FalconForce

Lifting the veil, a look at MDE under the hood

WWHF WAY WEST
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What you can expect from this talk

- Microsoft Defender for Endpoint (MDE) capabilities
- What kind of telemetry can you work with
- Where does it get its telemetry from
- Analyzing its configuration
- MDE compared to Sysmon

Capability outline

What can it do for you?

Microsoft Defender for Endpoint

All-in-one solution for protecting Windows, Mac and Linux Endpoints

- Anti-Virus
- Attack Surface Reduction (ASR)
- Exploit Guard
- Application Control (WDAC)
- EDR Telemetry
- Incident Response
- Software Inventory / Vulnerability Management
- Network Sensor
- DLP

Some parts are also available separately. Defender for Endpoint integrates these parts into a combined product and allows for centralized logging and management.

Anti-Virus Engine

Leverages existing Microsoft Defender Anti-Virus product.

- AV events are logged to M365 Defender Portal.

Signature-based detection (behavior + file characteristics).

Cloud-based detections where samples are uploaded to cloud for analysis and can be executed in a sandbox.

Great research on the signature database by Camille Mougey (https://github.com/commial/experiments/tree/master/windows-defender/VDM)

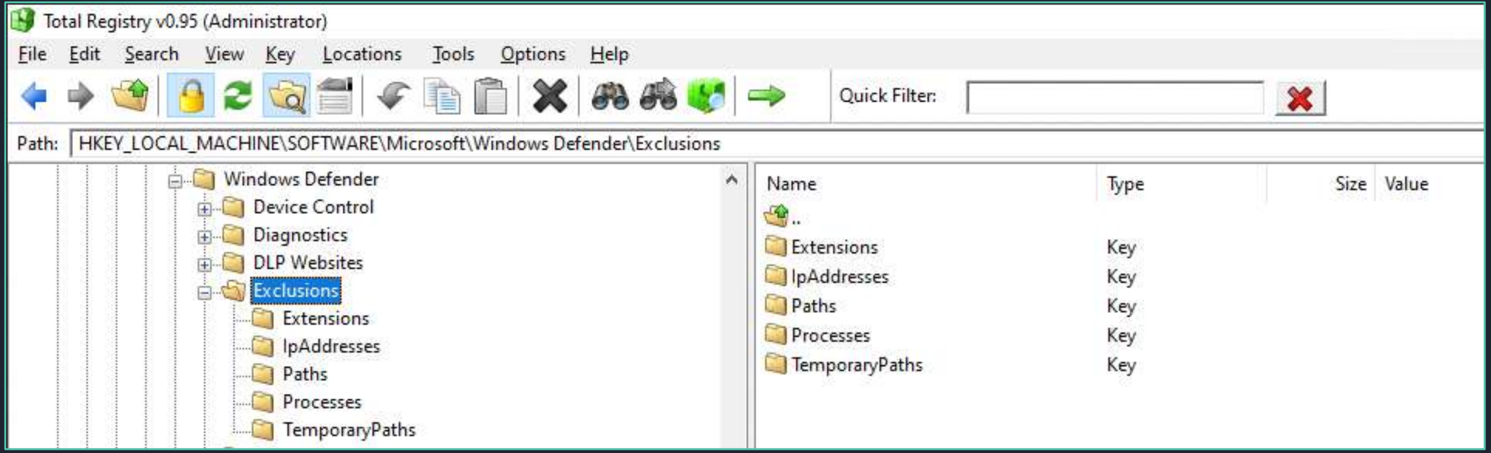
Anti-Virus Engine

Exclusions

- Frequently used by attackers to allow their payload to pass, monitor the registry changes.

- Process exclusions apply to the children of the listed process.
The listed process will still be scanned. Unless this file is added to the file exclusion list.

- These exclusions apply ONLY for the AV component, features like EDR and ASR still apply.



