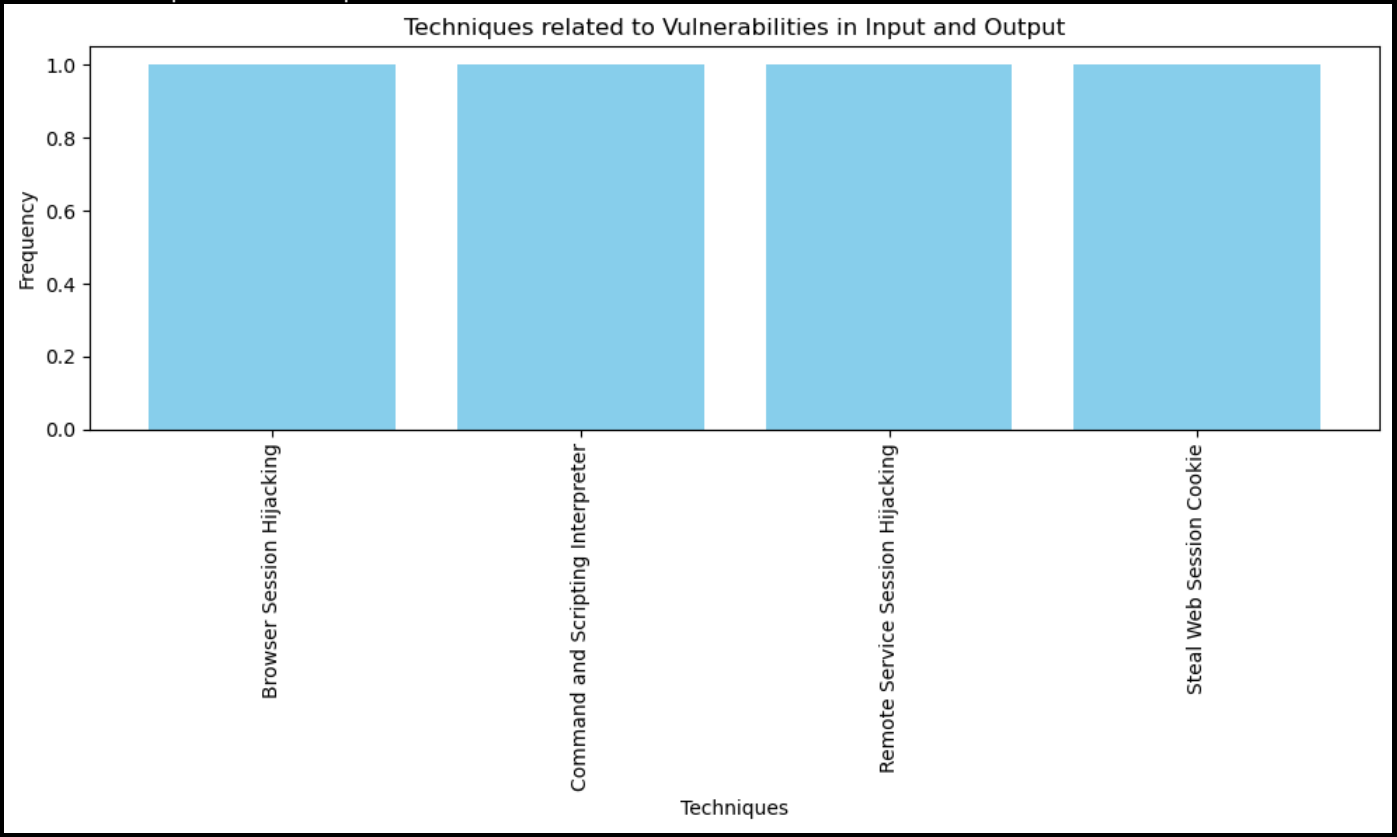
```
Module: Access Control
```



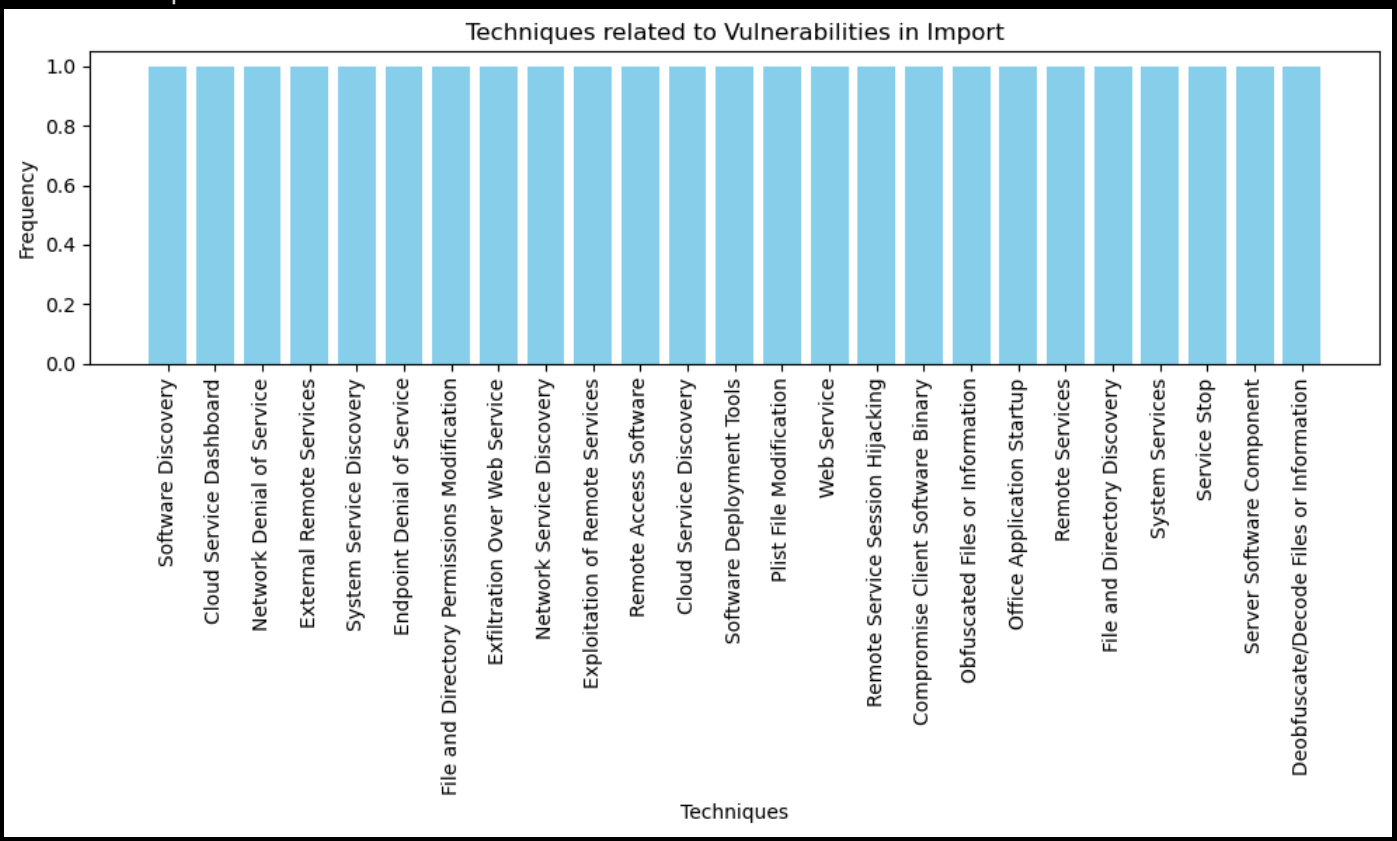

```
Module: Authentication
```



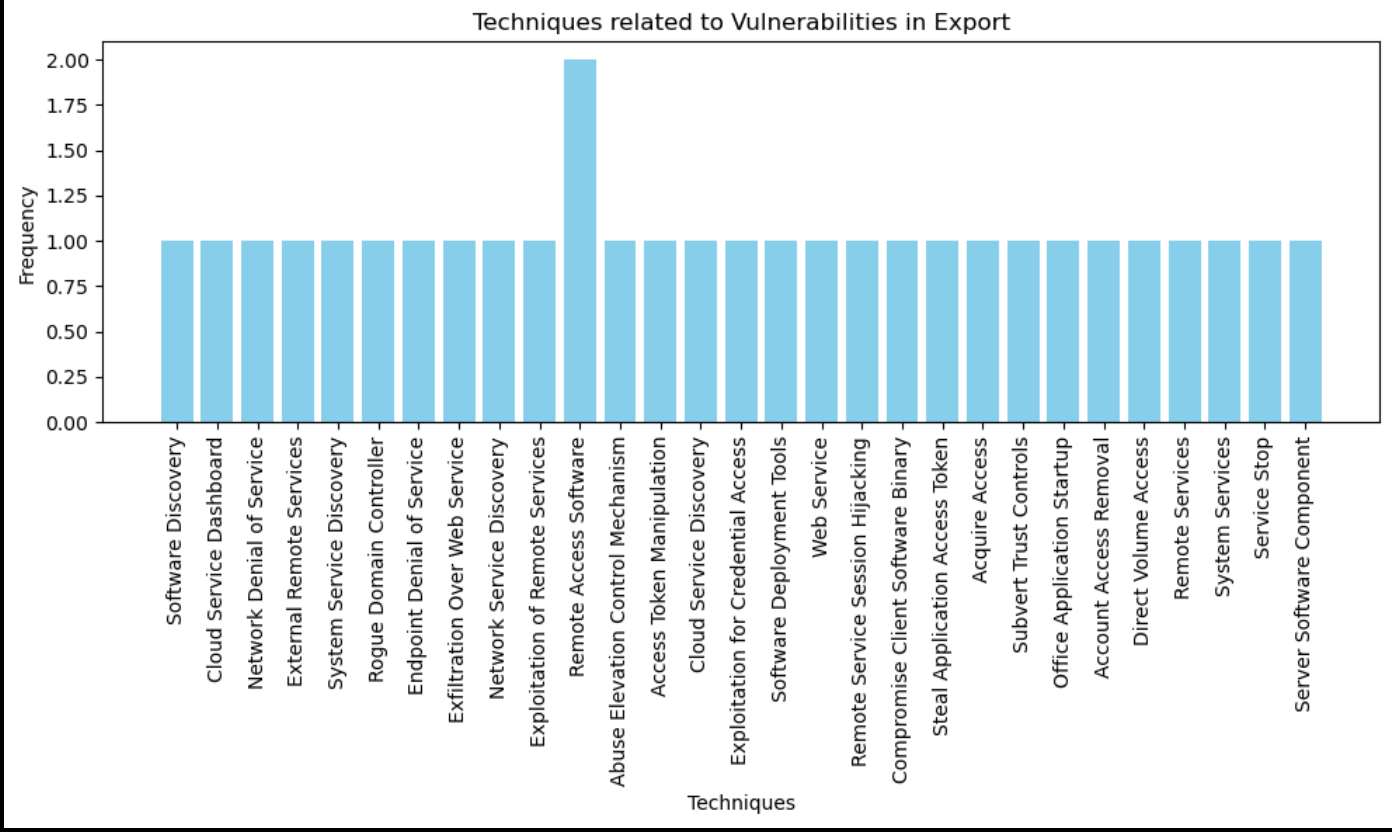
Module: Input and Output



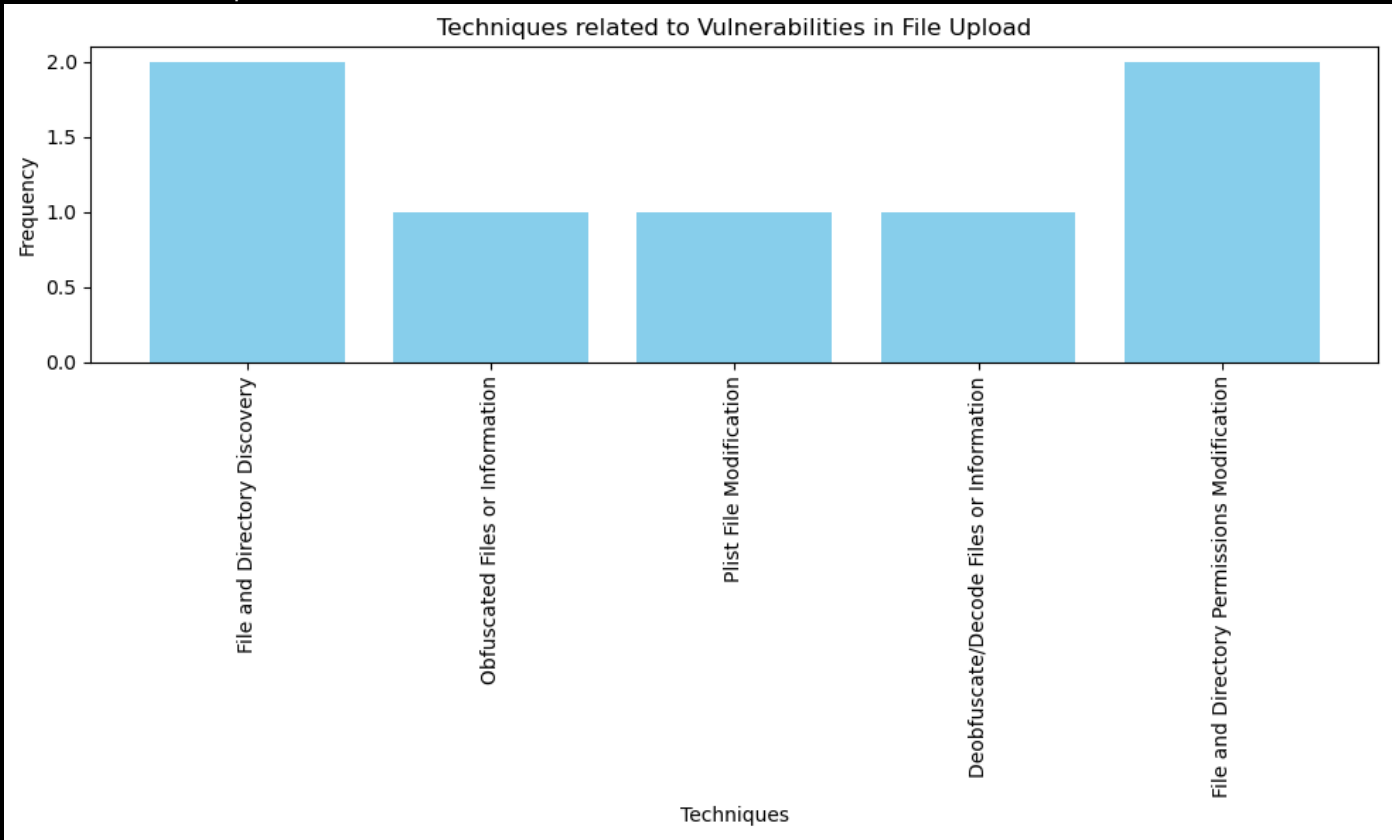
Module: Import



