# Atomic Red Team

## Introduction

How do threat actors execute initial payloads? What typical commands are performed by threat actors once a persistent connection is established in the network? What does it look like in our environment?

It can be overwhelming for security analysts to try learning every tactic, technique, and procedure (TTP) used by threat actors to test the capabilities of a Security Operations setup. That's why threat emulation frameworks were developed – they provide a structured and efficient way to simulate various techniques, making it easier for security analysts to evaluate the detection capabilities of a SOC. Many different approaches can be taken when emulating threats, and these frameworks help to organise and streamline the process.

**Learning Objectives**

In this room, we will learn how to utilize Atomic Red Team from the perspective of Blue Teamers, understanding how exactly threat actors run their TTPs and how significant it is to see it in action. In addition, we will tackle topics such as the following throughout the room:

- Breakdown of the Atomics - the main component of the Atomic Red Team Framework.
- Importance of emulated execution and cleanup during testing.
- Implications of threat emulation to detection engineering.

**Room Prerequisites**

It is suggested to clear the following rooms first before proceeding with this room:

- Introduction to Threat Emulation
- Threat Modeling
- Windows Event Logs
- Aurora

Now, let's defeat threats by becoming one with them.

## Atomic Red Team

**What is Atomic Red Team?**

Atomic Red Team is an open-source project that provides a framework for performing security testing and threat emulation. It consists of tools and techniques that can be used to simulate various types of attacks and security threats, such as malware, phishing attacks, and network compromise. The Atomic Red Team aims to help security professionals assess the effectiveness of their organization's security controls and incident response processes and identify areas for improvement.

The Atomic Red Team framework is designed to be modular and flexible, allowing security professionals to select the tactics and techniques most relevant to their testing needs. It is intended to be used with other tools and frameworks, such as the MITRE ATT&CK framework, which provides a comprehensive overview of common tactics and techniques threat actors use.

All the credit goes to Red Canary for creating this fantastic framework.

**Supported Platforms**

Atomic Red Team supports emulation on a wide range of platforms, not only on known Operating Systems but also in Cloud Environments. Below is the list of platforms supported by the Atomic Red Team.

| **Platform Type** | **Platforms Supported** |
|---|---|
| Operating System | Windows, Linux, macOS |
| Cloud Infrastructure | AWS, Azure, GCP |
| Cloud Services | Office 365, Google Workspaces, Azure AD |
| Others | Containers (Kubernetes) |

Take note that these platforms pertain to the targets of threat emulation, where attack techniques are executed and observed.

**Understanding How Emulation Works**

In a nutshell, Atomic Red Team emulates commands that mimic threat activity using Executors. Below is the list of available executors.

| Executor | Operating System | Notes |
|---|---|---|
| sh or bash - /bin/sh or /bin/bash | Linux or macOS | Commands executed by this Executor are usually Unix tools used by threat actors for malicious intent. |

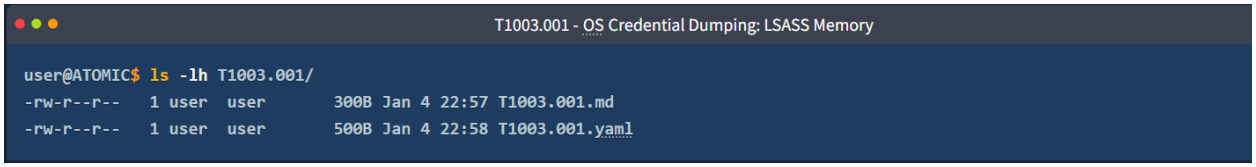
| | | |
|---|---|---|
| Command Prompt - cmd.exe | Windows | Commands executed by this Executor are usually Windows Built-in or Third-party binaries used by threat actors for malicious intent. |
| PowerShell - powershell.exe | Windows | Emulated commands by this Executor are commonly known malicious PowerShell modules that threat actors abuse. |
| Manual | N/A | The details given in this type are typically written as steps needed to be executed to emulate a threat, such as when GUI steps are involved that cannot be automated. |

**Deep-Dive Into Atomics**

Before seeing Executors in action, let's deal with the details inside an Atomic.

Atomics refers to different testing techniques based on the MITRE ATT&CK Framework. Each works as a standalone testing mock-up that Security Analysts can use to emulate a specific Technique, such as OS Credential Dumping: LSASS Memory, for a quick example.

Each Atomic typically contain two files, both of which are named by their MITRE ATT&CK Technique ID:




- Markdown File (.md): Contains all the information about the technique, the supported platform, Executor, GUID, and commands to be executed.
- YAML File (.yaml): Configuration used by frameworks, such as Invoke-Atomic and Atomic-Operator, to do the exact emulation of the technique

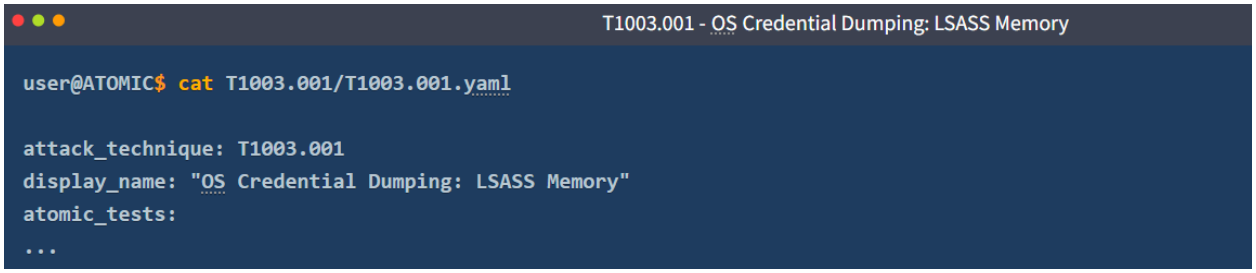
The Markdown file is written to be self-explanatory, so let's dive deep into the configuration files used to emulate commands.

There are 12 atomic tests for T1003.001, but we will present only one test below for brevity.

**Atomic YAML File Breakdown**

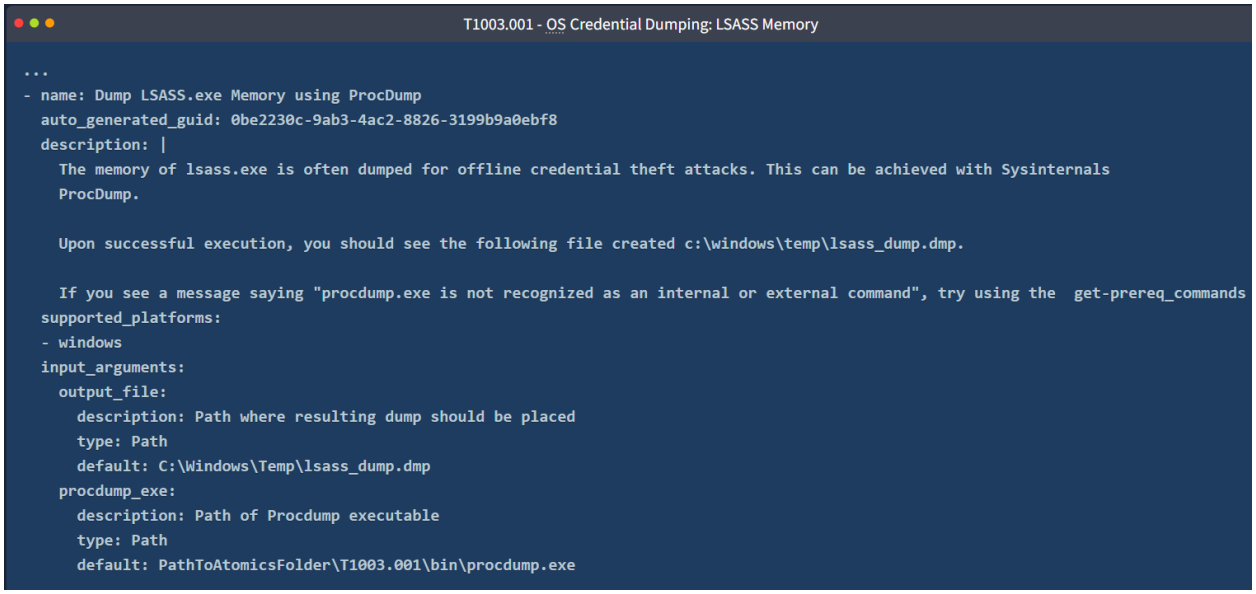
The first few fields are already given based on their field names:

- attack_technique: MITRE ATT&CK Technique ID, which also signifies the file's name.
- display_name: The technique name, similar to how it is presented as a MITRE Technique.
- atomic_tests: List of atomic tests, which details how every test is executed.




The following section details the contents of a single Atomic Test under the list of atomic_tests field:

- name: Short snippet that describes how it tests the technique.
- auto_generated_guid: Unique identifier of the specific test.
- description: A longer form of the test details and can be written in a multi-line format.
- supported_platforms: On what platform will the technique be executed (on a Windows machine in this case)
- input_arguments: Required values during the execution, resorts to the default value if nothing is supplied.




To conclude with the contents of an Atomic test, details about dependencies and executors are as follows:

- dependency_executor_name: Option on how the prerequisites will be validated. The possible values for this field are similar to the Executor field.
- dependencies:
    - prereq_command: Commands to check if the requirements for running this test are met. The conditions for the "command_prompt" Executor are not satisfied if any command returns a non-zero exit code. For the "Powershell" Executor, all commands are run as a script block, and the script block must return 0 for success.
    - get_prereq_command: Commands to meet this prerequisite or a message describing how to meet this requirement.

executor

- name: Name of the Executor; similar to what has been discussed above.
- command: Exact command to emulate the technique.
- cleanup_command: Commands for cleaning up the previous atomic test, such as deletion of files or reverting modified configurations.
- elevation_required: A boolean value that dictates if an admin privilege is required.

T1003.001 - OS Credential Dumping: LSASS Memory

```
...
  dependency_executor_name: powershell
  dependencies:
  - description: |
      ProcDump tool from Sysinternals must exist on disk at specified location (#{procdump_exe})
    prereq_command: |
      if (Test-Path #{procdump_exe}) {exit 0} else {exit 1}
    get_prereq_command: |
      [Net.ServicePointManager]::SecurityProtocol = [Net.SecurityProtocolType]::Tls12
      Invoke-WebRequest "https://download.sysinternals.com/files/Procdump.zip" -OutFile "$env:TEMP\Procdump.zip"
      Expand-Archive $env:TEMP\Procdump.zip $env:TEMP\Procdump -Force
      New-Item -ItemType Directory (Split-Path #{procdump_exe}) -Force | Out-Null
      Copy-Item $env:TEMP\Procdump\Procdump.exe #{procdump_exe} -Force
  executor:
    name: command_prompt
    command: |
      #{procdump_exe} -accepteula -ma lsass.exe #{output_file}
    cleanup_command: |
      del "#{output_file}" >nul 2> nul
    elevation_required: true
```

Before concluding this section, it is essential to highlight the cleanup feature of Atomics. But why is cleanup significant in threat emulation?

- First and foremost, it helps to ensure that the tested system returns to its original state after completing the emulation.
- Next, writing cleanup scripts help in minimizing the risk of accidental damage to the system since it serves as an additional verification of the execution. You understand the impact more as you write the reverse of the emulation.
- Lastly, it helps to maintain the integrity of the system being tested. Tools left after emulation exercises could be abused by potential threat actors.

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**Answer the questions below:**

**What type of executor is used for actions that cannot be automated?**
Answer: manual

**What is the field in an Atomic YAML file populated by a unique identifier to isolate a specific Atomic?**
Answer: auto_generated_guid

**What is the field in an Atomic YAML file populated by commands for deleting files used for emulation or reverting modified configurations?**
Answer: cleanup_command

## Invoke-AtomicRedTeam

We have previously understood Atomic Red Team and how Atomics work; let's extend our knowledge by seeing it in action.

As discussed, the main goal of the Atomic Red Team Framework is to ease the threat emulation process. Hence, tools such as Invoke-AtomicTest were created to utilize the automation and execution of Atomics. Let's start playing with these tools by emulating different attack patterns.

You may start the machine attached to this room by clicking the Start Machine button. This VM hosts the tools needed throughout the room.

Note: If the VM is not visible, use the blue Show Split View button at the top-right of the page. In addition, you may use the following credentials for alternative access via Remote Desktop (RDP):

TryHackMe Credentials

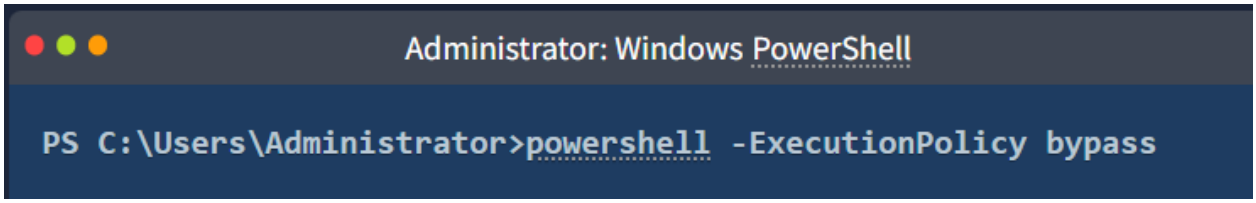
- Username administrator
- Password Emulation101!
- IP Address MACHINE_IP

**Invoke-AtomicRedTeam**

Invoke-AtomicRedTeam is a PowerShell module created by the same author (Red Canary) that allows Security Analysts to run simulations defined by Atomics. To avoid confusion, the primary cmdlet used in this module is Invoke-AtomicTest and not Invoke-AtomicRedTeam.

**Setup**

Open a PowerShell window with ExecutionPolicy set to bypass inside the provided Virtual Machine. This ignores all security warning prompts while loading the module.




Then load the module using the Import-Module cmdlet specifying the location of the Invoke-AtomicRedTeam.psd1 file.

```
PS C:\Users\Administrator> Import-Module "C:\Tools\invoke-atomicredteam\Invoke-AtomicRedTeam.psd1" -Force
PS C:\Users\Administrator>  $PSDefaultParameterValues = @{"Invoke-AtomicTest:PathToAtomicsFolder"="C:\Tools\Ato
micRedTeam\atomics"}
```

The additional command executed after the Import-Module specifies the location of the Atomics folder in this machine since it is not located in the default location, which is the C:\AtomicRedTeam\atomics directory. You might encounter an error if the latter command is not executed.

You can confirm if the module is successfully loaded once the help cmdlet provides information about Invoke-AtomicTest.

```
PS C:\Users\Administrator> help Invoke-AtomicTest

NAME
    Invoke-AtomicTest

SYNTAX
    Invoke-AtomicTest [-AtomicTechnique] <string[]> [-ShowDetails] [-ShowDetailsBrief] [-TestNumbers
    <string[]>] [-TestNames <string[]>] [-TestGuids <string[]>] [-PathToAtomicsFolder <string>]
    [-CheckPrereqs] [-PromptForInputArgs] [-GetPrereqs] [-Cleanup] [-NoExecutionLog] [-ExecutionLogPath
    <string>] [-Force] [-InputArgs <hashtable>] [-TimeoutSeconds <int>] [-Session <PSSession[]>]
    [-Interactive] [-KeepStdOutStdErrFiles] [-LoggingModule <string>] [-WhatIf] [-Confirm]
    [<CommonParameters>]


ALIASES
    None


REMARKS
    None
```

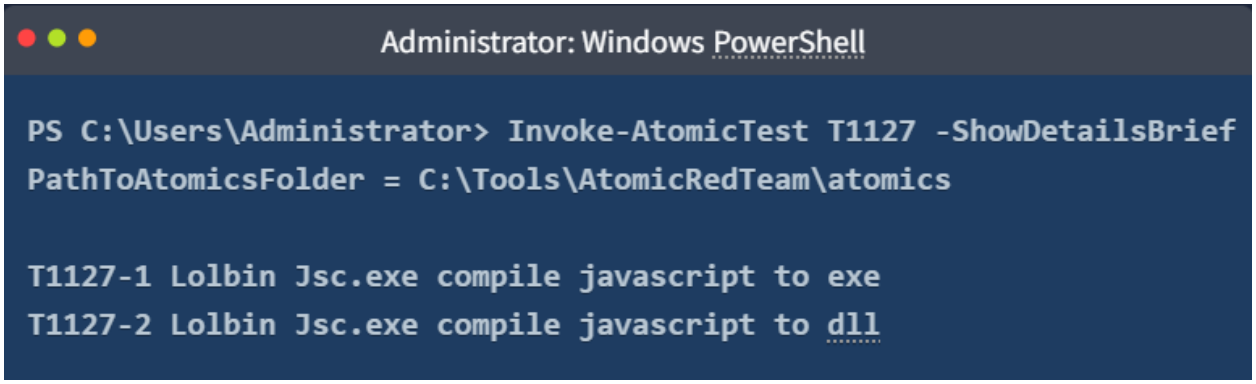
Based on the output of the help cmdlet, it can be seen that the syntax Invoke-AtomicTest goes in this format: Invoke-AtomicTest <NAME> <Optional parameters>

Note that the NAME placeholder uses the Technique ID of the target Atomic; the value "ALL" specifies that every Atomic will be used. The optional parameters will be highlighted in the succeeding sections.