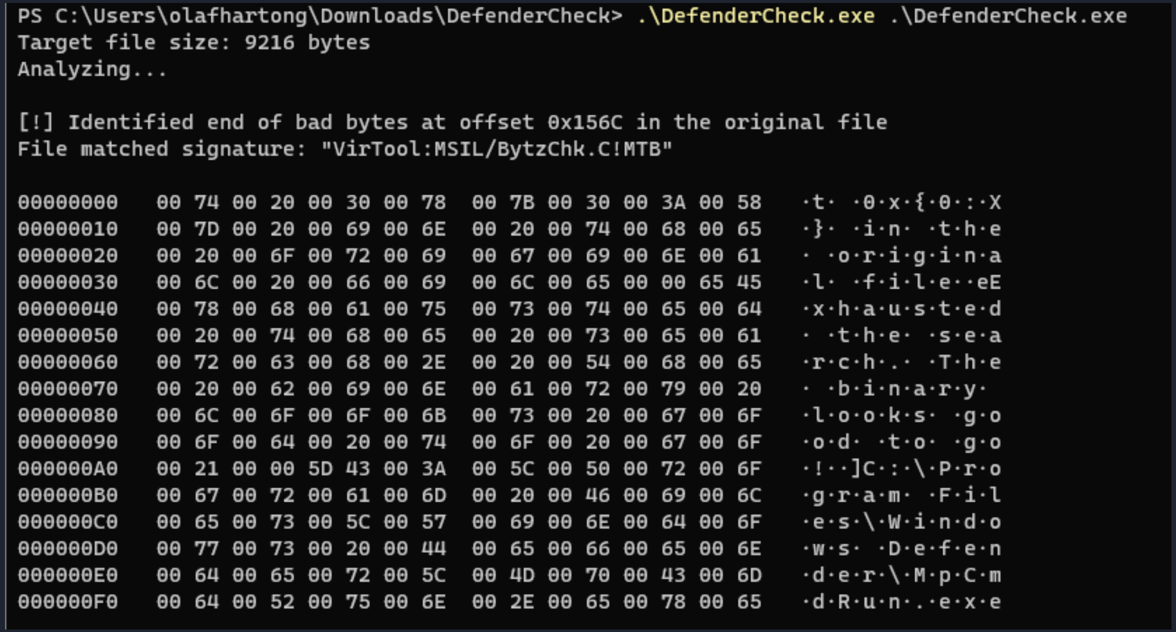
Total Registry v0.95 (Administrator)

Path: HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows Defender\Exclusions

Name	Type	Size	Value
..			
Extensions	Key		
IpAddresses	Key		
Paths	Key		
Processes	Key		
TemporaryPaths	Key		