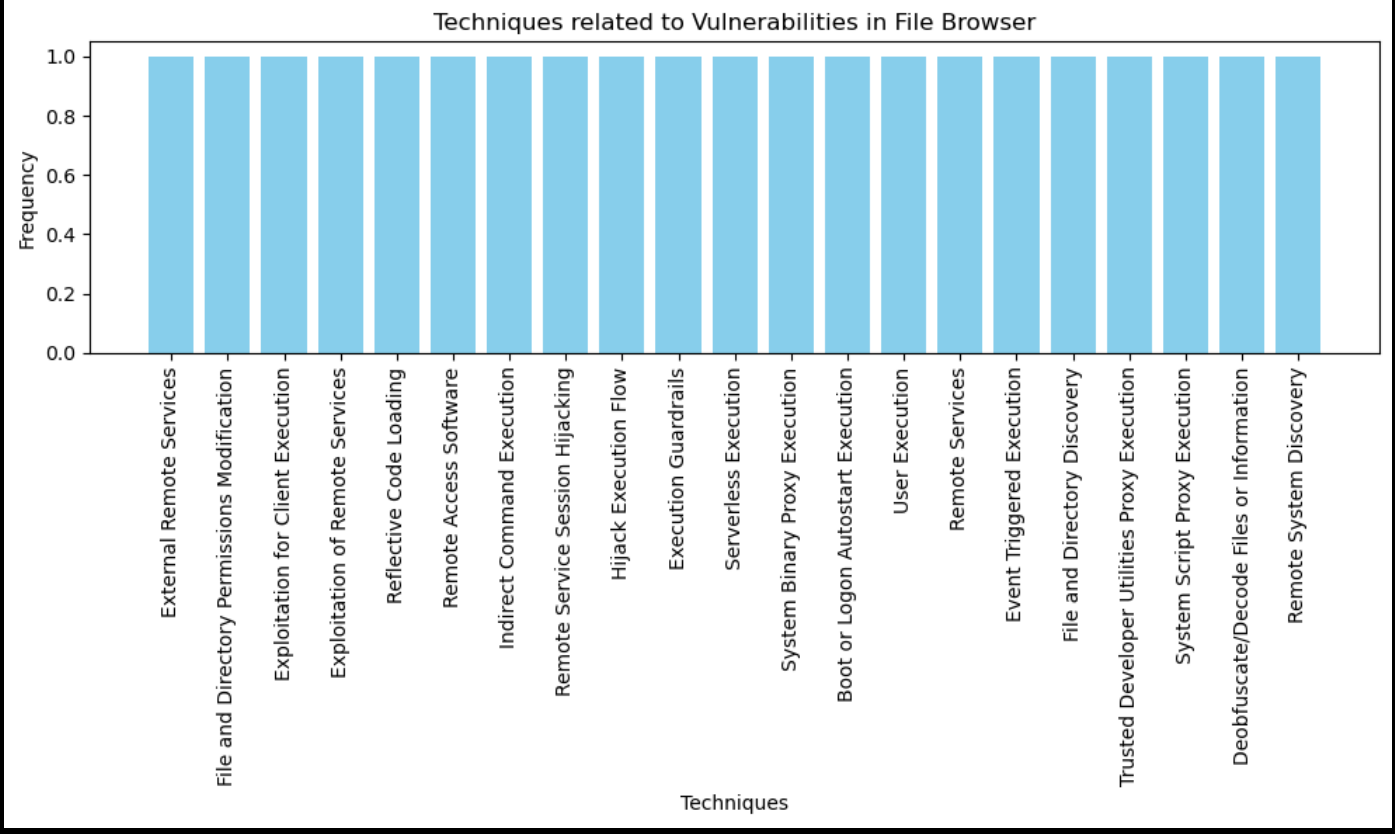
Module: Export



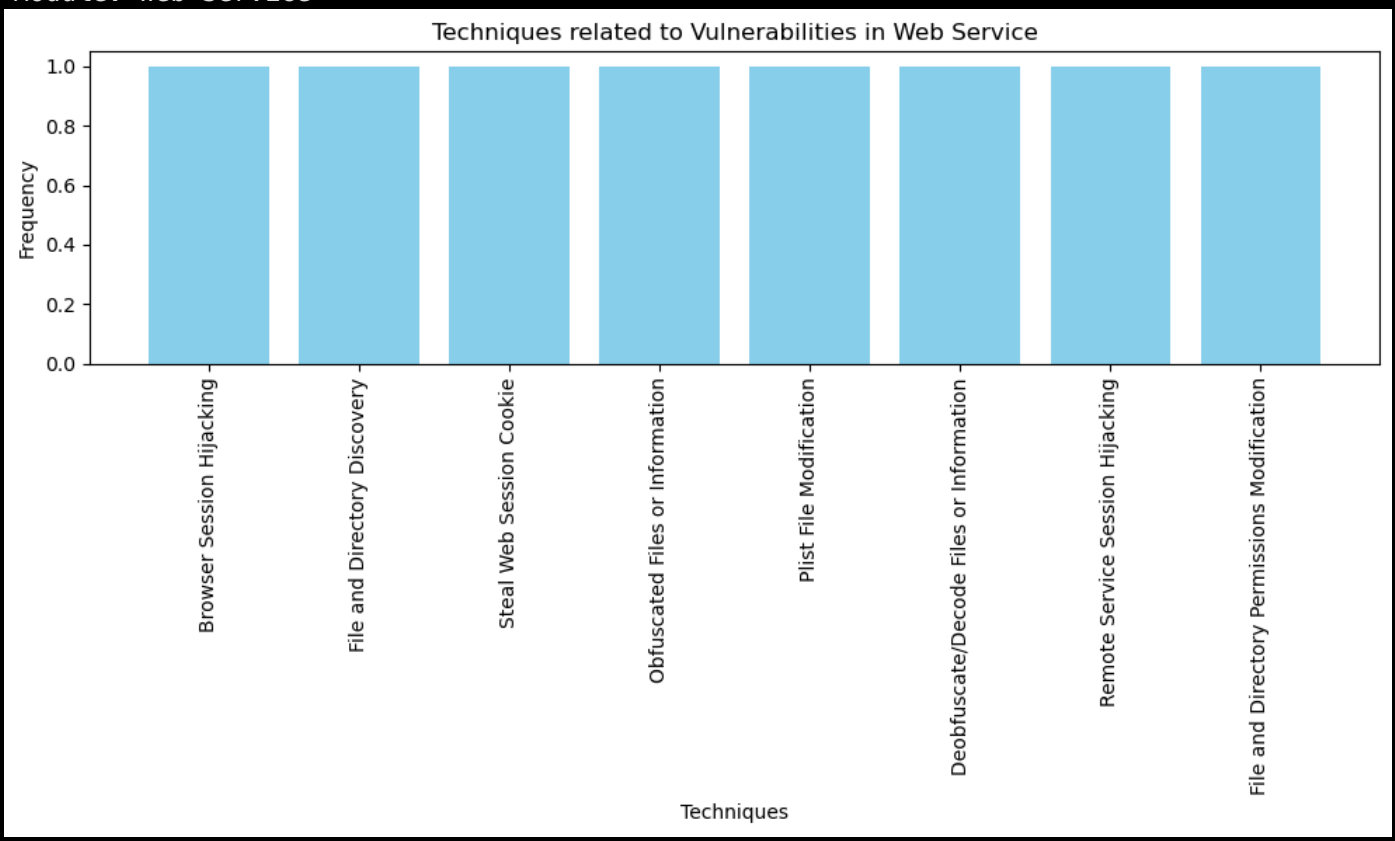
Module: File Upload



Module: File Browser



Module: Web Service



DevSecOps Maturity Model

Level 1

Think of maturity `level 1` like your first day at the gym. You're not lifting the