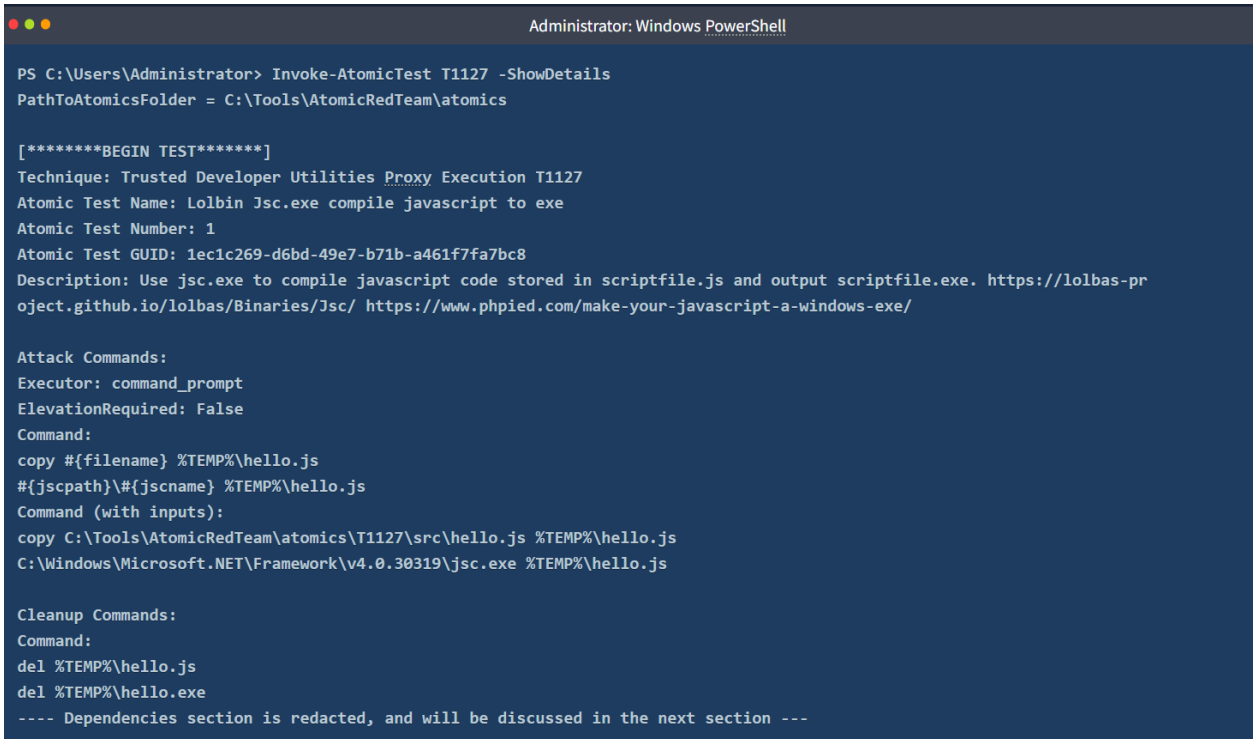
**Listing Atomic Techniques**

Before going to the emulation proper, let's first discuss the importance of understanding the Atomics before running commands.

We have previously elaborated the contents of an Atomic file, which contains mostly how the emulation works from start to finish. However, navigating through the GIT repository and reading the information about the techniques you want to emulate may be gruesome. With that in mind, this module can use a parameter that provides the details inside an Atomic file - ShowDetailsBrief and ShowDetails.




The output shows that ShowDetailsBrief lists the available tests in the specified Atomic and its corresponding Atomic Test number.

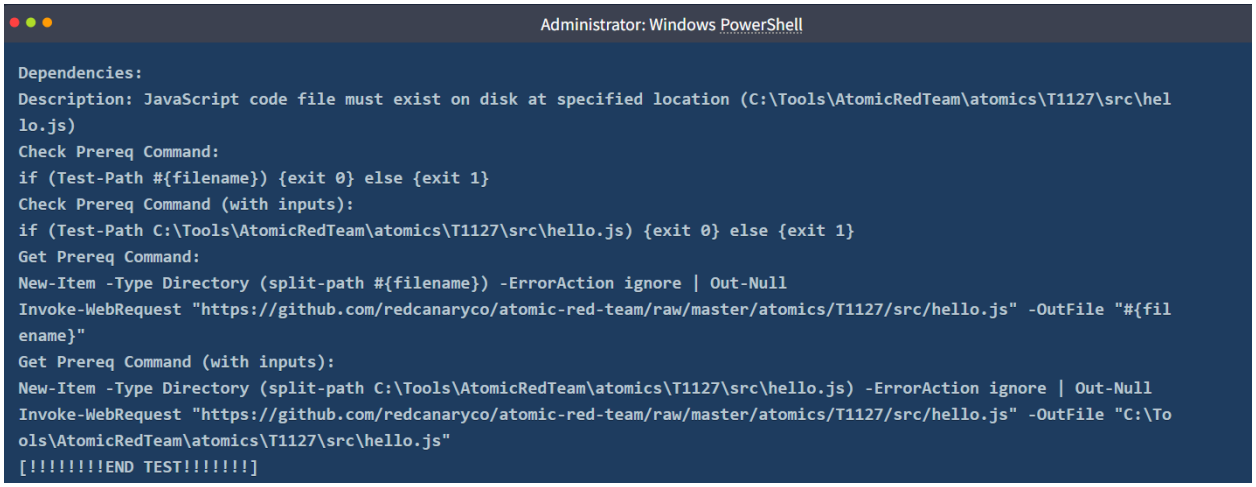



The output above shows that the ShowDetails parameter is the verbose version of ShowDetailsBrief, which only provides the list of tests inside the Atomic T1127.

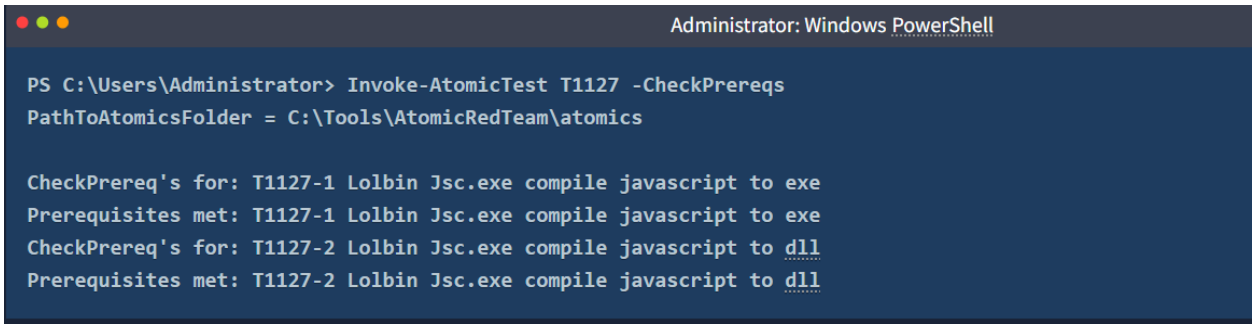
It may not be direct, but these two parameters are significant in executing emulation exercises. It is essential to learn and understand how many tests will be conducted under an Atomic, how it will be performed, and how to clean it up. Knowing these items gives us an overview of the impact on the target environment.

**Preparing Atomic Prerequisites**

Remember that every Atomic test may require some dependencies, such as binaries and files needed for execution. Below is the excerpt of Atomic T1127-1's dependency section using the ShowDetails parameter.

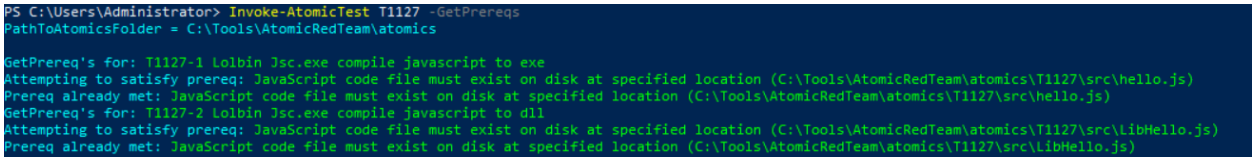



It is crucial to verify if the dependencies are met before executing the tests, and this can be done by using the CheckPrereqs parameter. In the case of  Atomic T1127-1, the file from C:\Tools\AtomicRedTeam\atomics\T1127\src\hello.js should exist.




If the required binaries, files or scripts do not exist in the machine, the GetPrereqs parameter can be used. This parameter automatically pulls the dependencies from an external resource. It also details what conditions are being attempted to satisfy and confirms if the prerequisite is already met.

Note: Usage of the GetPrereqs feature may fail since the provided instance has no outbound internet connection.



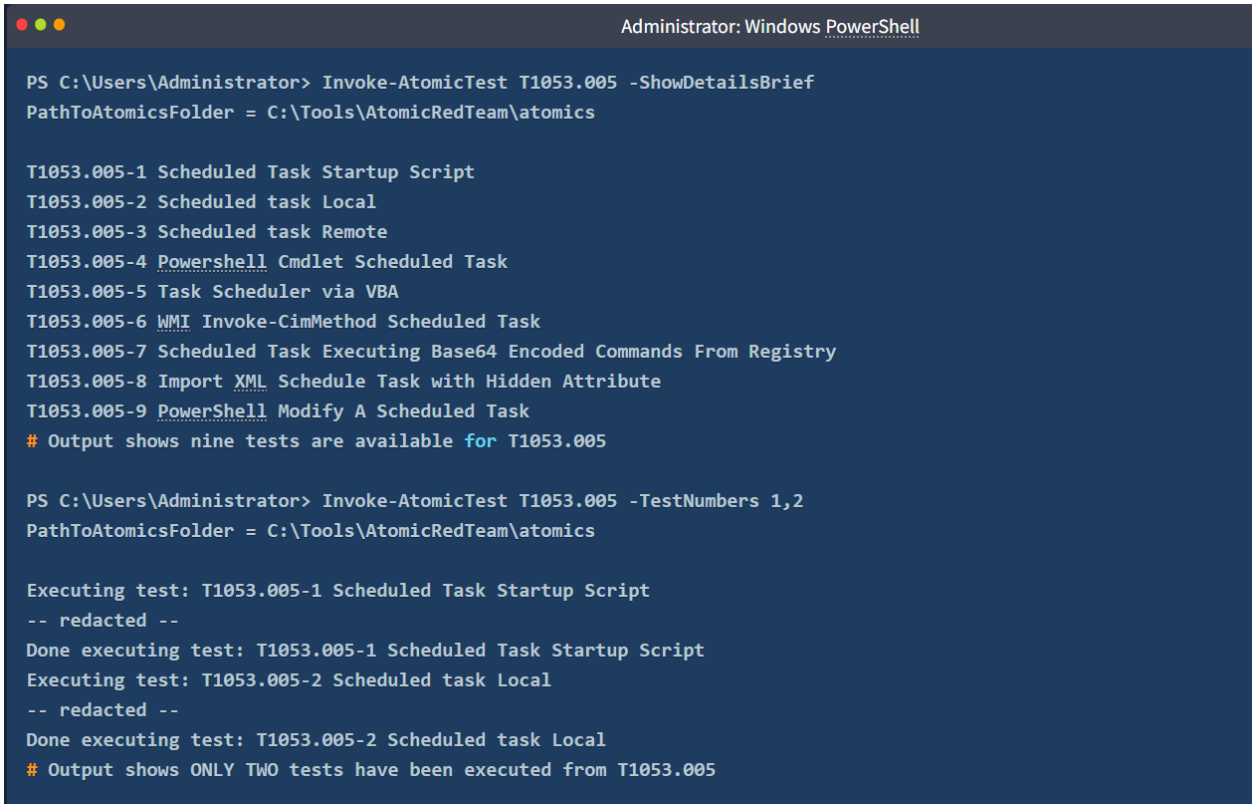

With everything prepared, the only thing left is to execute the Atomic tests.

**Execution**

Let's do the fun part, starting with emulating different MITRE ATT&CK Techniques. First, there are multiple ways to execute the Atomic tests, which will be detailed below.

| Parameter | Example | Details |
|---|---|---|
| TestNumbers | Invoke-AtomicTest T1127 -TestNumbers 1,2 | Executes tests based on the Atomic test number |
| TestNames | Invoke-AtomicTest T1127 -TestNames "Lolbin Jsc.exe compile javascript to dll" | Executes tests based on the Atomic test names |
| TestGuids | Invoke-AtomicTest T1127 -TestGuids 3fc9fea2-871d-414d-8ef6-02e85e322b80 | Executes tests based on the test GUID |
| N/A | Invoke-AtomicTest T1127 | Executes all tests under Atomic T1127 |
| N/A | Invoke-AtomicTest T1127-2 | Executes Atomic Test #2 of T1127 |

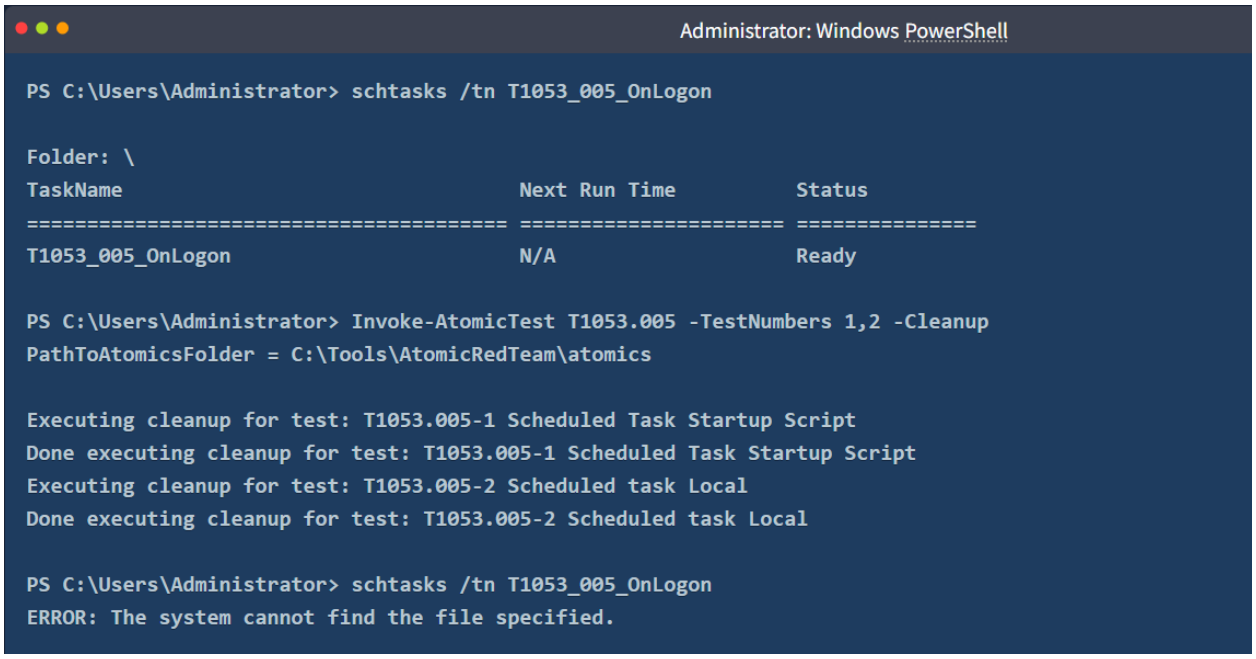
As an example, let's now see the tests in action with Atomic T1053.005 - Scheduled Task/Job: Scheduled Task.




You may have observed that the number of available tests was listed before conducting the test, and only two tests out of nine were executed due to the TestNumbers parameter.

**Cleanup**

As mentioned throughout the room, cleaning up the mess of emulating different techniques is VERY IMPORTANT. The Invoke-AtomicRedTeam module also has the option to execute the cleanup commands to revert every footprint left by the tests. This can be done by using the Cleanup parameter.




You may have observed that we executed schtasks before cleaning up the scheduled tasks created by the Atomic test T1053.005. This only shows that a scheduled task exists and was cleaned up after using the cleanup parameter.

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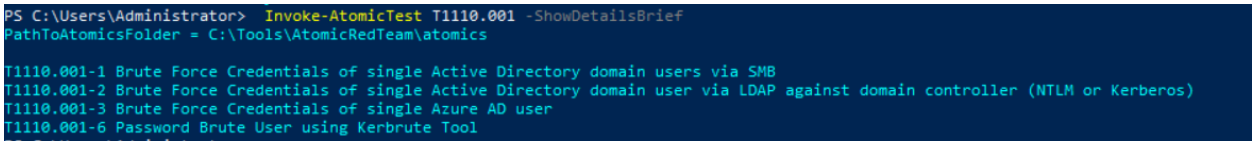
**Answer the questions below:**

**How many atomic tests are under Atomic T1110.001 that are supported on Windows hosts?**




Answer: 4

**What is the Atomic name of the second test under Atomic T1218.005?**

```
PS C:\Users\Administrator>  Invoke-AtomicTest T1218.005 -ShowDetailsBrief
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1218.005-1 Mshta executes JavaScript Scheme Fetch Remote Payload With GetObject
T1218.005-2 Mshta executes VBScript to execute malicious command
T1218.005-3 Mshta Executes Remote HTML Application (HTA)
T1218.005-4 Invoke HTML Application - Jscript Engine over Local UNC Simulating Lateral Moveme
T1218.005-5 Invoke HTML Application - Jscript Engine Simulating Double Click
T1218.005-6 Invoke HTML Application - Direct download from URI
T1218.005-7 Invoke HTML Application - JScript Engine with Rundll32 and Inline Protocol Handle
T1218.005-8 Invoke HTML Application - JScript Engine with Inline Protocol Handler
T1218.005-9 Invoke HTML Application - Simulate Lateral Movement over UNC Path
T1218.005-10 Mshta used to Execute PowerShell
```

Answer: Mshta executes VBScript to execute malicious command

**How many prerequisites are not met for Atomic T1003?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1003 -CheckPrereqs
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1003-1 Gsecdump
Prerequisites not met: T1003-1 Gsecdump
        [*] Gsecdump must exist on disk at specified location (C:\Tools\AtomicRedTeam\atomics\T1003\bin\gsecdump.exe)

Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1003-2 Credential Dumping with NPPSpy
Prerequisites not met: T1003-2 Credential Dumping with NPPSpy
        [*] NPPSpy.dll must be available in local temp directory
Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1003-3 Dump svchost.exe to gather RDP credentials
Prerequisites met: T1003-3 Dump svchost.exe to gather RDP credentials
CheckPrereq's for: T1003-4 Retrieve Microsoft IIS Service Account Credentials Using AppCmd (using list)
Prerequisites not met: T1003-4 Retrieve Microsoft IIS Service Account Credentials Using AppCmd (using list)
        [*] IIS must be installed prior to running the test
Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1003-5 Retrieve Microsoft IIS Service Account Credentials Using AppCmd (using config)
Prerequisites not met: T1003-5 Retrieve Microsoft IIS Service Account Credentials Using AppCmd (using config)
        [*] IIS must be installed prior to running the test
Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1003-6 Dump Credential Manager using keymgr.dll and rundll32.exe
Prerequisites met: T1003-6 Dump Credential Manager using keymgr.dll and rundll32.exe
```

Answer: 4

**What is the parameter used to execute the specific Atomic test via GUID?**

Answer: TestGuids

**What is the name of the scheduled task created after executing the 2nd test of Atomic T1053.005?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1053.005 -TestNumbers 2
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1053.005-2 Scheduled task Local
WARNING: The task name "spawn" already exists. Do you want to replace it (Y/N)?
Done executing test: T1053.005-2 Scheduled task Local
```

