Detecting & Removing an Attacker's WMI Persistence

By David French

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Windows Management Instrumentation (WMI) Event Subscription is a popular technique to establish persistence on an endpoint. I decided to spend some time playing with Empire's WMI modules and analyzing the artifacts for detection opportunities. I also reviewed the PowerShell commands that can be used to view and remove WMI event subscriptions.

"Windows Management Instrumentation Event Subscription" is MITRE ATT&CK Technique T1084.

Attackers may use the capabilities of WMI to subscribe to an event and execute arbitrary code when that event occurs, providing persistence on a system.

What is WMI?

"WMI is the Microsoft implementation of Web-Based Enterprise Management (WBEM), which is an industry initiative to develop a standard technology for accessing management information in an enterprise environment.

WMI uses the Common Information Model (CIM) industry standard to represent systems, applications, networks, devices, and other managed components."

An **event filter** is a WMI class that describes which events WMI delivers to an **event consumer**. An event filter also describes the conditions under which WMI delivers the events.

Configuring Sysmon Logging

Sysmon can be configured to log `WmiEventFilter`, `WmiEventConsumer`, and `WmiEventConsumerToFilter` activity and enable the detection of WMI abuse.

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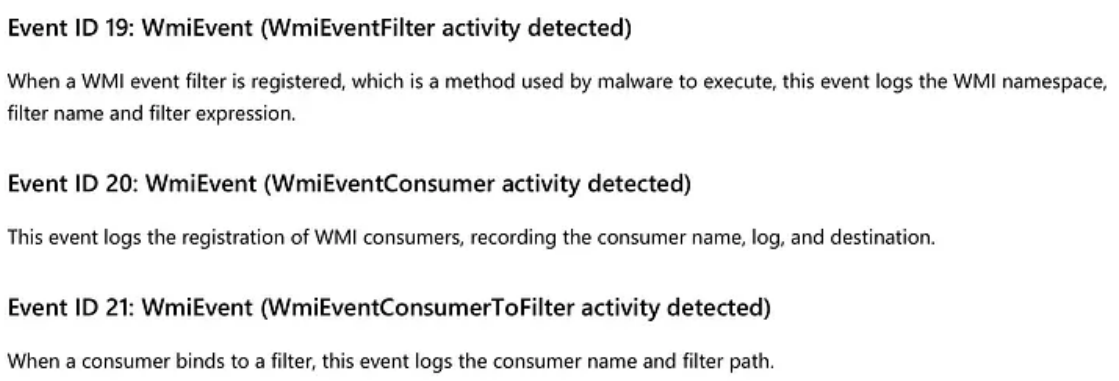

Sysmon Event IDs for WMI activity

Roberto Rodriguez's (@Cyb3rWard0g) Sysmon configuration file will capture the above Event IDs.

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Execute the following command to install Sysmon and apply a configuration file.

```
sysmon.exe -i -c .\config_file.xml
```

Establish Persistence

Let's use Empire's `Invoke-WMI` module to create a permanent WMI subscription and persist a stager on the victim endpoint.

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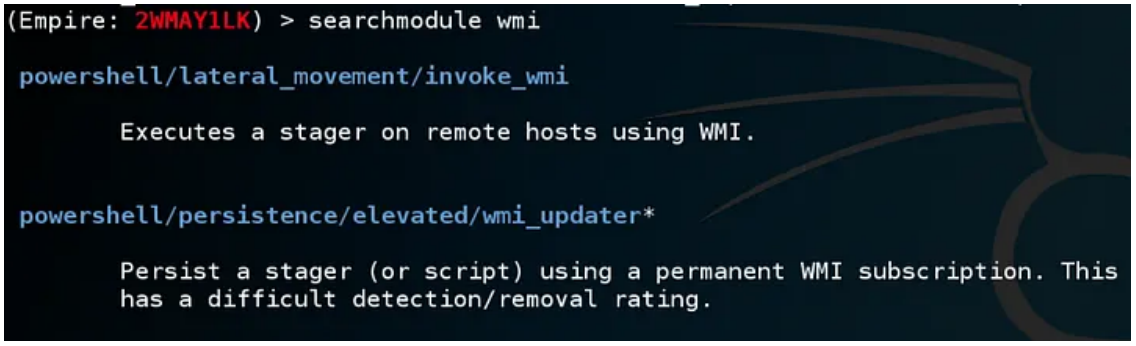