heavy weights just yet; you're learning the ropes and maybe doing some light cardio. Similarly, at level 1, you're just getting started with integrating security into your DevOps process.

- Security practices
- Process initiation
- Education
- Risk awareness
- Automation

Level 2

It's the point where you start to incorporate and follow security best practices more systematically.

- Adoption of best practices
- Continuous security
- Partial automation
- Regular training
- Proactive security

Level 3

It signifies the transition from just setting up DevSecOps practices to actively progressing toward their maturity.

- Advanced automation
- Integration of security
- Proactive and continuous
- Regular reviews and updates
- Enhanced training

Level 4

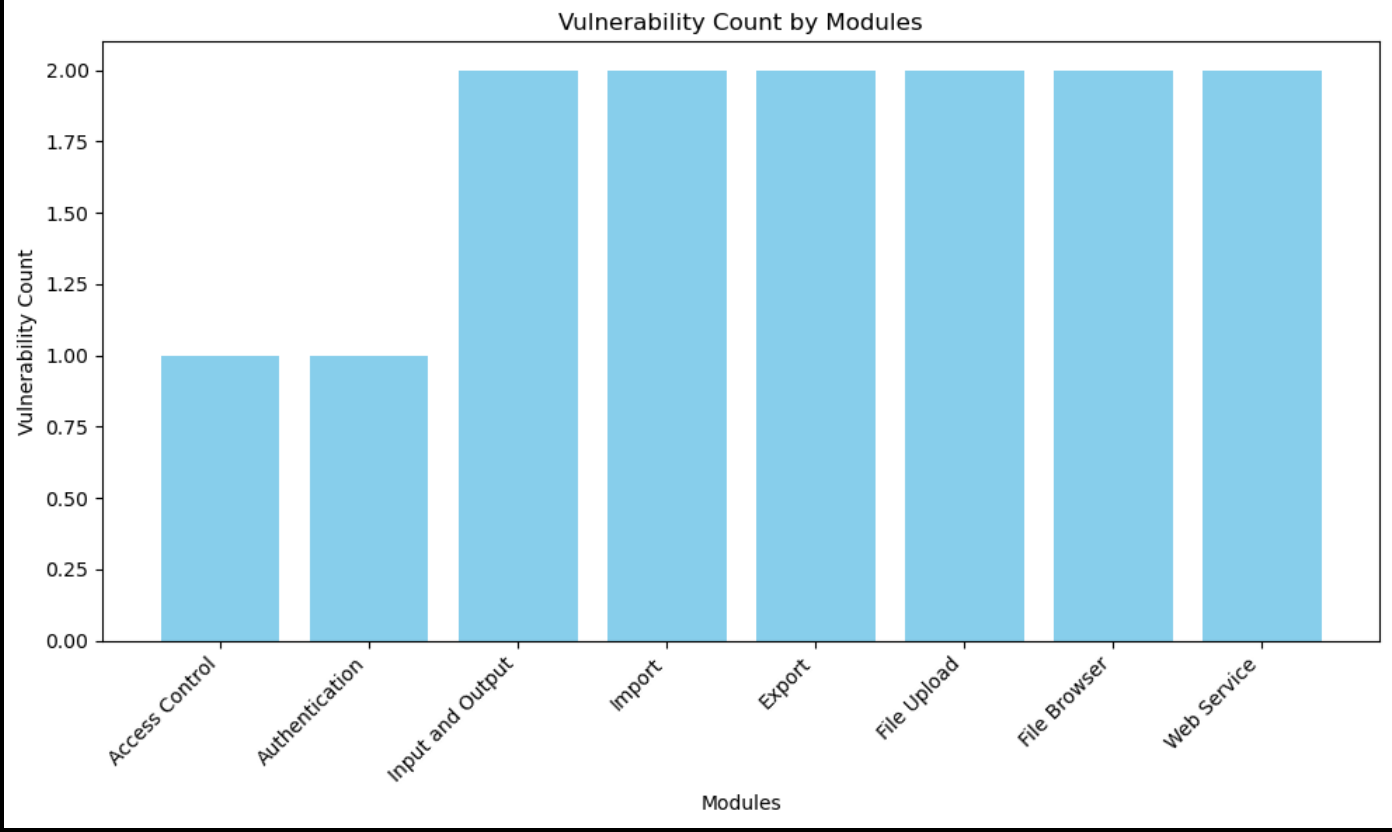
KPIs help in measuring our goals and their priority.