Answer: spawn

**What is the registry key modified after executing the 2nd test of Atomic T1547.001?**

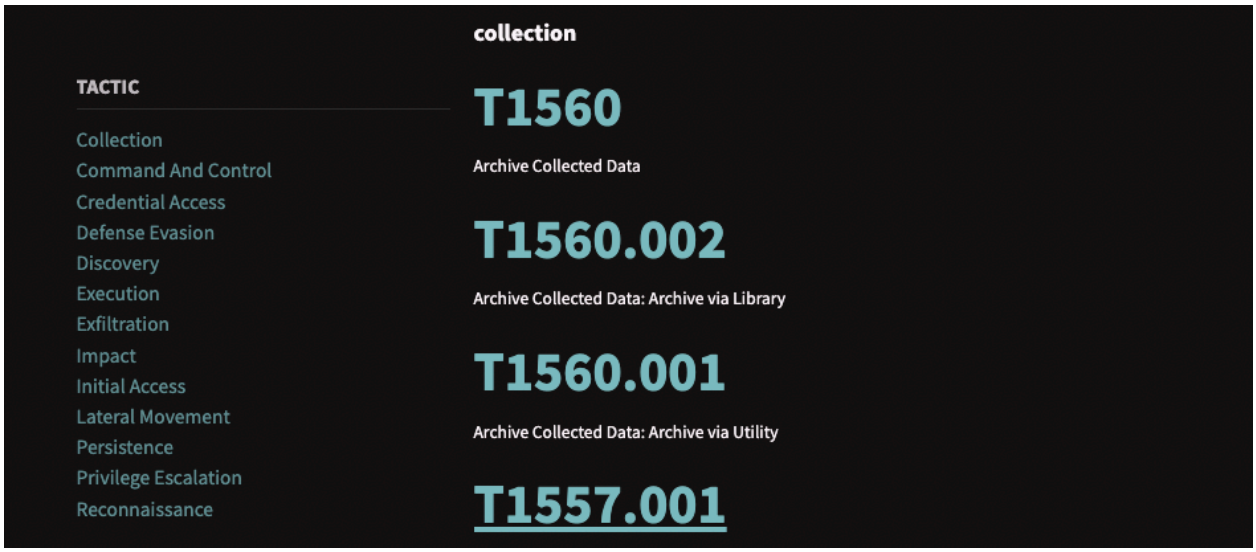
```
PS C:\Users\Administrator> Invoke-AtomicTest T1547.001 -TestNumbers 2 -ShowDetails
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

[********BEGIN TEST*******]
Technique: Boot or Logon Autostart Execution: Registry Run Keys / Startup Folder T1547.001
Atomic Test Name: Reg Key RunOnce
Atomic Test Number: 2
Atomic Test GUID: 554cbd88-cde1-4b56-8168-0be552eed9eb
Description: RunOnce Key Persistence.
Upon successful execution, cmd.exe will modify the registry to load AtomicRedTeam.dll to RunOnceEx. Output will be via stdout.

Attack Commands:
Executor: command_prompt
ElevationRequired: True
Command:
REG ADD HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnceEx\0001\Depend /v 1 /d "#{thing_to_execute}"
Command (with inputs):
REG ADD HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnceEx\0001\Depend /v 1 /d "C:\Path\AtomicRedTeam.dll"

Cleanup Commands:
Command:
REG DELETE HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnceEx\0001\Depend /v 1 /f >nul 2>&1
[!!!!!!!!END TEST!!!!!!!]
```

Answer:
HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnceEx\0001\Depend

## Revisiting MITRE ATT&CK

Based on the previous tasks, it was highlighted that the Atomic Red Team framework is heavily tied-up with MITRE ATT&CK. One clear connection is that every Atomic is written for a specific MITRE Technique, with the files of every Atomic named as its corresponding MITRE Technique ID.

In addition, an excerpt from [atomicredteam.io](atomicredteam.io) shows the available Tactics and Atomics under it, the Collection tactic in this case.



This correlation shows us that to maximise the Atomic Red Team framework's usage, we need to utilise our knowledge in MITRE ATT&CK Framework. Let's play again with the ATT&CK Navigator, one of the tools introduced in the Threat Modeling room.

**ATT&CK Navigator**

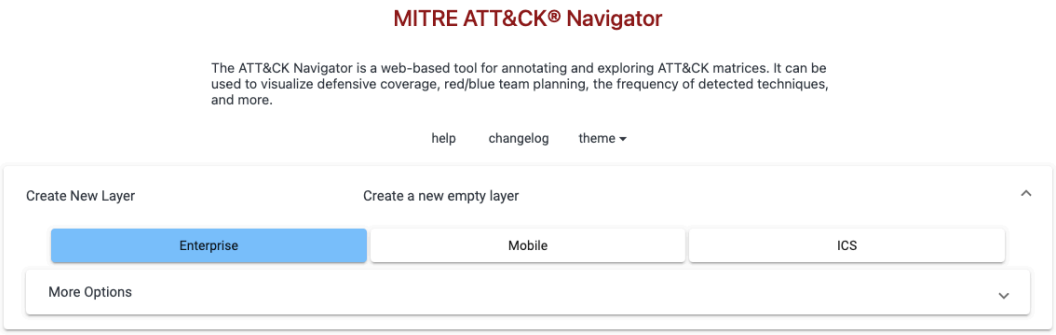
The ATT&CK Navigator is hosted in the same virtual machine deployed from the previous task.

You may access it via this link - http://MACHINE_IP/.

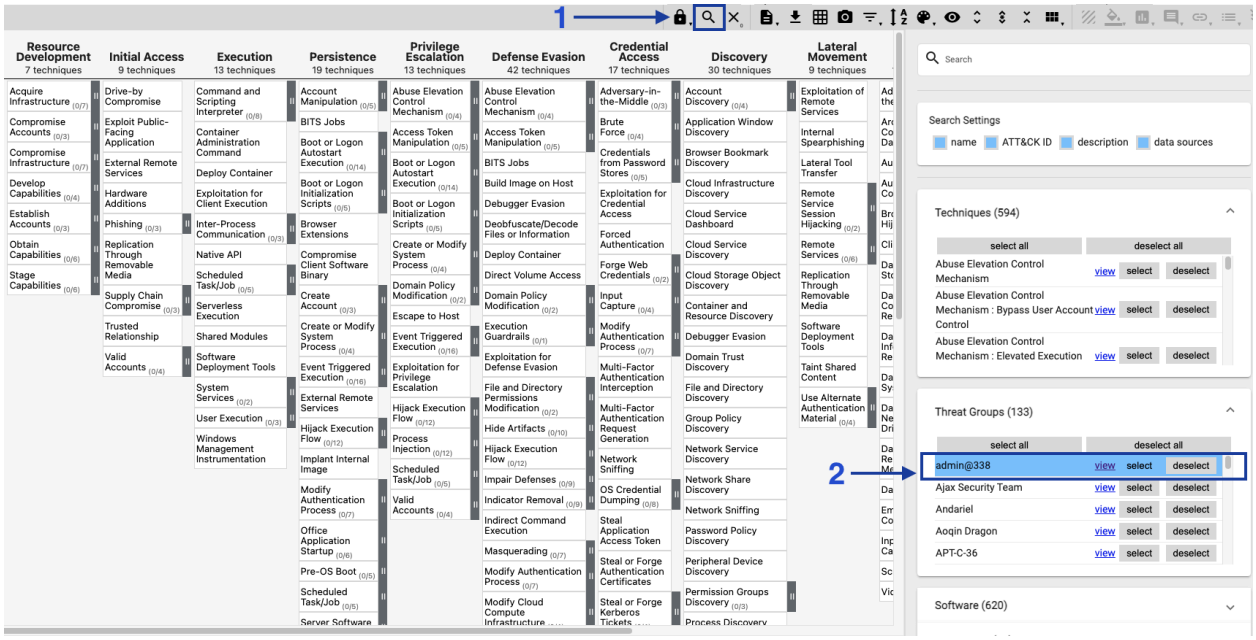
**Incorporating ATT&CK Navigator into Atomic Red Team**

Choosing what Atomic to pick might be overwhelming; thus, we need to have a sense of direction when doing threat emulation. By utilizing ATT&CK Navigator, we can dump the TTPs used by known APTs or cybercriminal groups and emulate their Atomics.

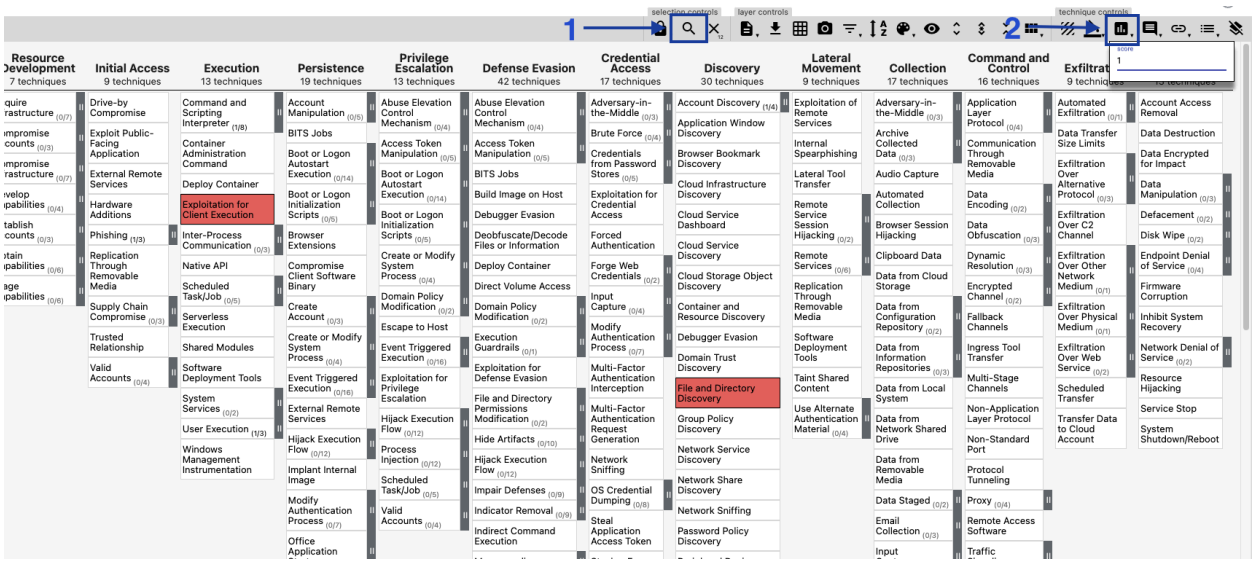
To start, create a new layer in the ATT&CK Navigator and choose Enterprise.



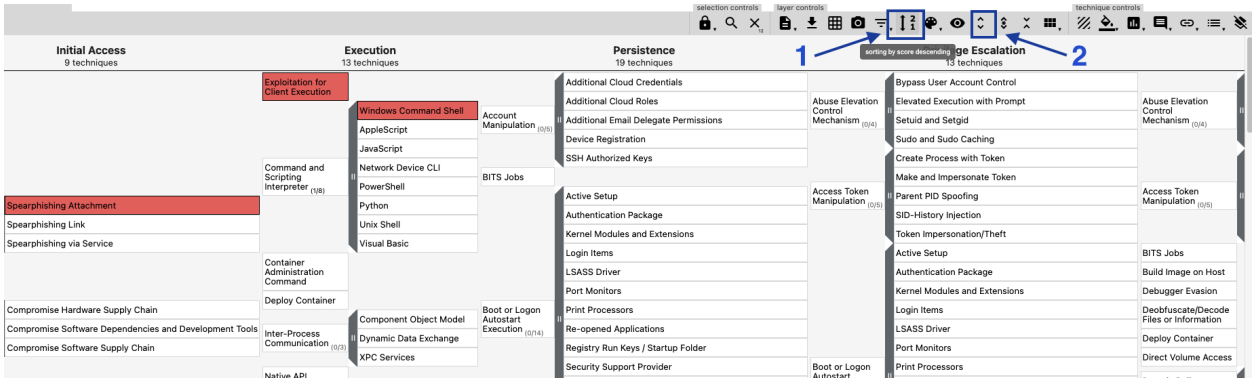

Then use the search functionality and navigate to the threat groups section. Let's select admin@338 as our interest group by clicking the select button. This action sets the techniques attributed to the admin@338 group.




Next, close the search sidebar by re-clicking the search icon, click the score button in the upper-right corner and put one (1) as its score. This action highlights all selected techniques, which eases out the readability of the matrix.




Lastly, let's sort out the techniques per column to place the scored technique in the topmost position. Click the filter button until it is set to sorting by score descending, and eventually click the expand sub-techniques button to display all highlighted techniques and sub-techniques.




Our steps should reflect all techniques we want to emulate from our selected threat group.

**Emulation of Admin@338 Group**

The following action is to list all techniques highlighted from the ATT&CK Navigator. It is essential to take note of the Tactic, Technique and its corresponding Technique ID, as every Atomic is named with the Technique ID. You may hover the mouse icon in the techniques to see the technique ID. Below are the summarized results we got from ATT&CK Navigator.

| Tactic | Technique ID | Technique |
|---|---|---|
| Initial Access | T1566.001 | Spearphishing Attachment |
| Execution | T1203 | Exploitation for Client Execution |
| Execution | T1059.003 | Command and Scripting Interpreter: Windows Command Shell |
| Discovery | T1083 | File and Directory Discovery |
| Discovery | T1082 | System Information Discovery |
| Discovery | T1016 | System Network Configuration Discovery |
| Discovery | T1049 | System Network Connections Discovery |
| Discovery | T1007 | System Service Discovery |
| Discovery | T1087.001 | Account Discovery: Local Account |

We have extracted nine (9) out of all the techniques in MITRE ATT&CK. The next thing we need to do is to determine if an Atomic exists for these techniques.

```
PS C:\Users\Administrator> ls C:\Tools\AtomicRedTeam\atomics | Where-Object Name -Match "T1566.001|T1203|T1059.003|T1083|T1082|T1016|T1049|T1007|T1087.001"


    Directory: C:\Tools\AtomicRedTeam\atomics


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         1/3/2023   5:20 PM                T1007
d-----         1/3/2023   5:20 PM                T1016
d-----         1/3/2023   5:20 PM                T1049
d-----         1/3/2023   5:20 PM                T1059.003
d-----         1/3/2023   5:20 PM                T1082
d-----         1/3/2023   5:20 PM                T1083
d-----         1/3/2023   5:20 PM                T1087.001
d-----         1/3/2023   5:21 PM                T1566.001
```

Eight out of nine techniques are available to be emulated. Before executing the tests, we must verify each technique and list all known tests for each Atomic.

```
PS C:\Users\Administrator>  'T1566.001','T1059.003','T1083','T1082','T1016','T1049','T1007','T1087.001' | ForEach-Object {echo "Enumerating $_"; Invoke-AtomicTest $_ -ShowDetailsBrief }
Enumerating T1566.001
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1566.001-1 Download Macro-Enabled Phishing Attachment
T1566.001-2 Word spawned a command shell and used an IP address in the command line
Enumerating T1059.003
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1059.003-1 Create and Execute Batch Script
T1059.003-2 Writes text to a file and displays it.
T1059.003-3 Suspicious Execution via Windows Command Shell
T1059.003-4 Simulate BlackByte Ransomware Print Bombing
T1059.003-5 Command Prompt read contents from CMD file and execute
Enumerating T1083
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1083-1 File and Directory Discovery (cmd.exe)
T1083-2 File and Directory Discovery (PowerShell)
T1083-5 Simulating MAZE Directory Enumeration
T1083-6 Launch DirLister Executable
Enumerating T1082
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1082-1 System Information Discovery
T1082-6 Hostname Discovery (Windows)
T1082-8 Windows MachineGUID Discovery
T1082-9 Griffon Recon
T1082-10 Environment variables discovery on windows
T1082-13 WinPwn - winPEAS
T1082-14 WinPwn - itm4nprivesc
T1082-15 WinPwn - Powersploits privesc checks
T1082-16 WinPwn - General privesc checks
T1082-17 WinPwn - GeneralRecon
T1082-18 WinPwn - Morerecon
T1082-19 WinPwn - RBCD-Check
T1082-20 WinPwn - PowerSharpPack - Watson searching for missing windows patches
T1082-21 WinPwn - PowerSharpPack - Sharpup checking common Privesc vectors
T1082-22 WinPwn - PowerSharpPack - Seatbelt
T1082-23 Azure Security Scan with SkyArk
```

```
Enumerating T1016
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1016-1 System Network Configuration Discovery on Windows
T1016-2 List Windows Firewall Rules
T1016-4 System Network Configuration Discovery (TrickBot Style)
T1016-5 List Open Egress Ports
T1016-6 Adfind - Enumerate Active Directory Subnet Objects
T1016-7 Qakbot Recon
T1016-9 DNS Server Discovery Using nslookup
Enumerating T1049
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1049-1 System Network Connections Discovery
T1049-2 System Network Connections Discovery with PowerShell
T1049-4 System Discovery using SharpView
Enumerating T1007
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1007-1 System Service Discovery
T1007-2 System Service Discovery - net.exe
Enumerating T1087.001
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

T1087.001-8 Enumerate all accounts on Windows (Local)
T1087.001-9 Enumerate all accounts via PowerShell (Local)
T1087.001-10 Enumerate logged on users via CMD (Local)
```