Reviewing Empire's WMI-related modules

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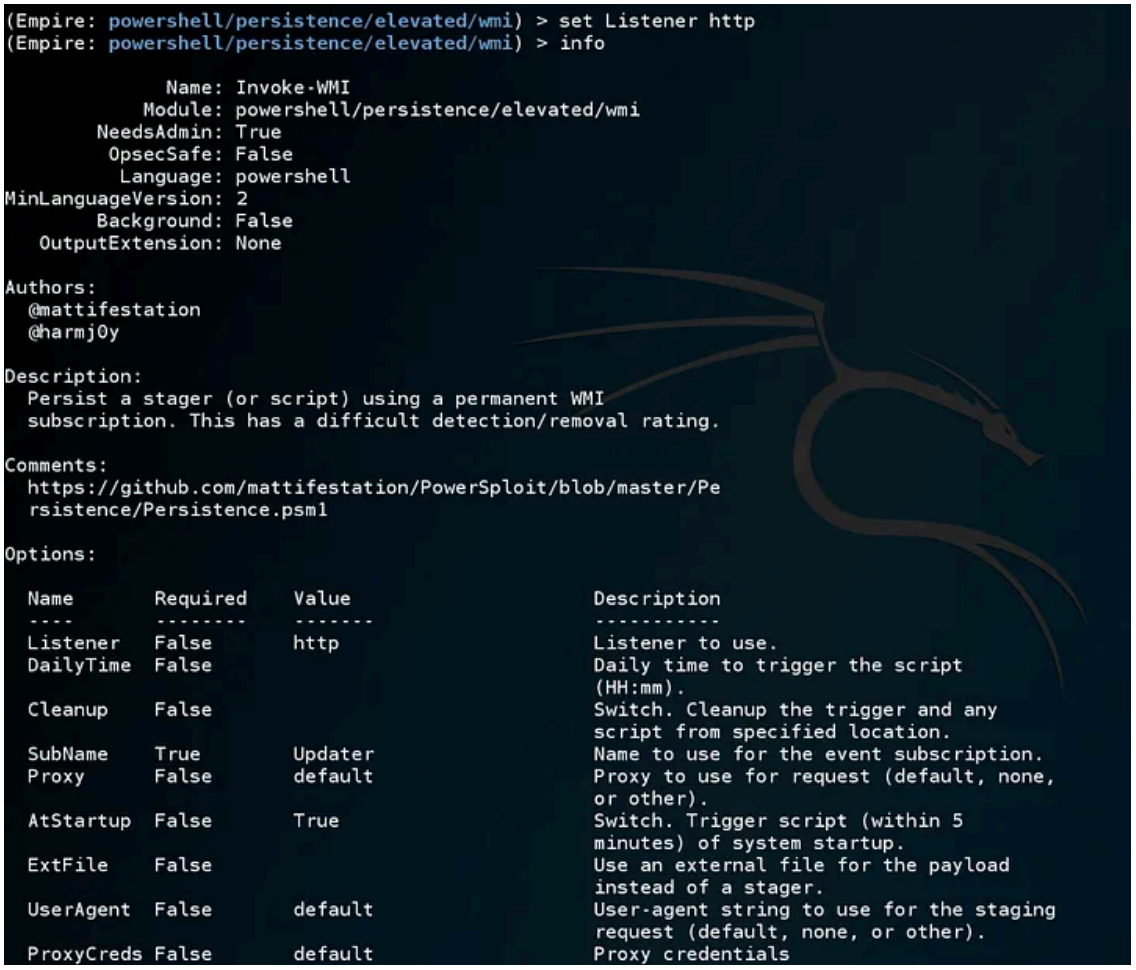

Reviewing the options for Empire's Invoke-WMI module

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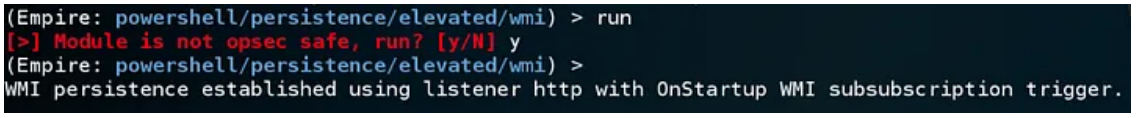

Running the module

Detection

Reviewing the Sysmon logs we can see that the Empire module:

1. Registered a WMI event filter
2. Registered a WMI event consumer
3. Bound the event consumer to the event filter

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Time	event_id	task
October 8th 2018, 18:54:39.869	19	WmiEventFilter activity detected (rule: WmiEvent)
October 8th 2018, 18:54:39.884	20	WmiEventConsumer activity detected (rule: WmiEvent)
October 8th 2018, 18:54:56.212	21	WmiEventConsumerToFilter activity detected (rule: WmiEvent)

Sysmon events logged after Empire Invoke-WMI module execution

The WMI event filter sets the conditions for the stager to execute, which includes references to the system's uptime.