- Vulnerability Count by severity

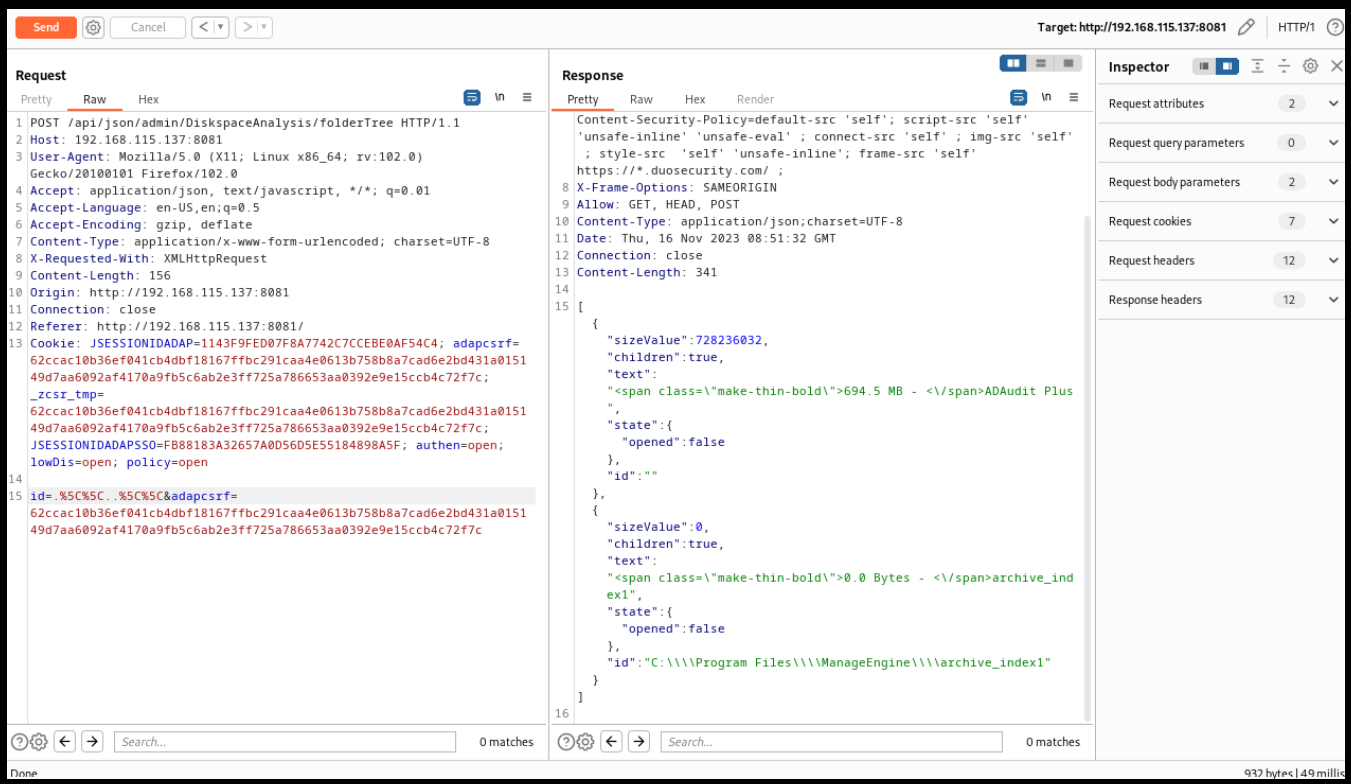
- Low Vulnerability Related Techniques Count
- Time to pwn Count