In addition, we need to check the prerequisites of each Atomic before starting the emulation.

```
PS C:\Users\Administrator> 'T1566.001','T1059.003','T1083','T1082','T1016','T1049','T1007','T1087.001' | ForEach-Object {echo "Enumerating $_"; Invoke-AtomicTest $_ -CheckPrereqs }
Enumerating T1566.001
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1566.001-1 Download Macro-Enabled Phishing Attachment
Prerequisites met: T1566.001-1 Download Macro-Enabled Phishing Attachment
CheckPrereq's for: T1566.001-2 Word spawned a command shell and used an IP address in the command line
Prerequisites not met: T1566.001-2 Word spawned a command shell and used an IP address in the command line
        [*] Microsoft Word must be installed

Try installing prereq's with the -GetPrereqs switch
Enumerating T1059.003
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1059.003-1 Create and Execute Batch Script
Prerequisites not met: T1059.003-1 Create and Execute Batch Script
        [*] Batch file must exist on disk at specified location ($env:TEMP\T1059.003_script.bat)

Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1059.003-2 Writes text to a file and displays it.
Prerequisites met: T1059.003-2 Writes text to a file and displays it.
CheckPrereq's for: T1059.003-3 Suspicious Execution via Windows Command Shell
Prerequisites met: T1059.003-3 Suspicious Execution via Windows Command Shell
CheckPrereq's for: T1059.003-4 Simulate BlackByte Ransomware Print Bombing
Prerequisites not met: T1059.003-4 Simulate BlackByte Ransomware Print Bombing
        [*] File to print must exist on disk at specified location ($env:temp\T1059_003note.txt)

Try installing prereq's with the -GetPrereqs switch
CheckPrereq's for: T1059.003-5 Command Prompt read contents from CMD file and execute
Prerequisites met: T1059.003-5 Command Prompt read contents from CMD file and execute
Enumerating T1083
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1083-1 File and Directory Discovery (cmd.exe)
Prerequisites met: T1083-1 File and Directory Discovery (cmd.exe)
CheckPrereq's for: T1083-2 File and Directory Discovery (PowerShell)
Prerequisites met: T1083-2 File and Directory Discovery (PowerShell)
CheckPrereq's for: T1083-5 Simulating MAZE Directory Enumeration
Prerequisites met: T1083-5 Simulating MAZE Directory Enumeration
CheckPrereq's for: T1083-6 Launch DirLister Executable
Prerequisites not met: T1083-6 Launch DirLister Executable
        [*] DirLister.exe must exist in the specified path C:\Tools\AtomicRedTeam\atomics\T1083\bin\DirLister.exe

Try installing prereq's with the -GetPrereqs switch
```

```
Enumerating T1082
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1082-1 System Information Discovery
Prerequisites met: T1082-1 System Information Discovery
CheckPrereq's for: T1082-6 Hostname Discovery (Windows)
Prerequisites met: T1082-6 Hostname Discovery (Windows)
CheckPrereq's for: T1082-8 Windows MachineGUID Discovery
Prerequisites met: T1082-8 Windows MachineGUID Discovery
CheckPrereq's for: T1082-9 Griffon Recon
Prerequisites met: T1082-9 Griffon Recon
CheckPrereq's for: T1082-10 Environment variables discovery on windows
Prerequisites met: T1082-10 Environment variables discovery on windows
CheckPrereq's for: T1082-13 WinPwn - winPEAS
Prerequisites met: T1082-13 WinPwn - winPEAS
CheckPrereq's for: T1082-14 WinPwn - itm4nprivesc
Prerequisites met: T1082-14 WinPwn - itm4nprivesc
CheckPrereq's for: T1082-15 WinPwn - Powersploits privesc checks
Prerequisites met: T1082-15 WinPwn - Powersploits privesc checks
CheckPrereq's for: T1082-16 WinPwn - General privesc checks
Prerequisites met: T1082-16 WinPwn - General privesc checks
CheckPrereq's for: T1082-17 WinPwn - GeneralRecon
Prerequisites met: T1082-17 WinPwn - GeneralRecon
CheckPrereq's for: T1082-18 WinPwn - Morerecon
Prerequisites met: T1082-18 WinPwn - Morerecon
CheckPrereq's for: T1082-19 WinPwn - RBCD-Check
Prerequisites met: T1082-19 WinPwn - RBCD-Check
CheckPrereq's for: T1082-20 WinPwn - PowerSharpPack - Watson searching for missing windows patches
Prerequisites met: T1082-20 WinPwn - PowerSharpPack - Watson searching for missing windows patches
CheckPrereq's for: T1082-21 WinPwn - PowerSharpPack - Sharpup checking common Privesc vectors
Prerequisites met: T1082-21 WinPwn - PowerSharpPack - Sharpup checking common Privesc vectors
CheckPrereq's for: T1082-22 WinPwn - PowerSharpPack - Seatbelt
Prerequisites met: T1082-22 WinPwn - PowerSharpPack - Seatbelt
CheckPrereq's for: T1082-23 Azure Security Scan with SkyArk
Prerequisites not met: T1082-23 Azure Security Scan with SkyArk
        [*] The SkyArk AzureStealth module must exist in $env:temp.
        [*] The AzureAD module must be installed.
        [*] The Az module must be installed.

Try installing prereq's with the -GetPrereqs switch
```

```
Enumerating T1016
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1016-1 System Network Configuration Discovery on Windows
Prerequisites met: T1016-1 System Network Configuration Discovery on Windows
CheckPrereq's for: T1016-2 List Windows Firewall Rules
Prerequisites met: T1016-2 List Windows Firewall Rules
CheckPrereq's for: T1016-4 System Network Configuration Discovery (TrickBot Style)
Prerequisites met: T1016-4 System Network Configuration Discovery (TrickBot Style)
CheckPrereq's for: T1016-5 List Open Egress Ports
Prerequisites met: T1016-5 List Open Egress Ports
CheckPrereq's for: T1016-6 Adfind - Enumerate Active Directory Subnet Objects
Prerequisites met: T1016-6 Adfind - Enumerate Active Directory Subnet Objects
CheckPrereq's for: T1016-7 Qakbot Recon
Prerequisites met: T1016-7 Qakbot Recon
CheckPrereq's for: T1016-9 DNS Server Discovery Using nslookup
Prerequisites met: T1016-9 DNS Server Discovery Using nslookup
Enumerating T1049
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1049-1 System Network Connections Discovery
Prerequisites met: T1049-1 System Network Connections Discovery
CheckPrereq's for: T1049-2 System Network Connections Discovery with PowerShell
Prerequisites met: T1049-2 System Network Connections Discovery with PowerShell
CheckPrereq's for: T1049-4 System Discovery using SharpView
Prerequisites not met: T1049-4 System Discovery using SharpView
       [*] Sharpview.exe must exist on disk at specified location (C:\Tools\AtomicRedTeam\atomics\T1049\bin\SharpView.exe)

Try installing prereq's with the -GetPrereqs switch
Enumerating T1007
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1007-1 System Service Discovery
Prerequisites met: T1007-1 System Service Discovery
CheckPrereq's for: T1007-2 System Service Discovery - net.exe
Prerequisites met: T1007-2 System Service Discovery - net.exe
Enumerating T1087.001
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1087.001-8 Enumerate all accounts on Windows (Local)
Prerequisites met: T1087.001-8 Enumerate all accounts on Windows (Local)
CheckPrereq's for: T1087.001-9 Enumerate all accounts via PowerShell (Local)
Prerequisites met: T1087.001-9 Enumerate all accounts via PowerShell (Local)
CheckPrereq's for: T1087.001-10 Enumerate logged on users via CMD (Local)
Prerequisites met: T1087.001-10 Enumerate logged on users via CMD (Local)
```

Given the number of tests for each Atomic, as shown above, we will only select one for brevity. Let's also focus on the tests that have met the prerequisites.

- T1059.003-3: Suspicious Execution via Windows Command Shell
- T1083-1: File and Directory Discovery (cmd.exe)
- T1082-6: Hostname Discovery (Windows)
- T1016-1: System Network Configuration Discovery on Windows
- T1049-1: System Network Connections Discovery
- T1007-2: System Service Discovery - net.exe
- T1087.001-9: Enumerate all accounts via PowerShell (Local)
- T1566.001-1: Download Macro-Enabled Phishing Attachment

The only thing left now is to emulate the Atomics. Unlike the PowerShell command snippets above, we will only execute the tests one at a time. This is to observe the emulation and not be overwhelmed by the terminal output.


Continue the execution of the remaining Atomic tests to answer the questions below.

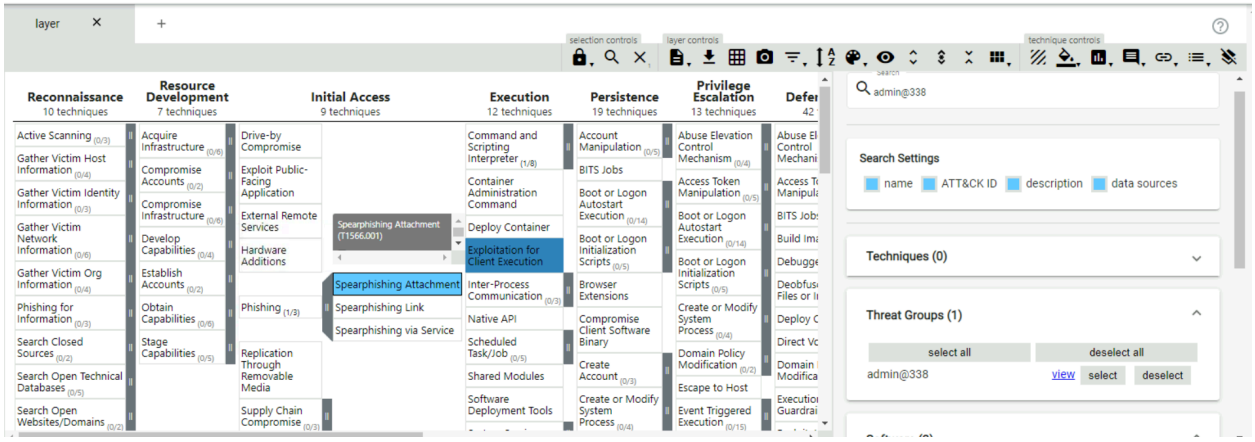
**********

**Answer the questions below:**

**Using the ATT&CK Navigator, how many techniques are attributed to admin@338?**

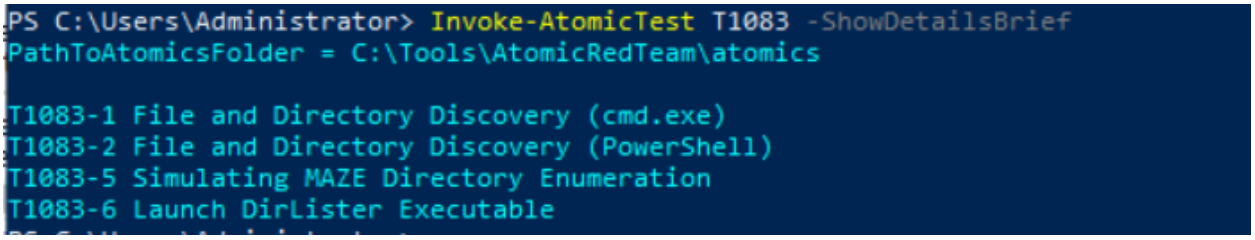
Answer: 9

**Using the mapping provided by the ATT&CK Navigator, what is the Technique ID of the phishing technique used by the threat group?**



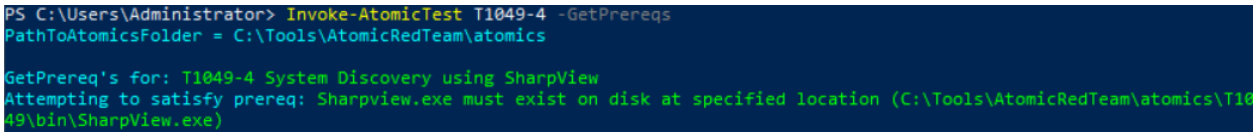

Answer: T1566.001

**How many Atomic tests on Atomic T1083 are supported on Windows hosts?**




Answer: 4

**What file should exist to satisfy the prerequisite of Atomic Test T1049-4?**




Answer: Sharpview.exe

**What is the echoed string upon executing Atomic Test T1059.003-3?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1059.003-3
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1059.003-3 Suspicious Execution via Windows Command Shell
Hello, from CMD!
Done executing test: T1059.003-3 Suspicious Execution via Windows Command Shell
```

Answer: Hello, from CMD!

**What is the hostname of the machine based on Atomic Test T1082-6?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1082-6
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1082-6 Hostname Discovery (Windows)
ATOMIC
Done executing test: T1082-6 Hostname Discovery (Windows)
```

Answer: ATOMIC

**How many accounts are disabled based on Atomic Test T1087.001-9?**

```
The command completed successfully.
Name               Enabled Description
----               ------- -----------
Administrator      True    Built-in account for administering the computer/domain
DefaultAccount     False   A user account managed by the system.
Guest              False   Built-in account for guest access to the computer/domain
WDAGUtilityAccount False   A user account managed and used by the system for Windows Defender Application Guard scen...
```

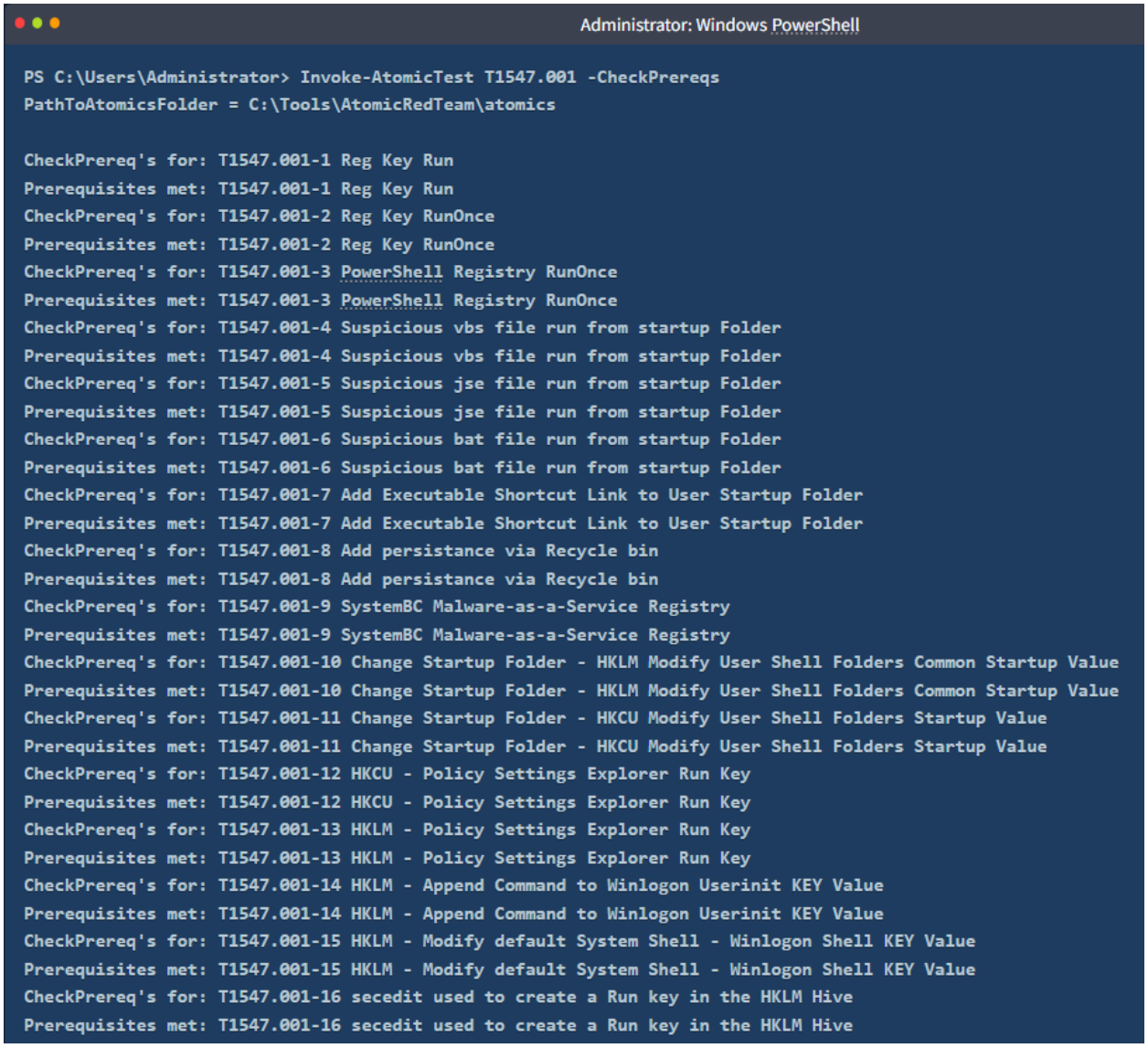
Answer: 3

## Emulation to Detection

From the previous tasks, we learned to operate with the Atomic Red Team framework and emulate different techniques across the mapping of MITRE ATT&CK. Now, let's wear our blue team hat and apply the benefits of threat emulation in detection engineering.

### Observing Telemetry

The easiest way to understand different TTPs is to see them first-hand. We will learn and observe how techniques work by checking the events/logs generated by the Atomic tests. For this section, let's use the tests from Atomic T1547.001, which is all about Boot or Logon Autostart Execution: Registry Run Keys / Startup FolderPermalink.



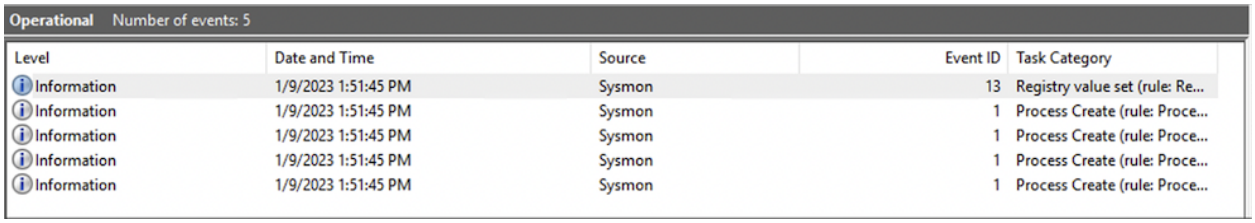

There are sixteen available tests for this Atomic, and all have prerequisites met. All of the tests can be executed without any problems.