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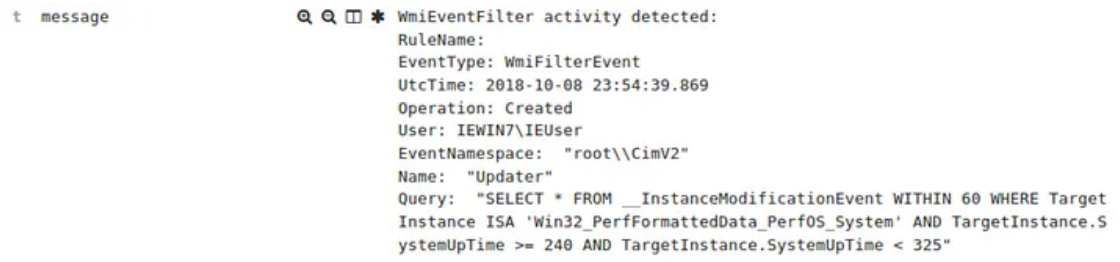

Sysmon Event ID 19: WmiEvent (WmiEventFilter activity detected)

The WMI event consumer contains the Empire stager in Base64-encoded form and is registered with the innocuous name, `Updater` when its default settings are used.

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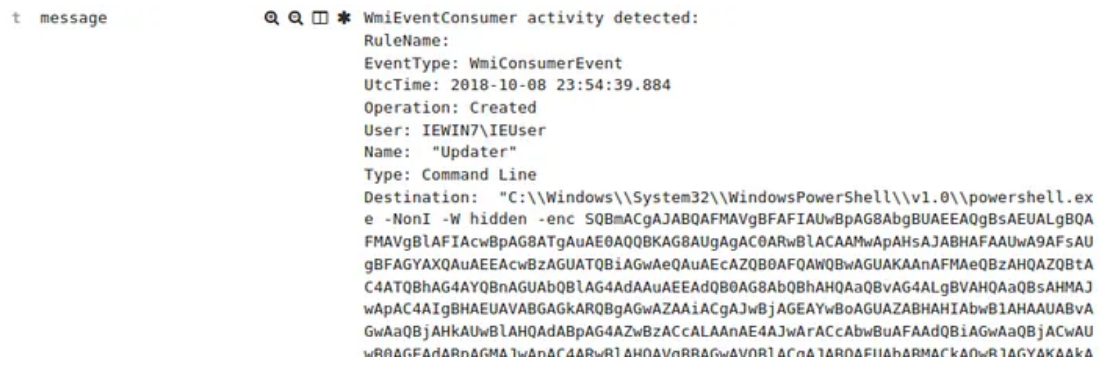

Sysmon Event ID 20: WmiEvent (WmiEventConsumer activity detected)

The WMI event consumer `CommandLineEventConsumer.Name=\"Updater\"` is bound to the event filter `__EventFilter.Name=\"Updater\"`

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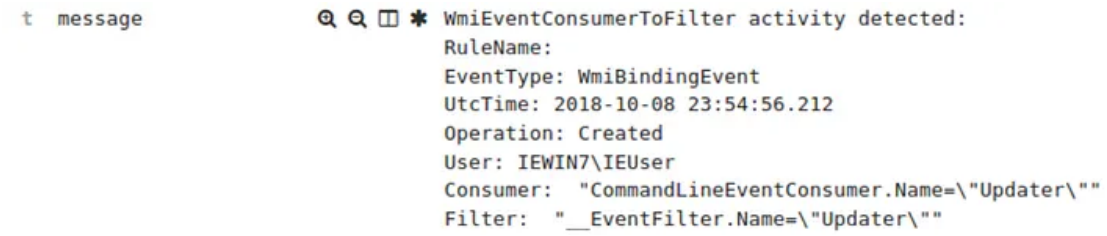

Sysmon Event ID 21: WmiEvent (WmiEventConsumerToFilter activity detected)

Now that the event consumer is bound to the event filter, **IF** the event filter conditions are true **THEN** trigger the event consumer (the stager).