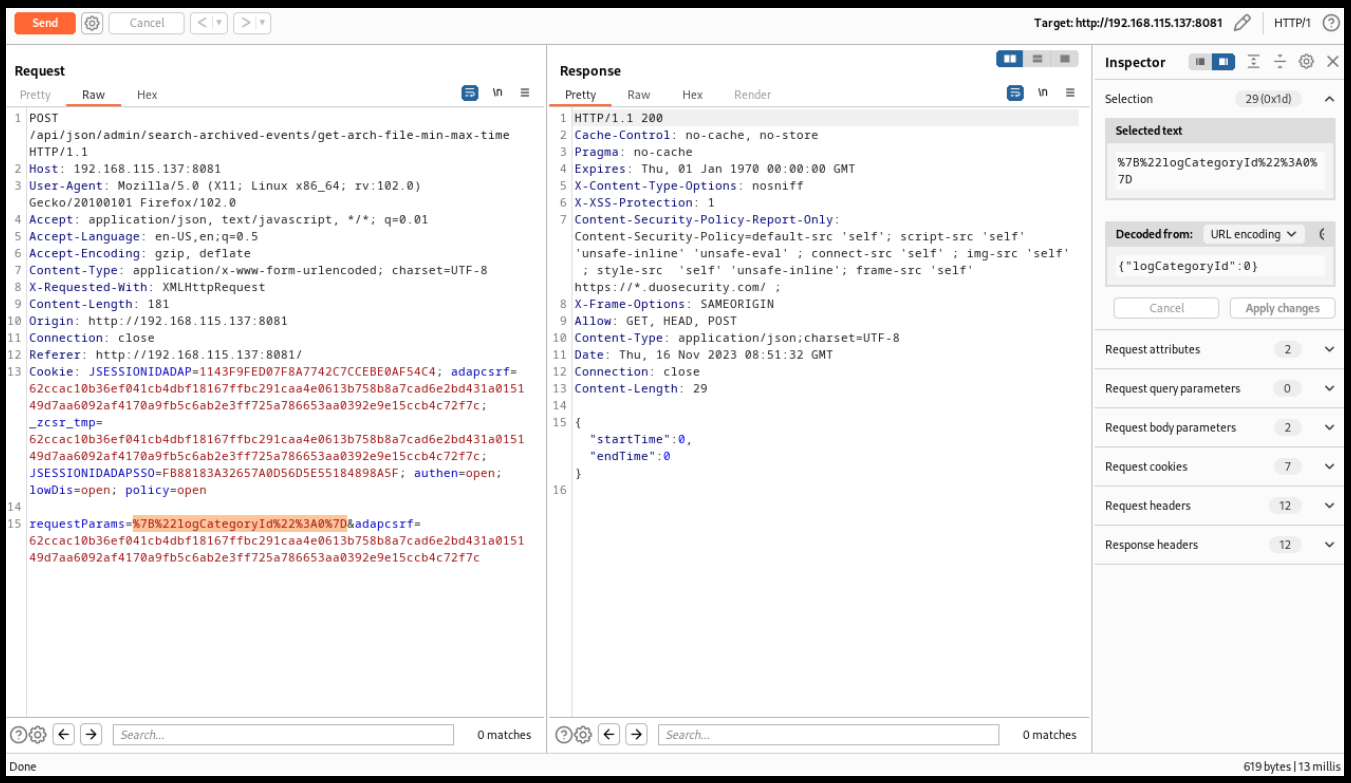
In [ ]:

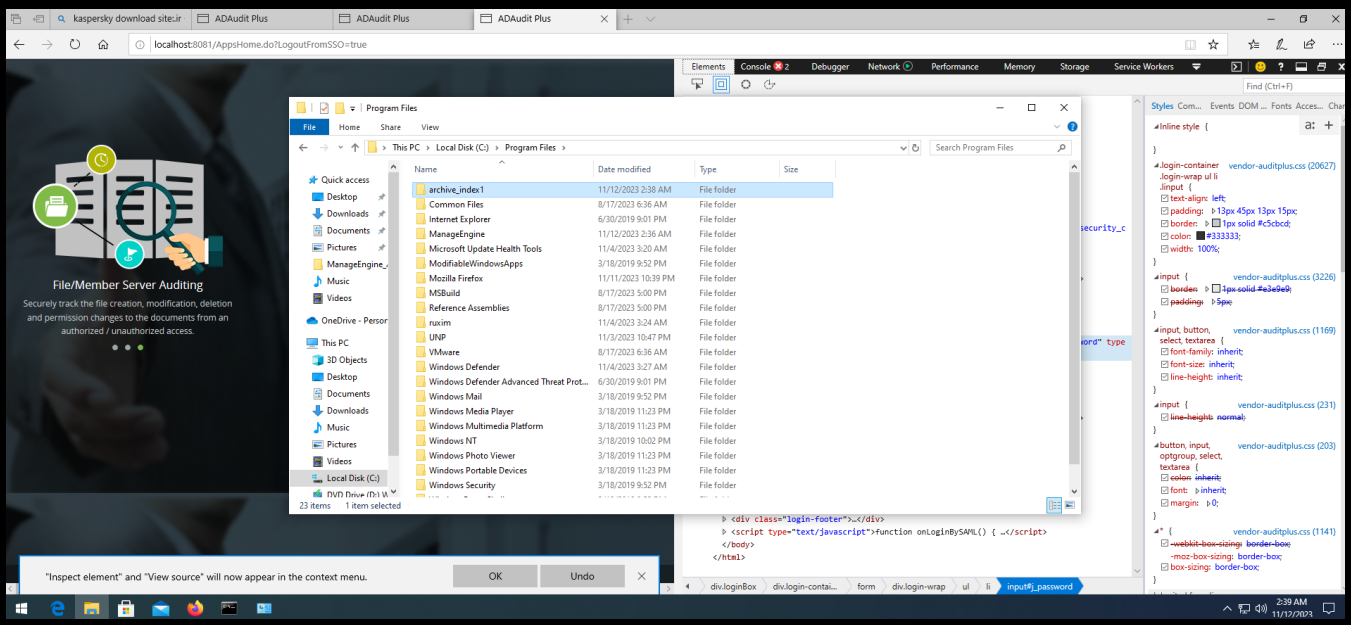
```python
import requests
import matplotlib.pyplot as plt

def fetch_vulnerabilities():
    vulnerabilities_url = "http://127.0.0.1:5000/modules/vuln"
    response = requests.get(vulnerabilities_url)
    if response.status_code == 200:
        vulnerabilities = response.json()
        return vulnerabilities
    else:
        print("Error fetching vulnerabilities:", response.status_code)
        return None

def main():
    vulnerabilities = fetch_vulnerabilities()
    if vulnerabilities:
        module_names = []
        vulnerability_counts = []

        # Iterate through each module
        for module in vulnerabilities:
            module_name = module.get('name', 'Unknown Module')
            vulnerability_list = module.get('vulnerabilities', [])
            vulnerability_count = len(vulnerability_list)
            module_names.append(module_name)
            vulnerability_counts.append(vulnerability_count)

        # Create bar plot
        plt.figure(figsize=(10, 6))
        plt.bar(module_names, vulnerability_counts, color='skyblue')
        plt.xlabel('Modules')
        plt.ylabel('Vulnerability Count')
        plt.title('Vulnerability Count by Modules')
        plt.xticks(rotation=45, ha='right')
        plt.tight_layout()
        plt.show()

if __name__ == "__main__":
    main()
```