**Sysmon**

For this task, we will view logs generated by Atomics through Sysmon. Let's fire up the Event Viewer and navigate to Applications and Services > Microsoft > Windows > Sysmon. Once done, clear the existing records and start executing the first test.

```
Administrator: Windows PowerShell

PS C:\Users\Administrator> Invoke-AtomicTestT1547.001 -TestNumbers 1
PathToAtomicsFolder = C: \Tools\AtomicRedTeam\atomics

Executing test: T1547.001-1 Reg Key Run
The operation completed successfully
Done executing test: T1547.001-1 Reg Key Run
```

Refresh the Event Viewer to view the latest updates, and always clear the logs before executing the next Atomic test



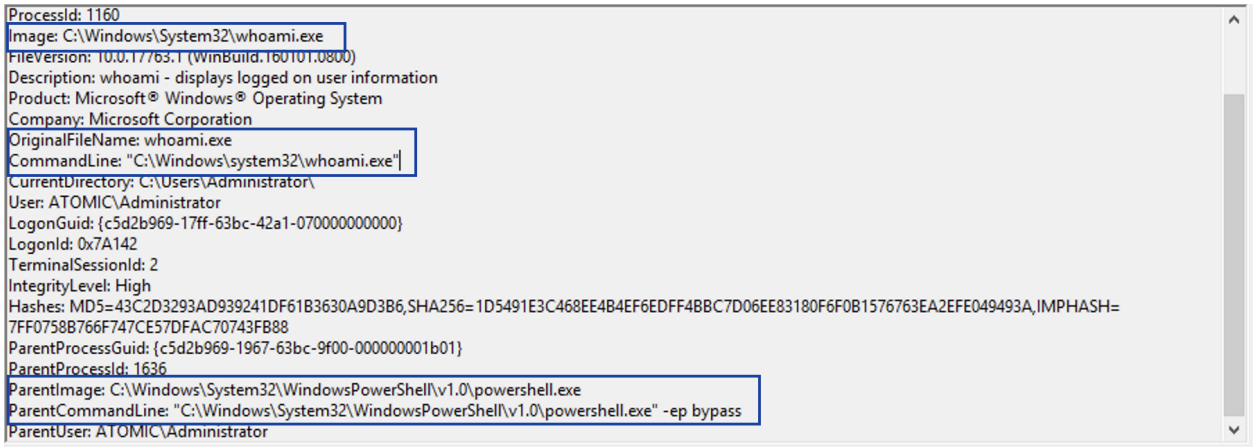
Operational Number of events: 5

| Level | Date and Time | Source | Event ID | Task Category |
|---|---|---|---|---|
| Information | 1/9/2023 1:51:45 PM | Sysmon | 13 | Registry value set (rule: Re... |
| Information | 1/9/2023 1:51:45 PM | Sysmon | 1 | Process Create (rule: Proce... |
| Information | 1/9/2023 1:51:45 PM | Sysmon | 1 | Process Create (rule: Proce... |
| Information | 1/9/2023 1:51:45 PM | Sysmon | 1 | Process Create (rule: Proce... |
| Information | 1/9/2023 1:51:45 PM | Sysmon | 1 | Process Create (rule: Proce... |

Note: Log clearing will only be practical if the emulation is done in a test environment. You may not have the luxury of clearing the logs in a production setup. This may require an additional understanding of the Atomic breakdown before executing it to know what logs are expected to appear.

Upon completing Atomic Test T1547.001-1, it generated five records. We can ignore the first two logs as it is part of Invoke-AtomicTest's execution; hence we can overlook the execution of the following binaries with PowerShell being its parent process throughout this task:

- whoami.exe
- hostname.exe



```
ProcessId: 1160
Image: C:\Windows\System32\whoami.exe
FileVersion: 10.0.17763.1 (WinBuild.160101.0800)
Description: whoami - displays logged on user information
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: whoami.exe
CommandLine: "C:\Windows\system32\whoami.exe"
CurrentDirectory: C:\Users\Administrator\
User: ATOMIC\Administrator
LogonGuid: {c5d2b969-17ff-63bc-42a1-070000000000}
LogonId: 0x7A142
TerminalSessionId: 2
IntegrityLevel: High
Hashes: MD5=43C2D3293AD939241DF61B3630A9D3B6,SHA256=1D5491E3C468EE4B4EF6EDFF4BBC7D06EE83180F6F0B1576763EA2EFE049493A,IMPHASH=
7FF0758B766F747CE57DFAC70743FB88
ParentProcessGuid: {c5d2b969-1967-63bc-9f00-000000001b01}
ParentProcessId: 1636
ParentImage: C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
ParentCommandLine: "C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" -ep bypass
ParentUser: ATOMIC\Administrator
```

```
ProcessId: 5112
Image: C:\Windows\System32\HOSTNAME.EXE
FileVersion: 10.0.17763.1 (WinBuild.160101.0800)
Description: Hostname APP
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: hostname.exe
CommandLine: "C:\Windows\system32\HOSTNAME.EXE"
CurrentDirectory: C:\Users\Administrator\
User: ATOMIC\Administrator
LogonGuid: {c5d2b969-17ff-63bc-42a1-070000000000}
LogonId: 0x7A142
TerminalSessionId: 2
IntegrityLevel: High
Hashes: MD5=7F95220A65A5A5D4A98873E86EF2E549,SHA256=1BFF2907C456F99277F45F9B2A21B1B3F11F6C01587D9E6D6F0B2B5F1472FE92,IMPHASH=
5CD891320C666621E9783444DB8CBA78
ParentProcessGuid: {c5d2b969-1967-63bc-9f00-000000001b01}
ParentProcessId: 1636
ParentImage: C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
ParentCommandLine: "C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" -ep bypass
ParentUser: ATOMIC\Administrator
```

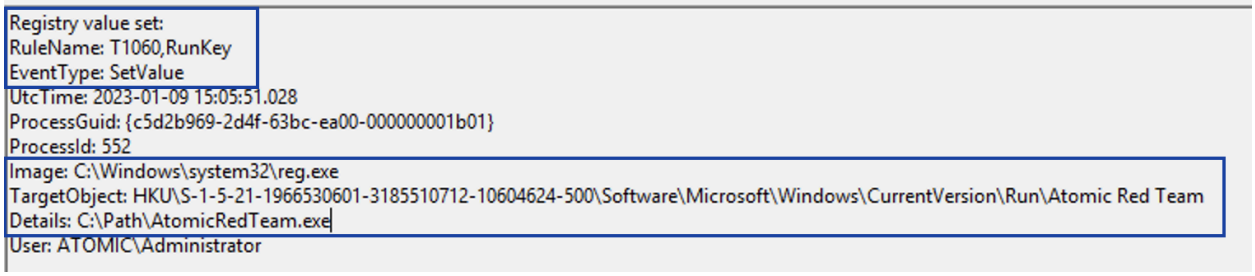
Ignoring the first two entries, we are left with three logs generated by the emulated Atomic test. The following three entries are Process Create events (Sysmon Event ID 1) and a single Registry Value Set event (Sysmon Event ID 13).

### Process Create Logs

```
UtcTime: 2023-01-09 15:05:50.984
ProcessGuid: {c5d2b969-2d4e-63bc-e800-000000001b01}
ProcessId: 200
Image: C:\Windows\System32\cmd.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows Command Processor
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: Cmd.Exe
CommandLine: "cmd.exe" /c "REG ADD "HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run" /V "Atomic Red Team" /t REG_SZ /F /D "C:\Path
\AtomicRedTeam.exe""
CurrentDirectory: C:\Users\ADMINI~1\AppData\Local\Temp\2\
User: ATOMIC\Administrator
LogonGuid: {c5d2b969-17ff-63bc-42a1-070000000000}
LogonId: 0x7A142
TerminalSessionId: 2
IntegrityLevel: High
Hashes: MD5=911D039E71583A07320B32BDE22F8E22,SHA256=BC866CFCDDA37E24DC2634DC282C7A0E6F55209DA17A8FA105B07414C0E7C527,IMPHASH=
272245E2988E1E430500B852C4FB5E18
ParentProcessGuid: {c5d2b969-1967-63bc-9f00-000000001b01}
ParentProcessId: 1636
```

```
Image: C:\Windows\System32\reg.exe
FileVersion: 10.0.17763.1 (WinBuild.160101.0800)
Description: Registry Console Tool
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: reg.exe
CommandLine: REG  ADD "HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run" /V "Atomic Red Team" /t REG_SZ /F /D "C:\Path\AtomicRedTeam.exe"
CurrentDirectory: C:\Users\ADMINI~1\AppData\Local\Temp\2\
User: ATOMIC\Administrator
LogonGuid: {c5d2b969-17ff-63bc-42a1-070000000000}
LogonId: 0x7A142
TerminalSessionId: 2
IntegrityLevel: High
Hashes: MD5=8A93ACAC33151793F8D52000071C0B06,SHA256=
19316D4266D0B776D9B2A05D5903D8CBC8F0EA1520E9C2A7E6D5960B6FA4DCAF,IMPHASH=BE482BE427FE212CFEF2CDA0E61F19AC
ParentProcessGuid: {c5d2b969-2d4e-63bc-e800-000000001b01}
ParentProcessId: 200
ParentImage: C:\Windows\System32\cmd.exe
ParentCommandLine: "cmd.exe" /c "REG ADD "HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run" /V "Atomic Red Team" /t REG_SZ /F /D "C:\Path
\AtomicRedTeam.exe""
ParentUser: ATOMIC\Administrator
```

### Registry Value Set Log




Based on the images above, we can summarise the events generated by Atomic test T1547.001-1 with the following information:

- The test generated three significant events: two Process Create events and one Registry Value Set event.
- The two Process Create events are caused by the execution of the reg.exe binary via the cmd.exe /c parameter.
- For this type of attack, the reg.exe binary is being utilized by threat actors to modify the registry key \SOFTWARE\Microsoft\Windows\CurrentVersion\Run.
- Lastly, the Registry Value points to a malicious binary (C:\Path\AtomicRedTeam.exe), which indicates that the binary will be executed during user logon.

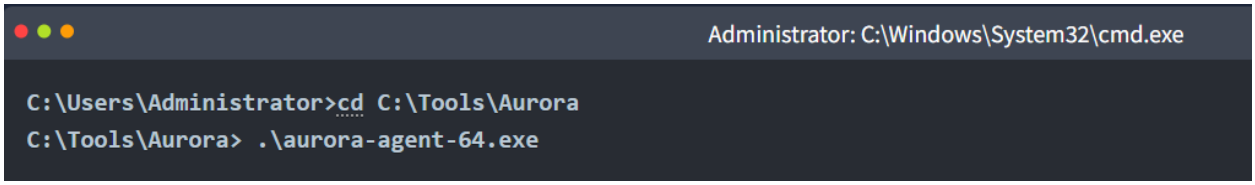
We have successfully reflected the first Atomic Test via Sysmon logs. Let's continue emulating the subsequent tests with Aurora EDR to test its detection capabilities.

**Aurora EDR**

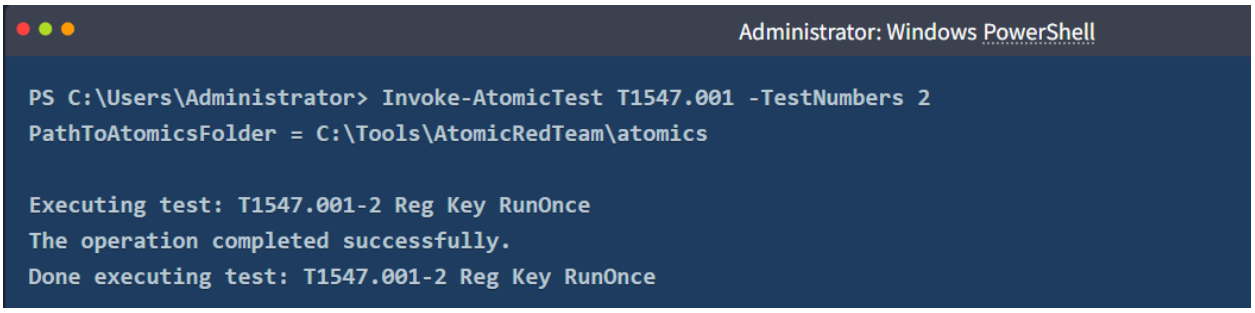
Note: If you are unfamiliar with Aurora EDR, you may proceed with this room first.

For a quick recap, Aurora is a Windows endpoint agent that uses Sigma rules and Indicators of Compromise (IOCs) to detect threat patterns on local event streams using Event Tracing for Windows (ETW). It is easy to correlate our previous learnings because Sigma rules are associated with the MITRE ATT&CK framework.

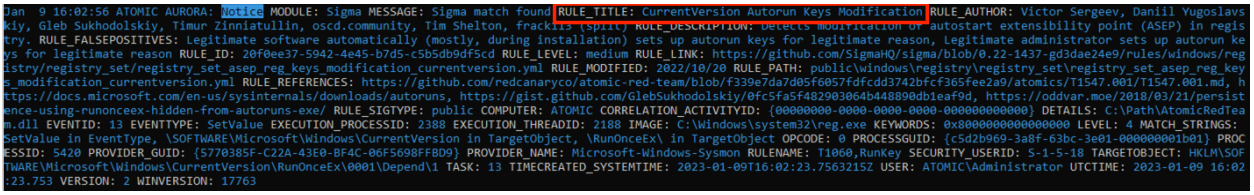
To run Aurora, open a PowerShell window. Then navigate to C:\Tools\Aurora and execute aurora-agent-64.exe.




Wait for the message that states Aurora Agent started before going back to the execution of Atomic Test T1547.001-2. Once the tool has successfully loaded, proceed to the next Atomic Test.




After execution, you may observe that the window running Aurora EDR has generated several detections related to Registry Modification.
Note: You may ignore the detection of whoami.exe, as shown in the first two detection logs.





The results summarise the following information:

- Sigma Rule Title, Description, and Notable False Positives
- Sigma match strings used
- Execution details such as Process Names, Command-line parameters and Hashes

The execution above is an excellent example of testing deployed rules by utilizing the Atomic Red Team for threat emulation. Moving forward, you may use the methodology gained from this task to test and improve your existing detection rules.

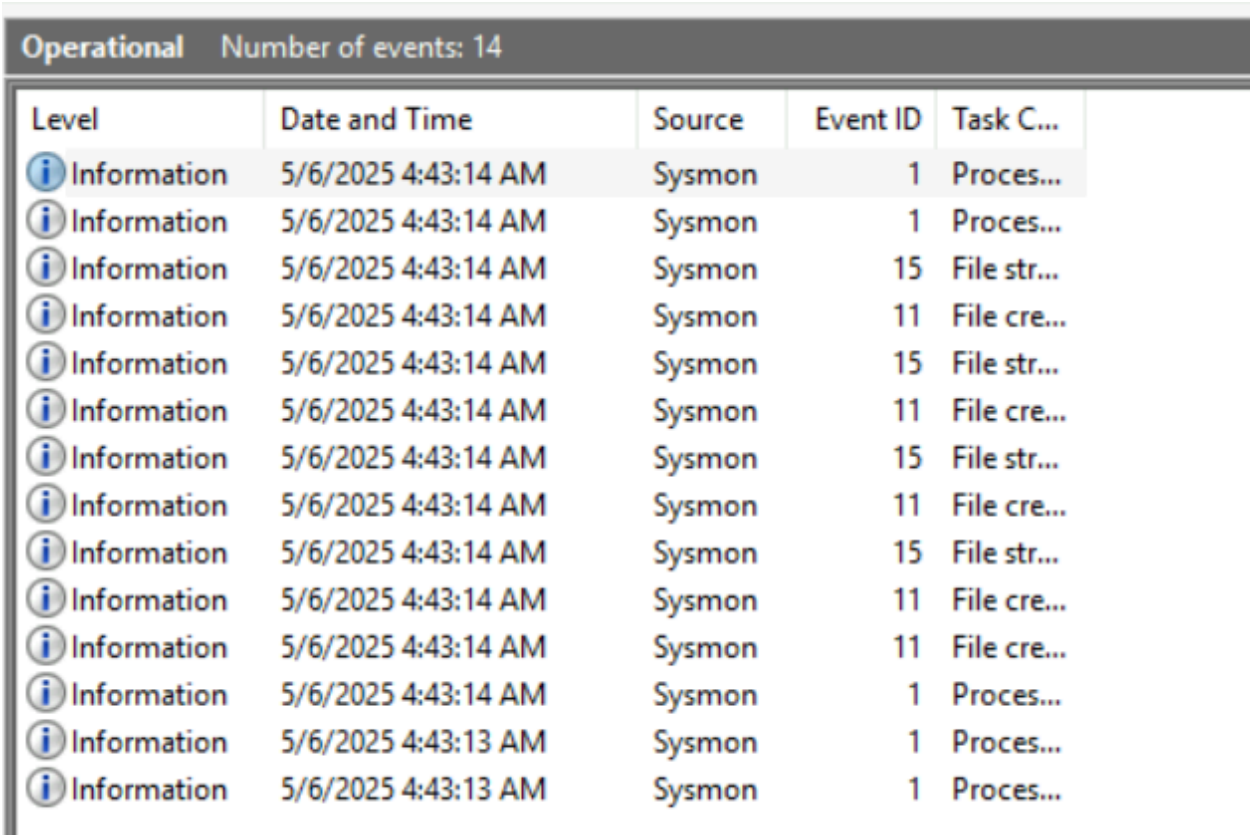
Now, continue emulating the remaining tests to answer the questions below.