Eradication

The simplest method to remove the entry from the WMI database is to use Autoruns. Launch Autoruns as an administrator and select the `WMI` tab to review WMI-related persistence.

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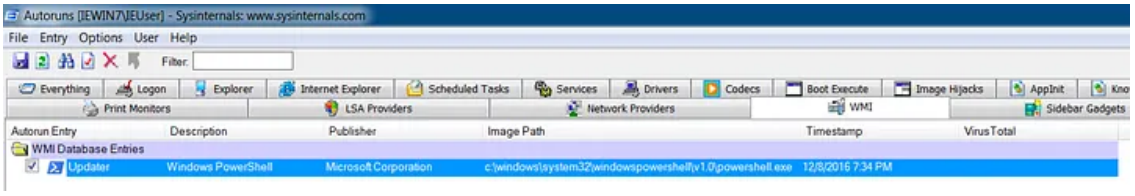

Using Autoruns to review WMI database entries

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Using Autoruns to review content of the WMI database

Right-click the malicious WMI database entry and select `Delete`.

Alternatively, you can remove the WMI event subscriptions from the command line.

Use `Get-WMIObject` in PowerShell to review the WMI event filter, event consumer, and consumer filter to event filter binding. Thanks to Boe Prox (@proxb) for explaining these commands in detail on his blog.

```
# Reviewing WMI Subscriptions using Get-WMIObject
# Event Filter
Get-WMIObject -Namespace root\Subscription -Class __EventFilter -Filter “Name='Updater'”# Event Cons
Get-WMIObject -Namespace root\Subscription -Class CommandLineEventConsumer -Filter “Name='Updater'”

 # Binding
Get-WMIObject -Namespace root\Subscription -Class __FilterToConsumerBinding -Filter “__Path LIKE '%U
```

Use `Remove-WMIObject` to remove all components of the WMI persistence.

```
# Removing WMI Subscriptions using Remove-WMIObject
# Event Filter
Get-WMIObject -Namespace root\Subscription -Class __EventFilter -Filter “Name=’Updater’” | Remove-Wm
Get-WMIObject -Namespace root\Subscription -Class CommandLineEventConsumer -Filter “Name=’Updater’”

 # Binding
Get-WMIObject -Namespace root\Subscription -Class __FilterToConsumerBinding -Filter “__Path LIKE ‘%U
```

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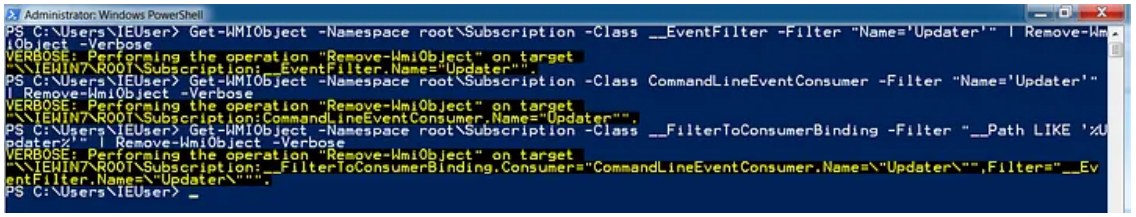

Removing WMI event subscriptions

Run Autoruns again to verify that the persistence was removed.

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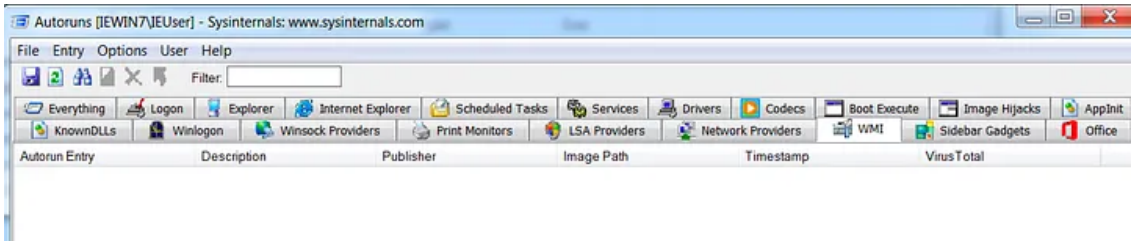

Source: https://medium.com/threatpunter/detecting-removing-wmi-persistence-60ccbb7dff96