Anti-Virus Engine

Check what it flags on with DefenderCheck



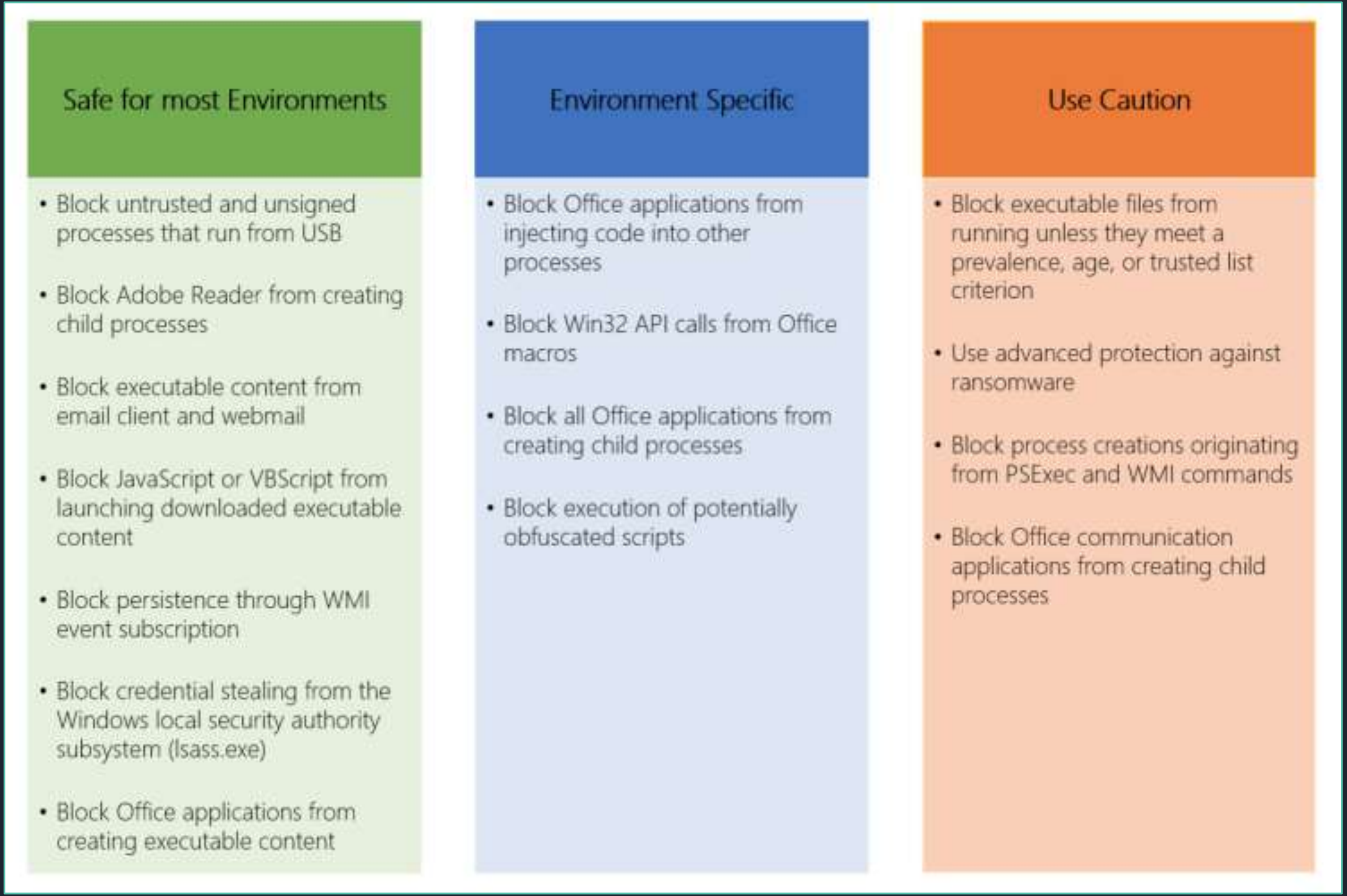
```
PS C:\Users\olafhartong\Downloads\DefenderCheck> .\DefenderCheck.exe .\DefenderCheck.exe
Target file size: 9216 bytes
Analyzing...

[!] Identified end of bad bytes at offset 0x156C in the original file
File matched signature: "VirTool:MSIL/BytzChk.C!MTB"

00000000   00 74 00 20 00 30 00 78  00 7B 00 30 00 3A 00 58   ·t· ·0·x·{·0·:·X
00000010   00 7D 00 20 00 69 00 6E  00 20 00 74 00 68 00 65   ·}· ·i·n· ·t·h·e
00000020   00 20 00 6F 00 72 00 69  00 67 00 69 00 6E 00 61   · ·o·r·i·g·i·n·a
00000030   00 6C 00 20 00 66 00 69  00 6C 00 65 00 00 65 45   ·l· ·f·i·l·e··eE
00000040   00 78 00 68 00 61 00 75  00 73 00 74 00 65 00 64   ·x·h·a·u·s·t·e·d
00000050   00 20 00 74 00 68 00 65  00 20 00 73 00 65 00 61   · ·t·h·e· ·s·e·a
00000060   00 72 00 63 00 68 00 2E  00 20 00 54 00 68 00 65   ·r·c·h·.· ·T·h·e
00000070   00 20 00 62 00 69 00 6E  00 61 00 72 00 79 00 20   · ·b·i·n·a·r·y·
00000080   00 6C 00 6F 00 6F 00 6B  00 73 00 20 00 67 00 6F   ·l·o·o·k·s· ·g·o
00000090   00 6F 00 64 00 20 00 74  00 6F 00 20 00 67 00 6F   ·o·d· ·t·o· ·g·o
000000A0   00 21 00 00 5D 43 00 3A  00 5C 00 50 00 72 00 6F   ·!··]C·:·\·P·r·o
000000B0   00 67 00 72 00 61 00 6D  00 20 00 46 00 69 00 6C   ·g·r·a·m· ·F·i·l
000000C0   00 65 00 73 00 5C 00 57  00 69 00 6E 00 64 00 6F   ·e·s·\·W·i·n·d·o
000000D0   00 77 00 73 00 20 00 44  00 65 00 66 00 65 00 6E   ·w·s· ·D·e·f·e·n
000000E0   00 64 00 65 00 72 00 5C  00 4D 00 70 00 43 00 6D   ·d·e·r·\·M·p·C·m
000000F0   00 64 00 52 00 75 00 6E  00 2E 00 65 00 78 00 65   ·d·R·u·n·.·e·x·e
```

Sometimes needs several changes to the source to not get detected anymore.

https://github.com/matterpreter/defendercheck

Attack Surface Reduction (ASR) rules

- ~16 rules to reduce the attack surface of Windows.
- Rules can be enabled and disabled via Reg keys / Group Policy.
- Can be configured to Block or only Audit.
- Events are logged in M365 Advanced Hunting tables.