**********

**Answer the questions below:**

**How many Sysmon events are generated after executing Atomic Test T1547.001-4?**

```
PS C:\Users\Administrator>  Invoke-AtomicTest T1547.001-4
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1547.001-4 Suspicious vbs file run from startup Folder
Microsoft (R) Windows Script Host Version 5.812
Copyright (C) Microsoft Corporation. All rights reserved.
T1547.001 Hello, World VBS!
Microsoft (R) Windows Script Host Version 5.812
Copyright (C) Microsoft Corporation. All rights reserved.
T1547.001 Hello, World VBS!
Done executing test: T1547.001-4 Suspicious vbs file run from startup Folder
```

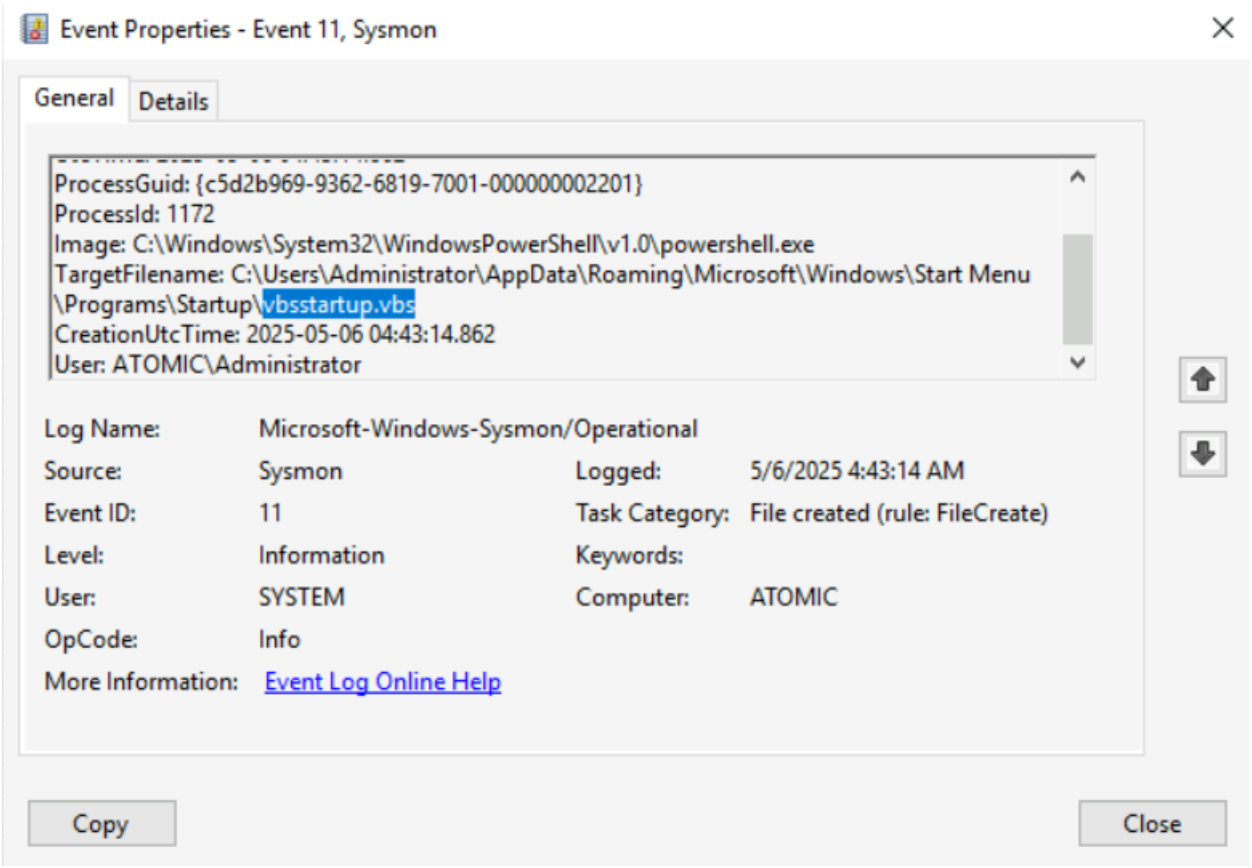


Operational Number of events: 14

| Level | Date and Time | Source | Event ID | Task C... |
|---|---|---|---|---|
| Information | 5/6/2025 4:43:14 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 15 | File str... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 15 | File str... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 15 | File str... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 15 | File str... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 4:43:14 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 4:43:13 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 4:43:13 AM | Sysmon | 1 | Proces... |

Answer: 14

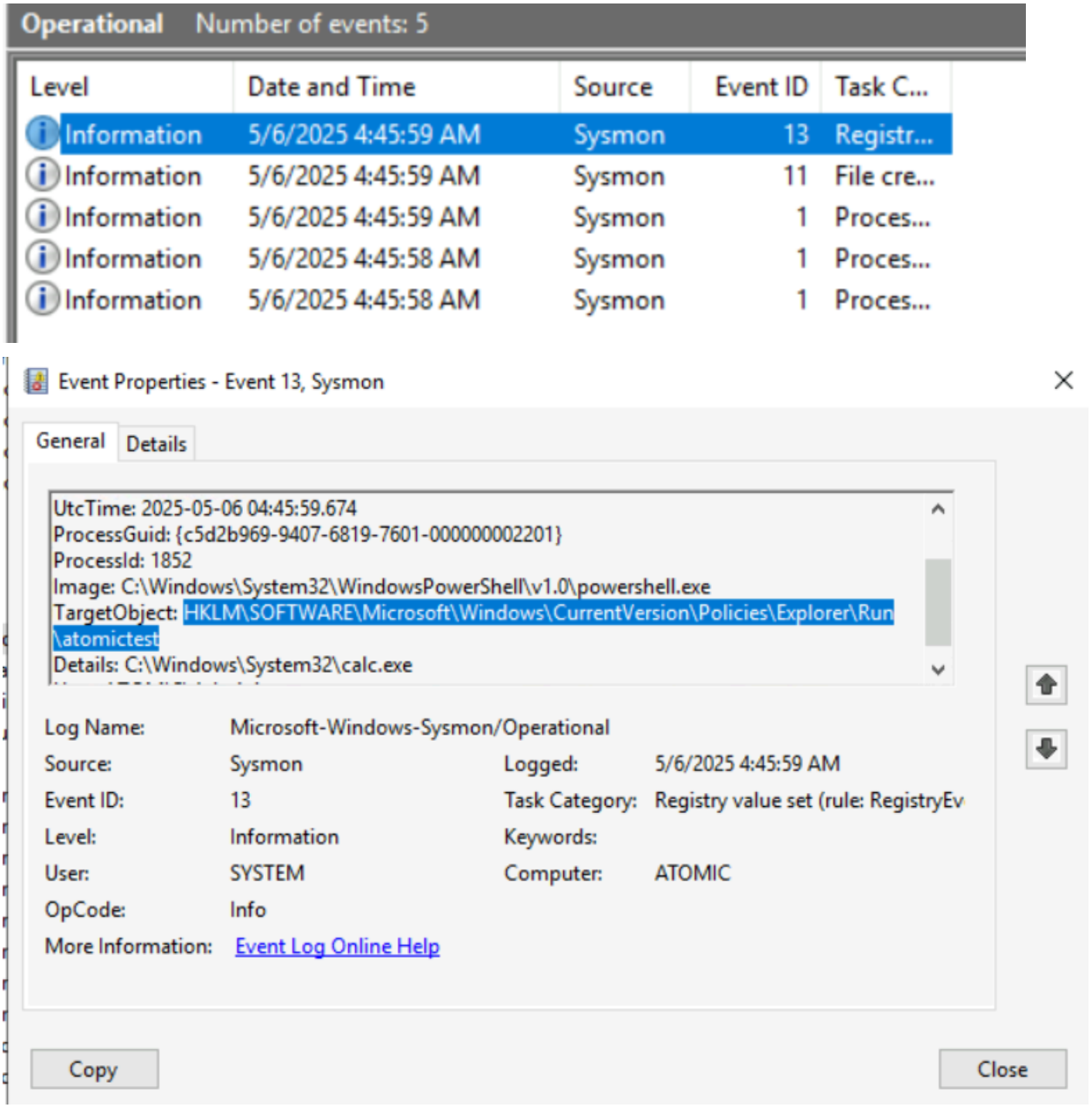
**Based on the same events from Q1, what is the file name created by the test?**




Answer: vbsstartup.vbs

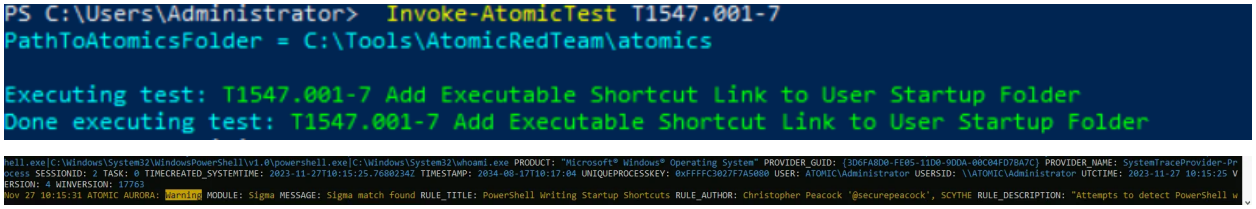
**Based on the Registry Value Set event generated after executing Atomic Test T1547.001-13, what is the value of the TargetObject field?**

```
PS C:\Users\Administrator>  Invoke-AtomicTest T1547.001-13
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1547.001-13 HKLM - Policy Settings Explorer Run Key
Hive: HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer
Name                           Property
----                           --------
Run
Done executing test: T1547.001-13 HKLM - Policy Settings Explorer Run Key
```



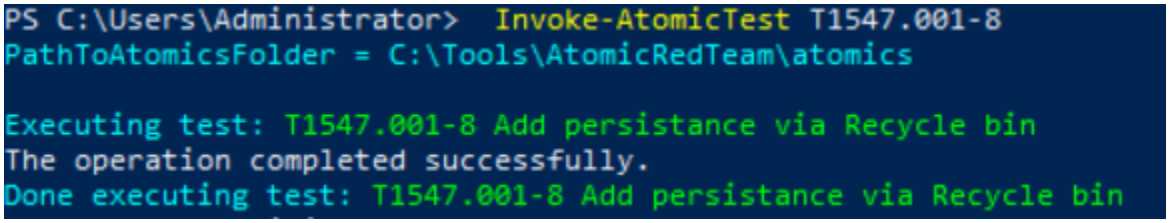

Answer:
HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\Explorer\Run\atomictest

**Excluding the WHOAMI detection, what is the title of the first rule triggered on Aurora EDR after executing Atomic Test T1547.001-7?**




Answer: Powershell Writing Startup Shortcuts

**Excluding the WHOAMI detection, what is the title of the first rule triggered on Aurora EDR after executing Atomic Test T1547.001-8?**



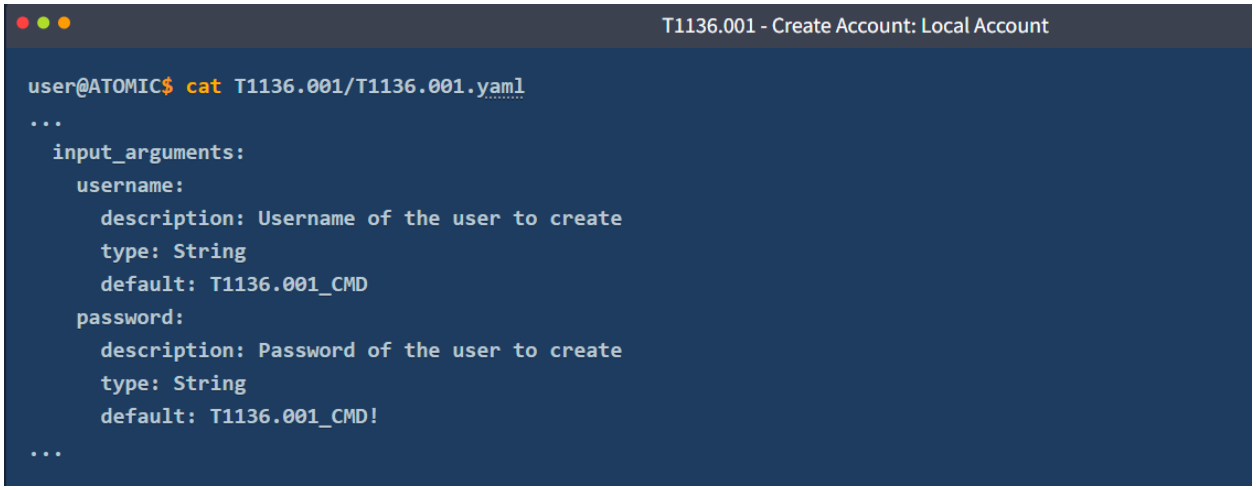

Answer: Registry Persistence Mechanisms in Recycle Bin

## Customizing Atomic Red Team

In some cases, the Atomic Red Team cannot cater to the organization's needs, such as emulating MITRE techniques that do not have a corresponding Atomic or tailoring a specific use case that only fits within a particular infrastructure or configuration setup. With that in mind, we need to be capable of creating custom Atomic tests and maximizing tests via custom arguments.

### Custom Input Arguments

Going back to the contents of the Atomic files, the input_argument field defines a hashtable wherein the key is the input name, and the value is another hashtable specifying the input arguments. Let's use the Create Account: Local Account technique as an example to expound this further.

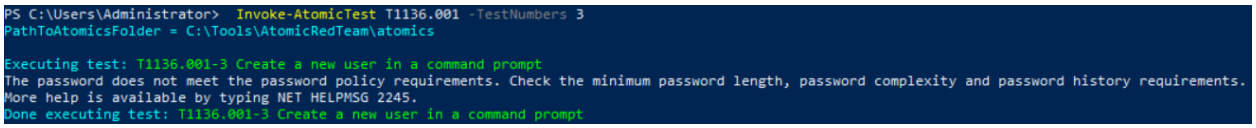


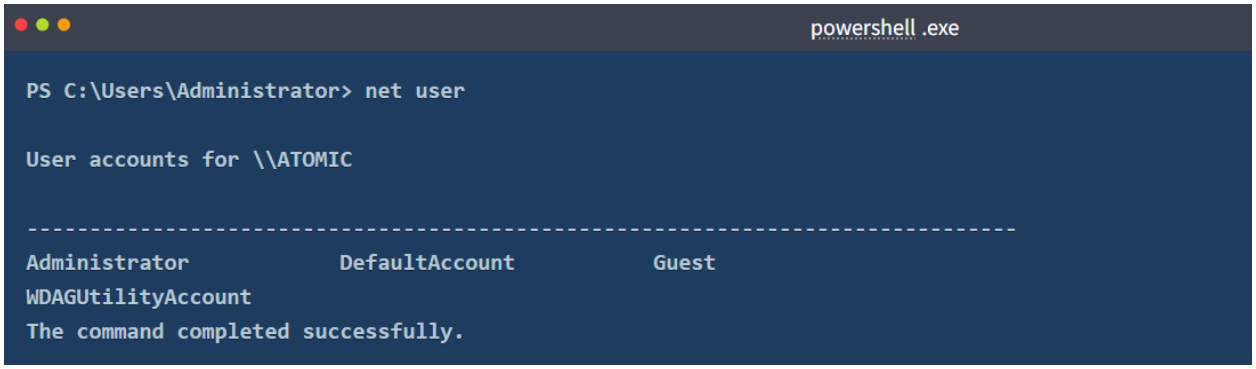

Using T1136.001 as an example, you may observe that the snippet above showcases two input names with the following information:

| Input Name | Input Definition |
|---|---|
| username | - This input argument is described as the "Username of the user to create"<br>- The username input type is String<br>- The value defaults to T1136.001_CMD |
| password | - This input argument is described as the "Password of the user to create"<br>- The password input type is String<br>- The value defaults to T1136.001_CMD! |

Knowing these, executing this Atomic test will create a user named T1136.001_CMD, having T1136.001_CMD! as its password.

We can test this out and verify it manually by executing Atomic Test #3 of T1136.001.



Based on the output of the Atomic test and the net user command,  the user was not created successfully due to the existing password policy requirement. We can try customizing the input arguments and replacing the password to satisfy the policy.

For this, we can either use one of these two parameters:

- PromptForInputArgs: set the values of the input arguments interactively

```
powershell .exe

PS C:\Users\Administrator> Invoke-AtomicTest T1136.001 -TestNumbers 3 -PromptForInputArgs
```

- InputArgs: pass a hashtable that contains the key-value pair of input arguments and its values

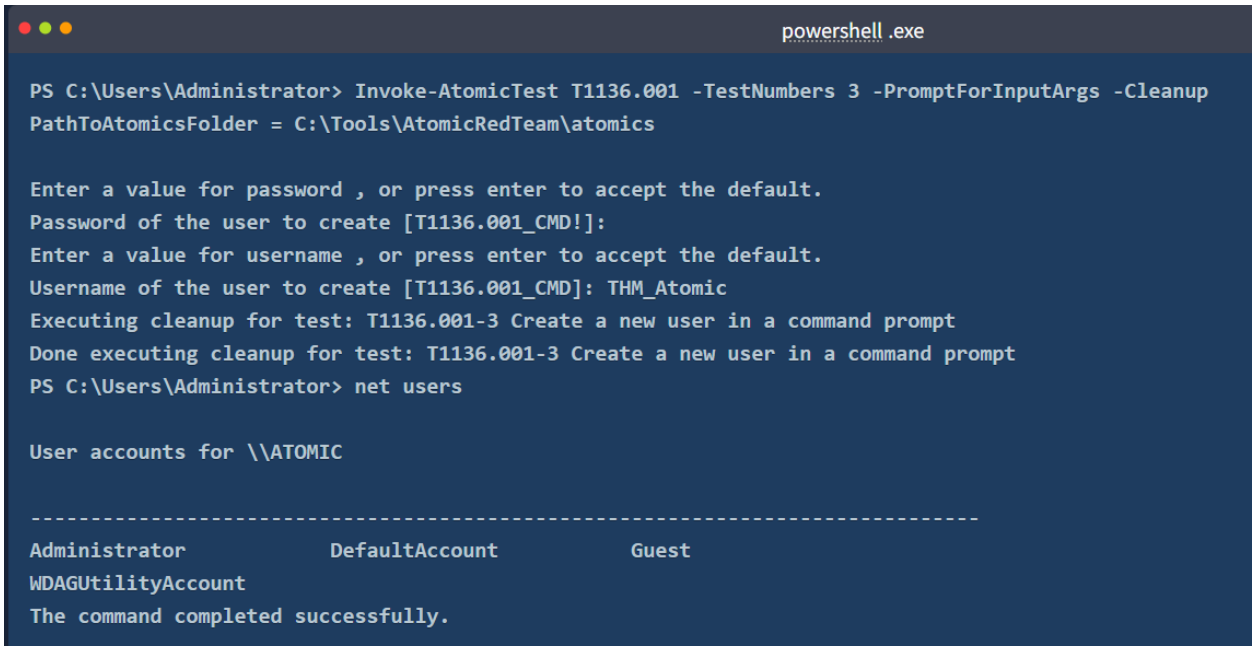
```
powershell .exe

PS C:\Users\Administrator> $customArgs = @{ "username" = "THM_Atomic"; "password" = "p@ssw0rd" }
PS C:\Users\Administrator> Invoke-AtomicTest T1136.001 -TestNumbers 3 -InputArgs $customArgs
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1136.001-3 Create a new user in a command prompt
The command completed successfully.
Done executing test: T1136.001-3 Create a new user in a command prompt
```

The execution of the following commands below resulted in a new user named THM_Atomic.