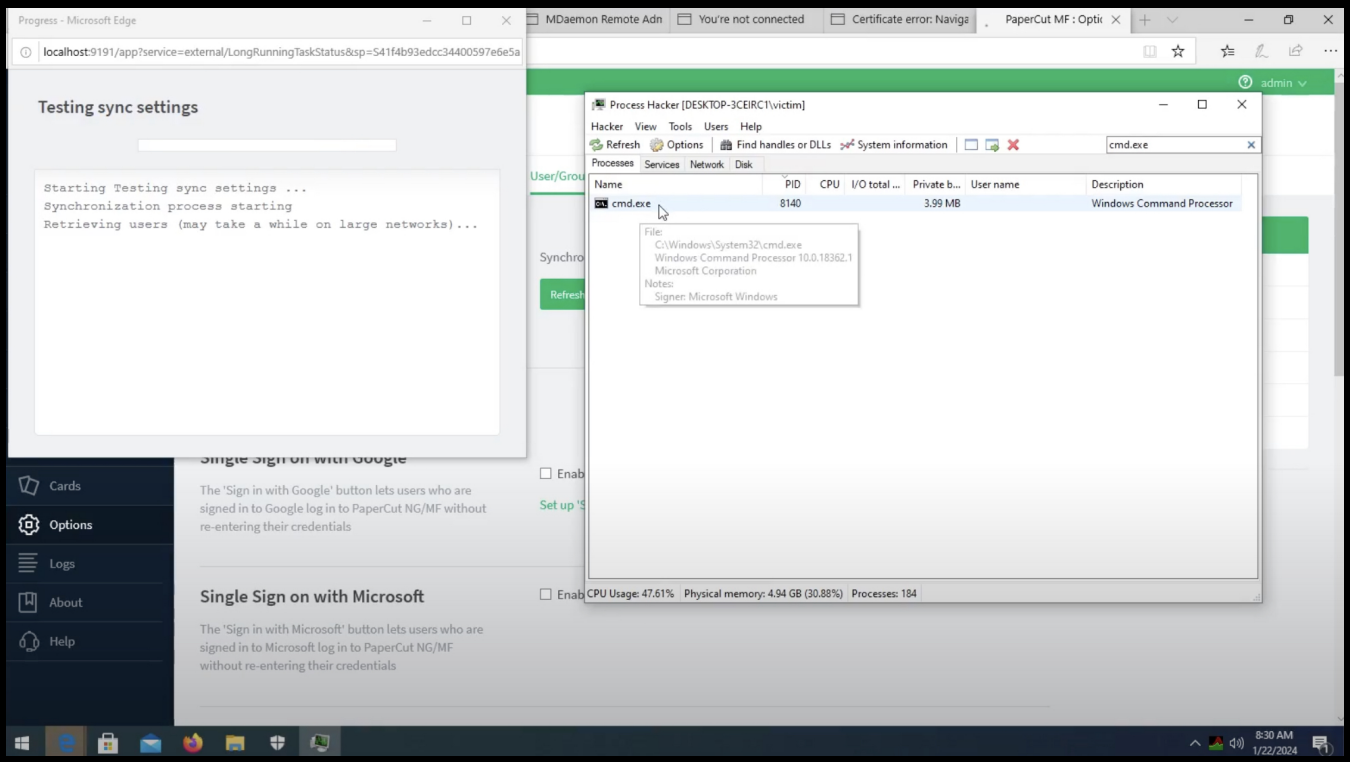
Case Study: ManageEngine AD Audit(CVE-2023-50785)







Case Study: Papercut MF


Progress - Microsoft Edge
localhost:9191/app?service=external/LongRunningTaskStatus&sp=S41f4b93edcc34400597e6e5a
Testing sync settings
Starting Testing sync settings ...
Synchronization process starting
Retrieving users (may take a while on large networks)...
MDaemon Remote Adn
You're not connected
Certificate error: Naviga
PaperCut MF : Optic
admin
Process Hacker [DESKTOP-3CEIRC1\victim]
Hacker View Tools Users Help
Refresh Options Find handles or DLLs System information
cmd.exe
Processes Services Network Disk
Name PID CPU I/O total ... Private b... User name Description
cmd.exe 8140 3.99 MB Windows Command Processor
File:
C:\Windows\System32\cmd.exe
Windows Command Processor 10.0.18362.1
Microsoft Corporation
Notes:
Signer: Microsoft Windows
CPU Usage: 47.61% Physical memory: 4.94 GB (30.88%) Processes: 184
Cards
Options
Logs
About
Help
Single Sign on with Google
The 'Sign in with Google' button lets users who are signed in to Google log in to PaperCut NG/MF without re-entering their credentials
Single Sign on with Microsoft
The 'Sign in with Microsoft' button lets users who are signed in to Microsoft log in to PaperCut NG/MF without re-entering their credentials
8:30 AM
1/22/2024