Safe for most Environments	Environment Specific	Use Caution
• Block untrusted and unsigned processes that run from USB • Block Adobe Reader from creating child processes • Block executable content from email client and webmail • Block JavaScript or VBScript from launching downloaded executable content • Block persistence through WMI event subscription • Block credential stealing from the Windows local security authority subsystem (lsass.exe) • Block Office applications from creating executable content	• Block Office applications from injecting code into other processes • Block Win32 API calls from Office macros • Block all Office applications from creating child processes • Block execution of potentially obfuscated scripts	• Block executable files from running unless they meet a prevalence, age, or trusted list criterion • Use advanced protection against ransomware • Block process creations originating from PSExec and WMI commands • Block Office communication applications from creating child processes

https://blog.palantir.com/microsoft-defender-attack-surface-reduction-recommendations-a5c7d41c3cf8

Attack Surface Reduction (ASR) rules

First and foremost, enable as much of them as you can, they're quite good and will slow a capable attacker down.

Even in audit only mode they provide great value.

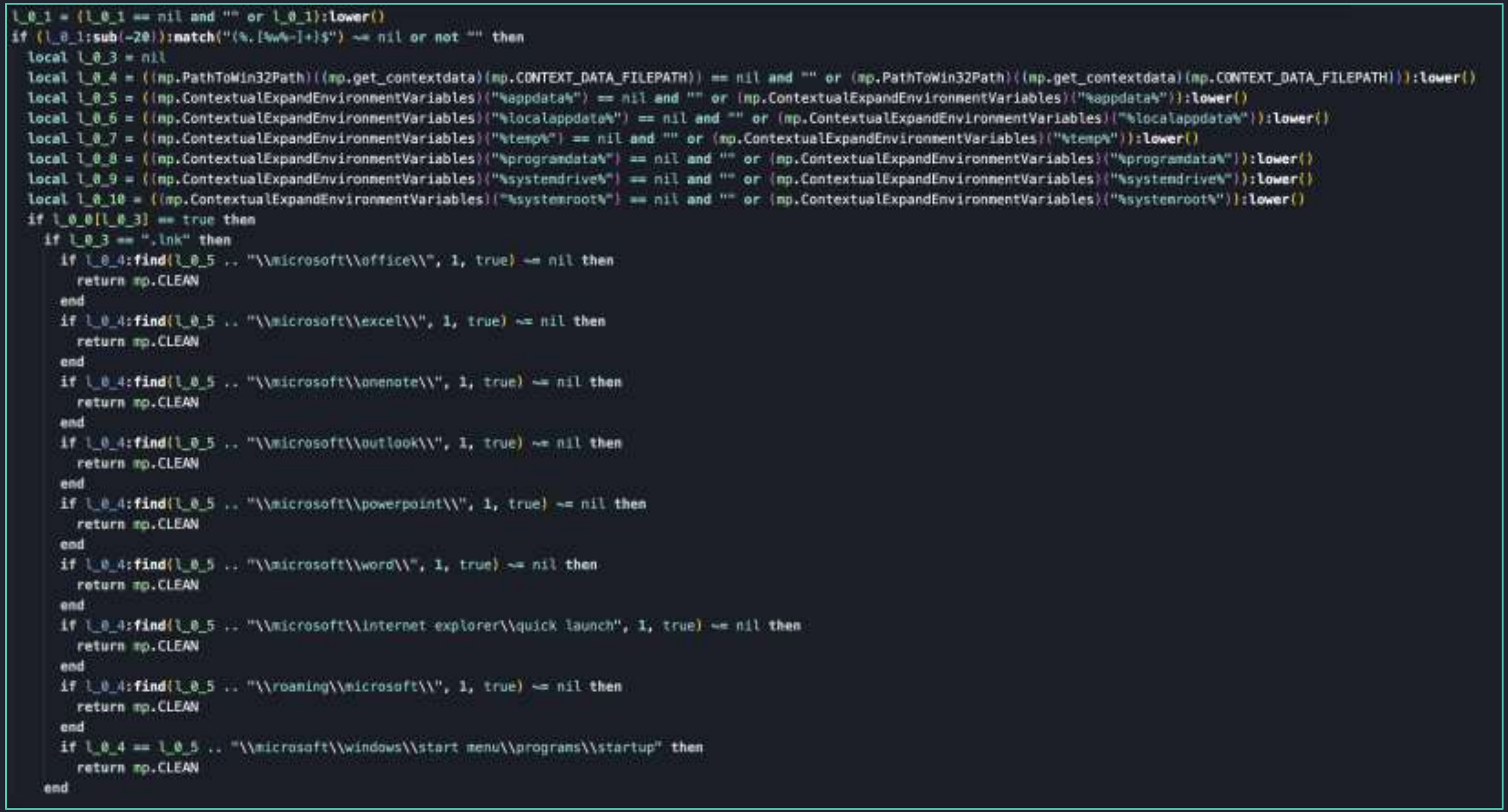
These rules are written in LUA and essentially are signature rules based on regex paths.