The result can then be verified by checking the local users via net.exe. The user THM_Atomic was successfully created, as shown in the output below.

```
powershell .exe

PS C:\Users\Administrator> net user

User accounts for \\ATOMIC

-------------------------------------------------------------------------------
Administrator            DefaultAccount           Guest
THM_Atomic               WDAGUtilityAccount
The command completed successfully.
```

Lastly, these parameters can be used in conjunction with the cleanup parameter. Given the case, you need to specify the values used to revert successfully after the execution.




The command snippet above shows that the newly created account was successfully removed from the users' list.

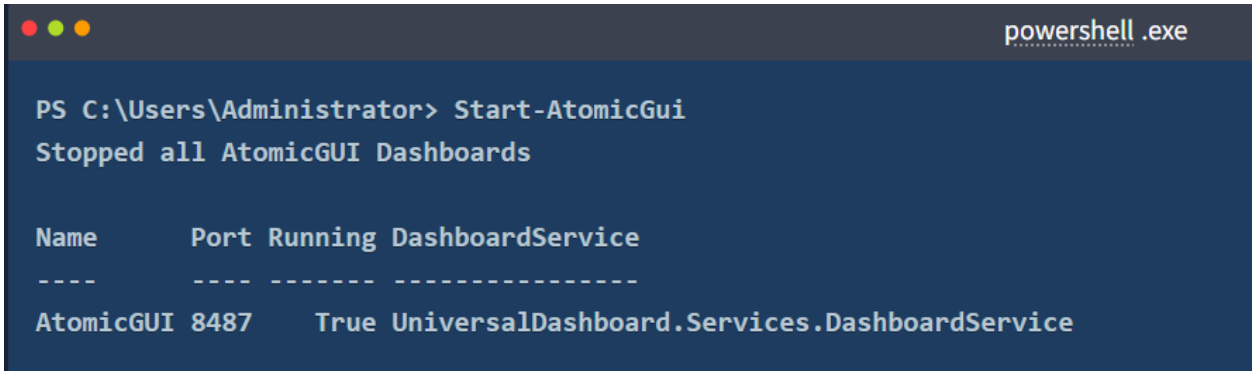
One last important thing to highlight is that not all Atomics can use this functionality. Only the Atomics that have defined the input_arguments section can change values during execution. If you need to execute a more specific test, you may create your own Atomic test.

**Creating New Atomic Tests**

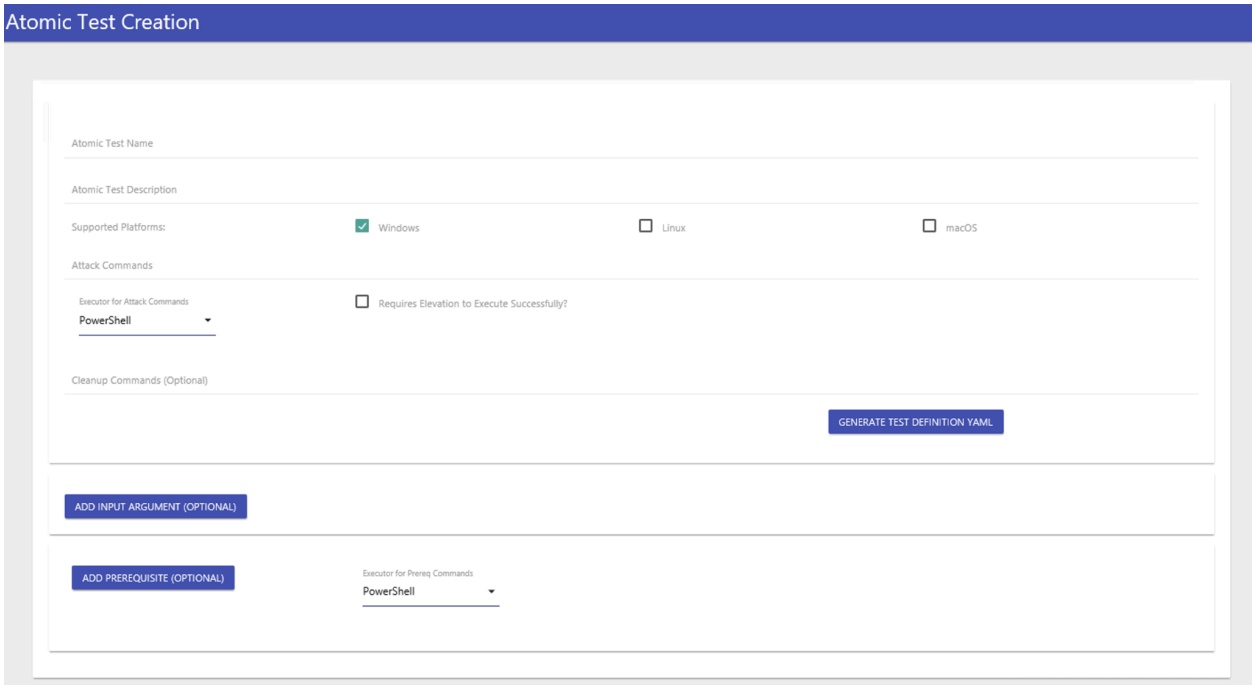
The Invoke-AtomicRedTeam module also has a functionality that eases up the creation of Atomic Tests, and it is named the Atomic GUI.

The Atomic GUI is a web-based form that users can fill out to generate the YAML definition of Atomic Tests. The result of this tool can then be inserted into the appropriate Atomic technique.

To start the web application, execute Start-AtomicGUI via PowerShell.

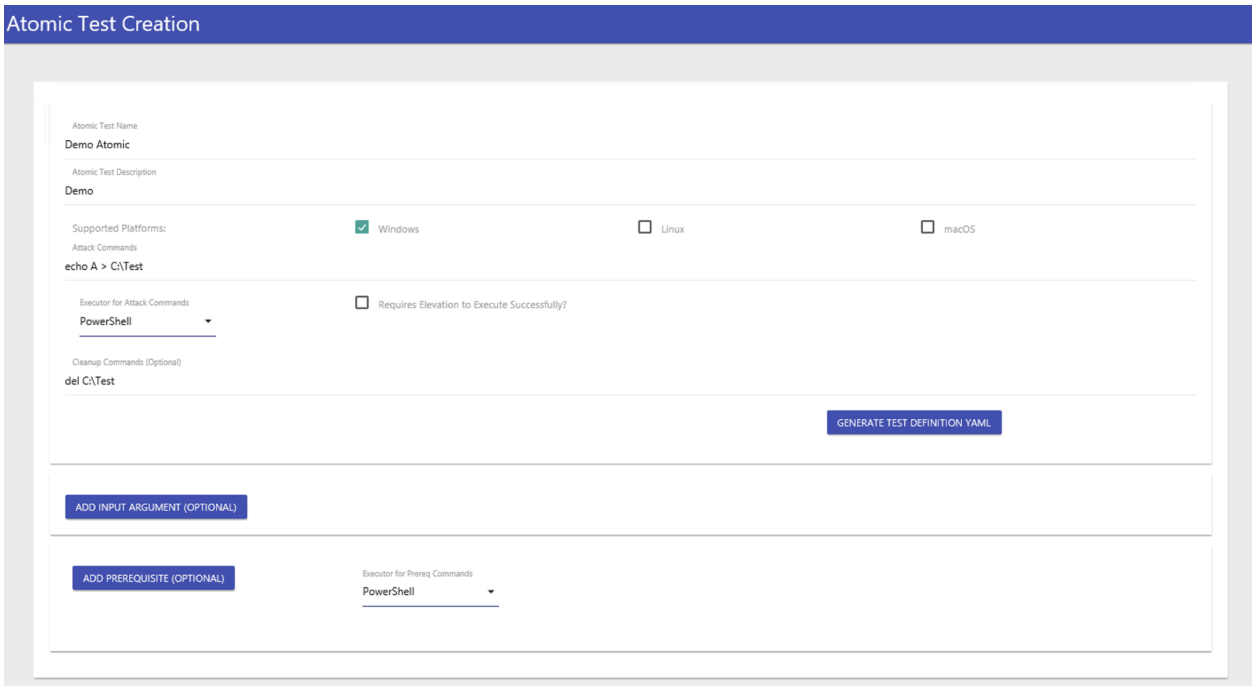



Once the tool runs, access the application using the URL http://localhost:8487/home via a browser.

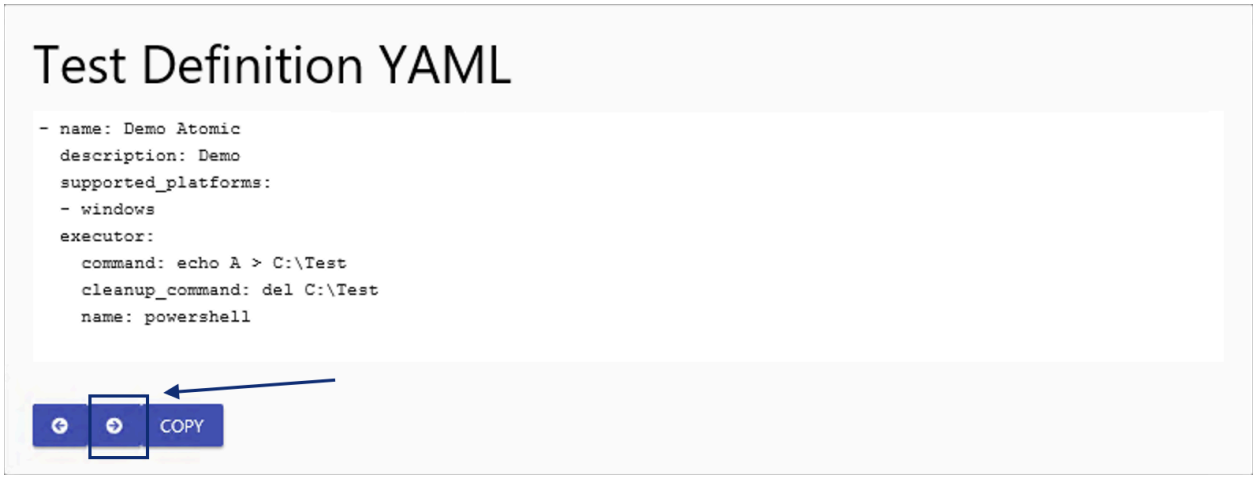



You may observe that all the values needed for a test can be quickly filled out, like:

- Atomic Test Name and Definition
- Supported Platforms
- Attack Commands, Command Executor, Required Elevation and Cleanup Commands
- Custom input arguments
- Prerequisites and their Executor




After writing the values, you can generate the output by clicking GENERATE TEST DEFINITION. This results in a YAML output that can be inserted into any Atomic Techniques needing modification.




Note: Add two spaces to align the Atomic Tests in the target Atomic YAML file. You may click the highlighted button above twice to insert the appropriate indentation.

**********

**Answer the questions below:**

**What parameter should you use to customize the input arguments interactively?**
Answer: PromptForInputArgs

**What parameter should you use in conjunction with InputArgs/PromptForInputArgs to revert the changes made by the test?**
Answer: Cleanup

**What is the default port used by the Atomic GUI?**
Answer: 8487

## Case Study: Emulating APT37

To apply all items discussed in the previous tasks, let's do a case study for the emulation of APT37.

APT37, also known as Reaper, is a cyber espionage group that has been active since 2012 and is believed to be operating out of North Korea. The group has been known to target a wide range of organizations, including government agencies, defence contractors, and media companies.

You may follow these guidelines, which is a summary of the methodology covered above:

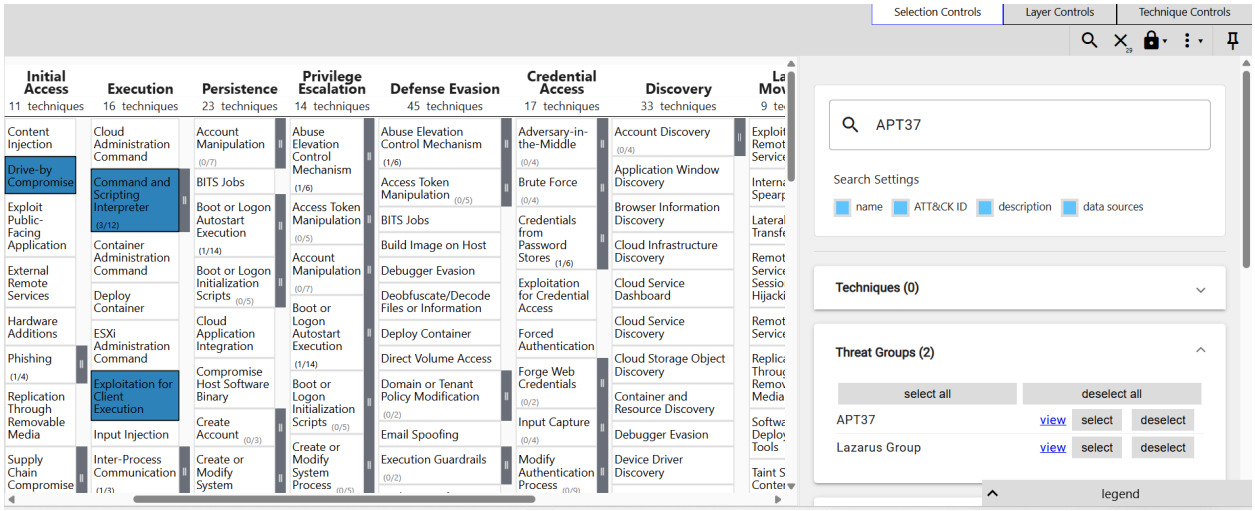
- Start by gathering the techniques attributed to APT37 using ATT&CK Navigator.
- Correlate all existing Atomics with the known techniques the given threat actor uses.
- Emulate all available Atomic Tests and observe the events generated via Event Viewer or Aurora EDR.
- Ensure to execute a cleanup after every test.
- Document and review the results.

Lastly, answer the questions below to complete this task. Good luck!

**********

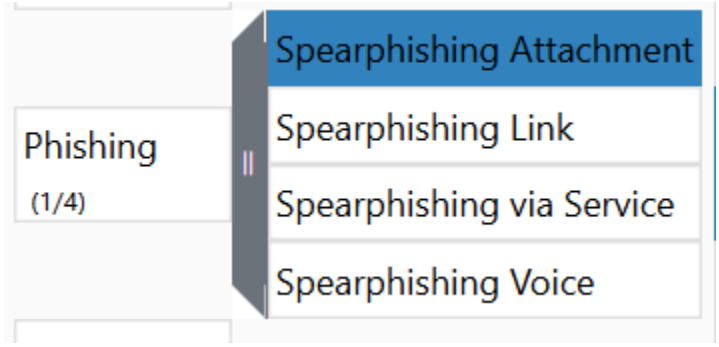
**Answer the questions below:**

**Using the ATT&CK Navigator, how many techniques are attributed to APT37?**




Answer: 29

**Using the mapping provided by the ATT&CK Navigator, what is the phishing technique used by the threat group?**




Answer: Spearphishing Attachment

**How many techniques attributed to APT37 have an existing Atomic file?**

To do this I had to collect all of the technique names attributed to APT37.

- “T1189|T1059|T1203|T1106|T1055|T1027|T1120|T1057|T1082|T1033|T1123|T1005|T1105|T1529”

```
PS C:\Users\Administrator> ls C:\Tools\AtomicRedTeam\atomics | Where-Object Name -Match "T1189|T1059|T1203|T1106|T1055|T1027|T1120|T1057|T1082|T1033|T1123|T1005|T1105|T1529"

    Directory: C:\Tools\AtomicRedTeam\atomics


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         1/3/2023   5:20 PM                T1027
d-----         1/3/2023   5:20 PM                T1027.001
d-----         1/3/2023   5:20 PM                T1027.002
d-----         1/3/2023   5:20 PM                T1027.004
d-----         1/3/2023   5:20 PM                T1027.006
d-----         1/3/2023   5:20 PM                T1033
d-----         1/3/2023   5:20 PM                T1055
d-----         1/3/2023   5:20 PM                T1055.001
d-----         1/3/2023   5:20 PM                T1055.003
d-----         1/3/2023   5:20 PM                T1055.004
d-----         1/3/2023   5:20 PM                T1055.012
d-----         1/3/2023   5:20 PM                T1057
d-----         1/3/2023   5:20 PM                T1059.001
d-----         1/3/2023   5:20 PM                T1059.002
d-----         1/3/2023   5:20 PM                T1059.003
d-----         1/3/2023   5:20 PM                T1059.004
d-----         1/3/2023   5:20 PM                T1059.005
d-----         1/3/2023   5:20 PM                T1059.006
d-----         1/3/2023   5:20 PM                T1082
d-----         1/3/2023   5:20 PM                T1105
d-----         1/3/2023   5:20 PM                T1106
d-----         1/3/2023   5:20 PM                T1120
d-----         1/3/2023   5:20 PM                T1123
d-----         1/3/2023   5:20 PM                T1529
```

Answer: 21

**Based on the results of Q3, which Atomic has no tests supported on Windows?**

Answer: T1059.006

**What is the description of the prerequisite needed for Atomic Test T1055-1?**

```
PS C:\Users\Administrator>  Invoke-AtomicTest  T1055-1 -GetPrereqs
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

GetPrereq's for: T1055-1 Shellcode execution via VBA
Attempting to satisfy prereq: The 64-bit version of Microsoft Office must be installed
You will need to install Microsoft Word (64-bit) manually to meet this requirement
Failed to meet prereq: The 64-bit version of Microsoft Office must be installed
Attempting to satisfy prereq: C:\Tools\AtomicRedTeam\atomics\T1055\src\x64\T1055-macrocode.txt must exist on disk at specified location
Prereq already met: C:\Tools\AtomicRedTeam\atomics\T1055\src\x64\T1055-macrocode.txt must exist on disk at specified location
```

Answer: The 64-bit version of Microsoft Office must be installed

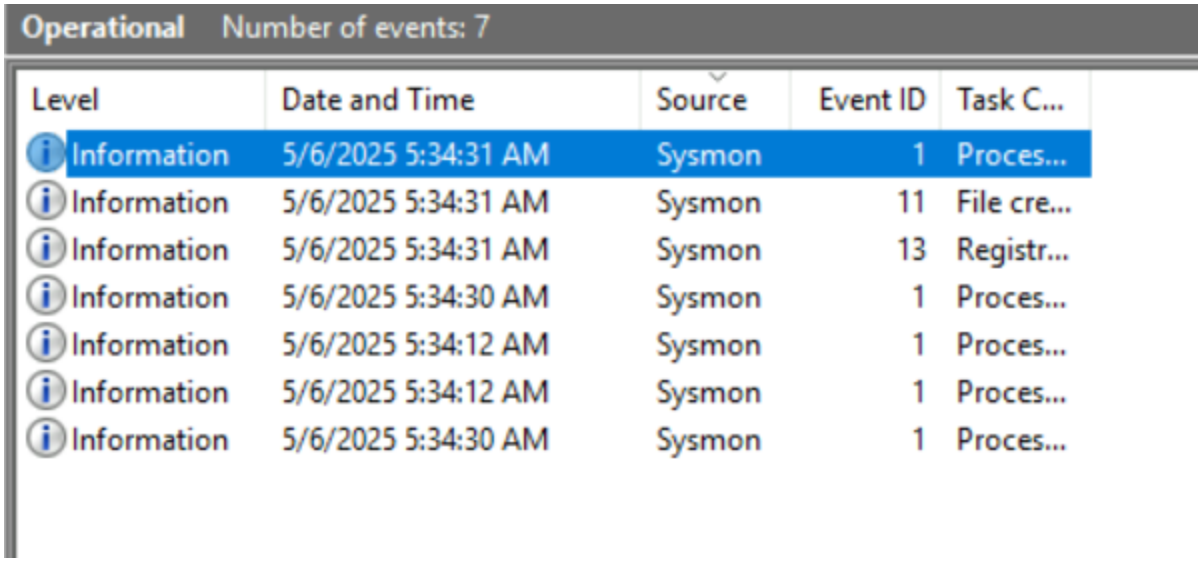
**How many Atomic tests have met the prerequisites for Atomic T1082?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1082 -CheckPrereqs
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

CheckPrereq's for: T1082-1 System Information Discovery
Prerequisites met: T1082-1 System Information Discovery
CheckPrereq's for: T1082-6 Hostname Discovery (Windows)
Prerequisites met: T1082-6 Hostname Discovery (Windows)
CheckPrereq's for: T1082-8 Windows MachineGUID Discovery
Prerequisites met: T1082-8 Windows MachineGUID Discovery
CheckPrereq's for: T1082-9 Griffon Recon
Prerequisites met: T1082-9 Griffon Recon
CheckPrereq's for: T1082-10 Environment variables discovery on windows
Prerequisites met: T1082-10 Environment variables discovery on windows
CheckPrereq's for: T1082-13 WinPwn - winPEAS
Prerequisites met: T1082-13 WinPwn - winPEAS
CheckPrereq's for: T1082-14 WinPwn - itm4nprivesc
Prerequisites met: T1082-14 WinPwn - itm4nprivesc
CheckPrereq's for: T1082-15 WinPwn - Powersploits privesc checks
Prerequisites met: T1082-15 WinPwn - Powersploits privesc checks
CheckPrereq's for: T1082-16 WinPwn - General privesc checks
Prerequisites met: T1082-16 WinPwn - General privesc checks
CheckPrereq's for: T1082-17 WinPwn - GeneralRecon
Prerequisites met: T1082-17 WinPwn - GeneralRecon
CheckPrereq's for: T1082-18 WinPwn - Morerecon
Prerequisites met: T1082-18 WinPwn - Morerecon
CheckPrereq's for: T1082-19 WinPwn - RBCD-Check
Prerequisites met: T1082-19 WinPwn - RBCD-Check
CheckPrereq's for: T1082-20 WinPwn - PowerSharpPack - Watson searching for missing windows patches
Prerequisites met: T1082-20 WinPwn - PowerSharpPack - Watson searching for missing windows patches
CheckPrereq's for: T1082-21 WinPwn - PowerSharpPack - Sharpup checking common Privesc vectors
Prerequisites met: T1082-21 WinPwn - PowerSharpPack - Sharpup checking common Privesc vectors
CheckPrereq's for: T1082-22 WinPwn - PowerSharpPack - Seatbelt
Prerequisites met: T1082-22 WinPwn - PowerSharpPack - Seatbelt
CheckPrereq's for: T1082-23 Azure Security Scan with SkyArk
Prerequisites not met: T1082-23 Azure Security Scan with SkyArk
        [*] The SkyArk AzureStealth module must exist in $env:temp.
        [*] The AzureAD module must be installed.
        [*] The Az module must be installed.

Try installing prereq's with the -GetPrereqs switch
```

Answer: 15

**What are the three event IDs logged based on the execution of Atomic Test 1547.001-3? Provide the IDs in ascending order (e.g. 1,2,3).**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1547.001-3
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing test: T1547.001-3 PowerShell Registry RunOnce
Done executing test: T1547.001-3 PowerShell Registry RunOnce
```



Operational Number of events: 7

| Level | Date and Time | Source | Event ID | Task C... |
|---|---|---|---|---|
| Information | 5/6/2025 5:34:31 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 5:34:31 AM | Sysmon | 11 | File cre... |
| Information | 5/6/2025 5:34:31 AM | Sysmon | 13 | Registr... |
| Information | 5/6/2025 5:34:30 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 5:34:12 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 5:34:12 AM | Sysmon | 1 | Proces... |
| Information | 5/6/2025 5:34:30 AM | Sysmon | 1 | Proces... |

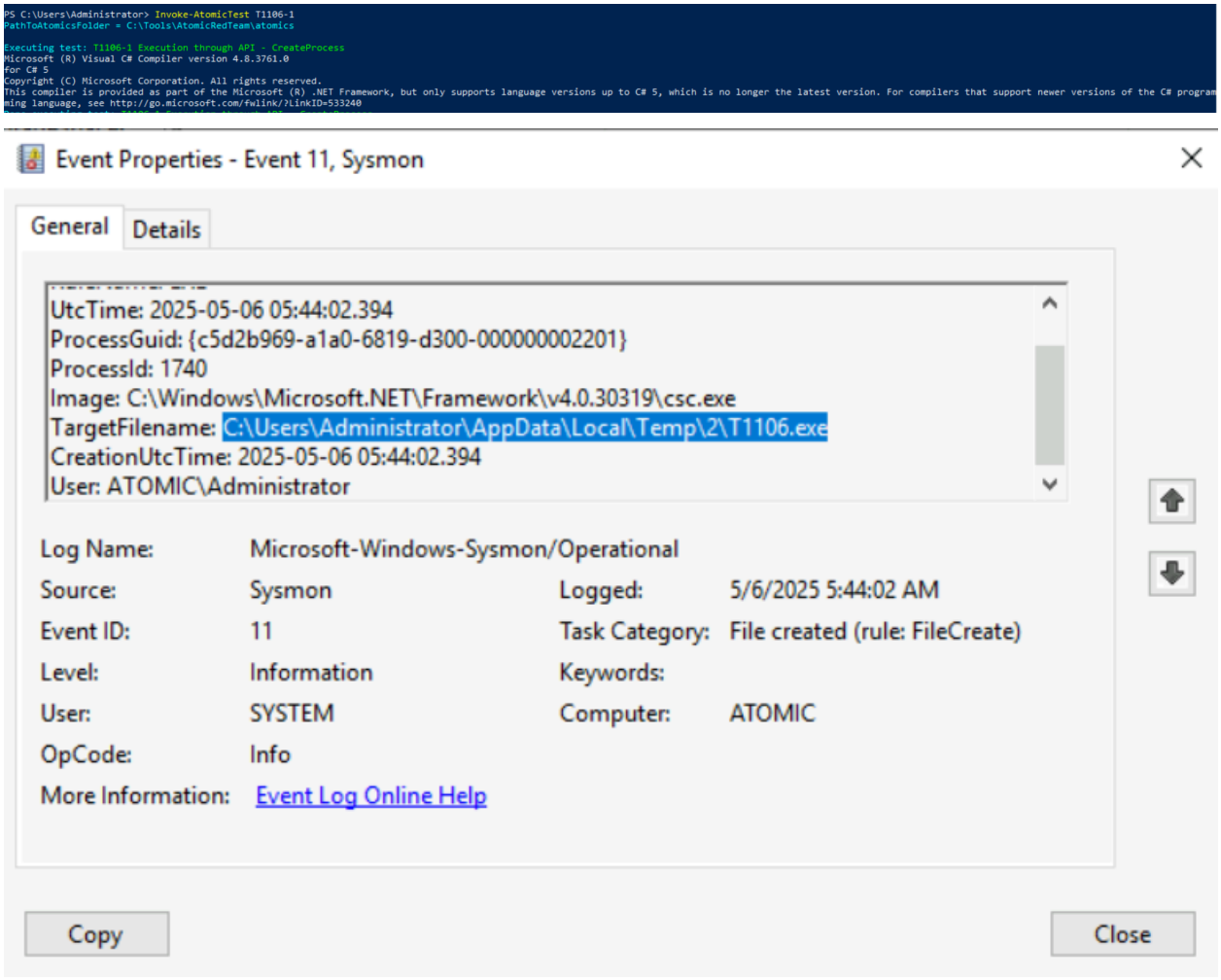
Answer: 1,11,13

**What command is executed (with default input value) by Atomic Test T1529-1? Do not run without the ShowDetails parameter.**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1529 -ShowDetails
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

[********BEGIN TEST********]
Technique: System Shutdown/Reboot T1529
Atomic Test Name: Shutdown System - Windows
Atomic Test Number: 1
Atomic Test GUID: ad254fa8-45c0-403b-8c77-e00b3d3e7a64
Description: This test shuts down a Windows system.

Attack Commands:
Executor: command_prompt
ElevationRequired: True
Command:
shutdown /s /t #{timeout}
Command (with inputs):
shutdown /s /t 1
[!!!!!!!!END TEST!!!!!!!!]
```

Answer: shutdown /s /t 1

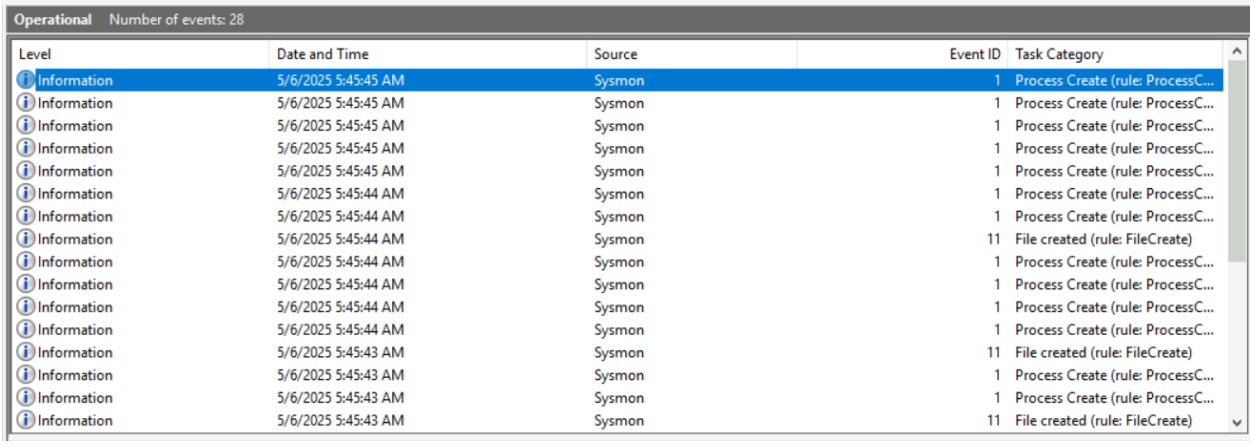
**What is the value of the TargetFilename inside the File Creation log (Event ID 11) generated by Atomic Test T1106-1?**




Answer: C:\Users\Administrator\AppData\Local\Temp\2\T1106.exe

**How many events are generated by executing the cleanup actions of Atomic T1105?**

```
PS C:\Users\Administrator> Invoke-AtomicTest T1105 -Cleanup
PathToAtomicsFolder = C:\Tools\AtomicRedTeam\atomics

Executing cleanup for test: T1105-7 certutil download (urlcache)
Done executing cleanup for test: T1105-7 certutil download (urlcache)
Executing cleanup for test: T1105-8 certutil download (verifyctl)
Done executing cleanup for test: T1105-8 certutil download (verifyctl)
Executing cleanup for test: T1105-9 Windows - BITSAdmin BITS Download
Done executing cleanup for test: T1105-9 Windows - BITSAdmin BITS Download
Executing cleanup for test: T1105-10 Windows - PowerShell Download
Done executing cleanup for test: T1105-10 Windows - PowerShell Download
Executing cleanup for test: T1105-11 OSTAP Worming Activity
Done executing cleanup for test: T1105-11 OSTAP Worming Activity
Executing cleanup for test: T1105-12 svchost writing a file to a UNC path
Done executing cleanup for test: T1105-12 svchost writing a file to a UNC path
Executing cleanup for test: T1105-13 Download a File with Windows Defender MpCmdRun.exe
Done executing cleanup for test: T1105-13 Download a File with Windows Defender MpCmdRun.exe
Executing cleanup for test: T1105-15 File Download via PowerShell
Done executing cleanup for test: T1105-15 File Download via PowerShell
Executing cleanup for test: T1105-16 File download with finger.exe on Windows
Done executing cleanup for test: T1105-16 File download with finger.exe on Windows
Executing cleanup for test: T1105-17 Download a file with IMEWDBLD.exe
Done executing cleanup for test: T1105-17 Download a file with IMEWDBLD.exe
Executing cleanup for test: T1105-18 Curl Download File
Done executing cleanup for test: T1105-18 Curl Download File
Executing cleanup for test: T1105-19 Curl Upload File
Done executing cleanup for test: T1105-19 Curl Upload File
Executing cleanup for test: T1105-20 Download a file with Microsoft Connection Manager Auto-Download
Done executing cleanup for test: T1105-20 Download a file with Microsoft Connection Manager Auto-Download
Executing cleanup for test: T1105-21 MAZE Propagation Script
Done executing cleanup for test: T1105-21 MAZE Propagation Script
Executing cleanup for test: T1105-22 Printer Migration Command-Line Tool UNC share folder into a zip file
Done executing cleanup for test: T1105-22 Printer Migration Command-Line Tool UNC share folder into a zip file
Executing cleanup for test: T1105-23 Lolbas replace.exe use to copy file
Done executing cleanup for test: T1105-23 Lolbas replace.exe use to copy file
Executing cleanup for test: T1105-24 Lolbas replace.exe use to copy UNC file
Done executing cleanup for test: T1105-24 Lolbas replace.exe use to copy UNC file
Executing cleanup for test: T1105-25 certreq download
Done executing cleanup for test: T1105-25 certreq download
Executing cleanup for test: T1105-26 Download a file using wscript
Done executing cleanup for test: T1105-26 Download a file using wscript
Executing cleanup for test: T1105-28 Nimgrab - Transfer Files
Done executing cleanup for test: T1105-28 Nimgrab - Transfer Files
Executing cleanup for test: T1105-29 iwr or Invoke Web-Request download
Done executing cleanup for test: T1105-29 iwr or Invoke Web-Request download
```



Operational Number of events: 28

| Level | Date and Time | Source | Event ID | Task Category |
|---|---|---|---|---|
| Information | 5/6/2025 5:45:45 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:45 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:45 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:45 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:45 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 11 | File created (rule: FileCreate) |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:44 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:43 AM | Sysmon | 11 | File created (rule: FileCreate) |
| Information | 5/6/2025 5:45:43 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:43 AM | Sysmon | 1 | Process Create (rule: ProcessC... |
| Information | 5/6/2025 5:45:43 AM | Sysmon | 11 | File created (rule: FileCreate) |

Answer: 28

# Conclusion

Congratulations! You have completed the Atomic Red Team room.

Throughout the room, we have tackled the following topics about how Blue Teamers can leverage Atomic Red Team:

- Breakdown of each Atomic, the main component of the Atomic Red Team Framework.
- Tools such as Invoke-AtomicRedTeam and ATT&CK Navigator to model and execute threat activity.
- Importance of reverting or cleaning up after conducting the tests.
- Logging and Detection Rules review based on the emulation activity.
- Customization of Atomic tests for the specific needs during testing.
- Case study simulation to emulate the activity of a known threat group.

Threat Emulation Frameworks such as the Atomic Red Team are commonly viewed as a tool only for Red Teamers, yet being knowledgeable about it may aid in learning how threat actors do the job. Knowing how attackers do it simplifies understanding how to defend it.