The rules are compiled and stored within the Defender AV database.
Camille Mougey decompiled them and made them available here:

https://github.com/commial/experiments/tree/master/windows-defender/ASR

Attack Surface Reduction (ASR) rules

The rules (currently) primarily look for file / path names or commandlines, not signer information or other unique attributes. This allows an attacker to bypass them.



```
l_0_1 = (l_0_1 == nil and "" or l_0_1):lower()
if (l_0_1:sub(-20)):match("(%.[%w%-]+)$") ~= nil or not "" then
  local l_0_3 = nil
  local l_0_4 = ((mp.PathToWin32Path)((mp.get_contextdata)(mp.CONTEXT_DATA_FILEPATH)) == nil and "" or (mp.PathToWin32Path)((mp.get_contextdata)(mp.CONTEXT_DATA_FILEPATH))):lower()
  local l_0_5 = ((mp.ContextualExpandEnvironmentVariables)("%appdata%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%appdata%")):lower()
  local l_0_6 = ((mp.ContextualExpandEnvironmentVariables)("%localappdata%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%localappdata%")):lower()
  local l_0_7 = ((mp.ContextualExpandEnvironmentVariables)("%temp%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%temp%")):lower()
  local l_0_8 = ((mp.ContextualExpandEnvironmentVariables)("%programdata%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%programdata%")):lower()
  local l_0_9 = ((mp.ContextualExpandEnvironmentVariables)("%systemdrive%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%systemdrive%")):lower()
  local l_0_10 = ((mp.ContextualExpandEnvironmentVariables)("%systemroot%") == nil and "" or (mp.ContextualExpandEnvironmentVariables)("%systemroot%")):lower()
  if l_0_0[l_0_3] == true then
    if l_0_3 == ".lnk" then
      if l_0_4:find(l_0_5 .. "\\microsoft\\office\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\excel\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\onenote\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\outlook\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\powerpoint\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\word\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\microsoft\\internet explorer\\quick launch", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4:find(l_0_5 .. "\\roaming\\microsoft\\", 1, true) ~= nil then
        return mp.CLEAN
      end
      if l_0_4 == l_0_5 .. "\\microsoft\\windows\\start menu\\programs\\startup" then
        return mp.CLEAN
    end
```

https://github.com/commial/experiments/tree/master/windows-defender/ASR

Exploit Guard

Successor to EMET (Enhanced Mitigation Experience Toolkit).

System wide security prevention measures to block certain types of exploits such as buffer overflows.

Many additional features can be enabled per application, for example:

- Block Arbitrary Code.
- Block loading low integrity images (DLLs).
- Disable Direct System Calls.
- Block creation of Child Processes.

Windows Defender Application Control (WDAC)

Used to control which drivers and applications are allowed to run, does not require license!
Successor to AppLocker, available in Windows 10 and up and Server 2016+

Policies can be layered and built to allow on deny based on:

- The codesigning certificate(s)
- Attributes in the PE header
- Reputation in the Microsoft's Intelligent Security Graph
- The path from which the app or file is launched
- The parent process
- The launching identity

Excellent blogs on this by Matt Graeber https://mattifestation.medium.com

EDR Telemetry

Relies on a separate Windows Service, exclusive to MDE called ‘Sense’ running via MsSense.exe.

Collects relevant data from running system, for example:

- File Events (File Creation, Deletion).
- Network Connections.
- Suspicious API usage such as Reading memory from another process.

All events are logged and stored in ‘Advanced Hunting’ tables where they can be queried, and custom detection rules can be created to detect unwanted behavior.

EDR Telemetry

Which events are logged is controlled and configured by Microsoft.

- For example: list of registry keys that are monitored is fixed and cannot be extended.
- Focus on events that change the system.

Some events are (heavily) sampled to avoid excessive logging taking place, most notably:

- Network connections.
- File writes.
- Less events are logged from trusted processes (Microsoft-signed).
- Some events such as reading memory from a remote process are limited to LSASS process.

Main data source is Event Tracing for Windows (ETW).

- Over 65 different providers queried.
- This includes 'private' ETW logs, such as Threat Intelligence.

Data Storage

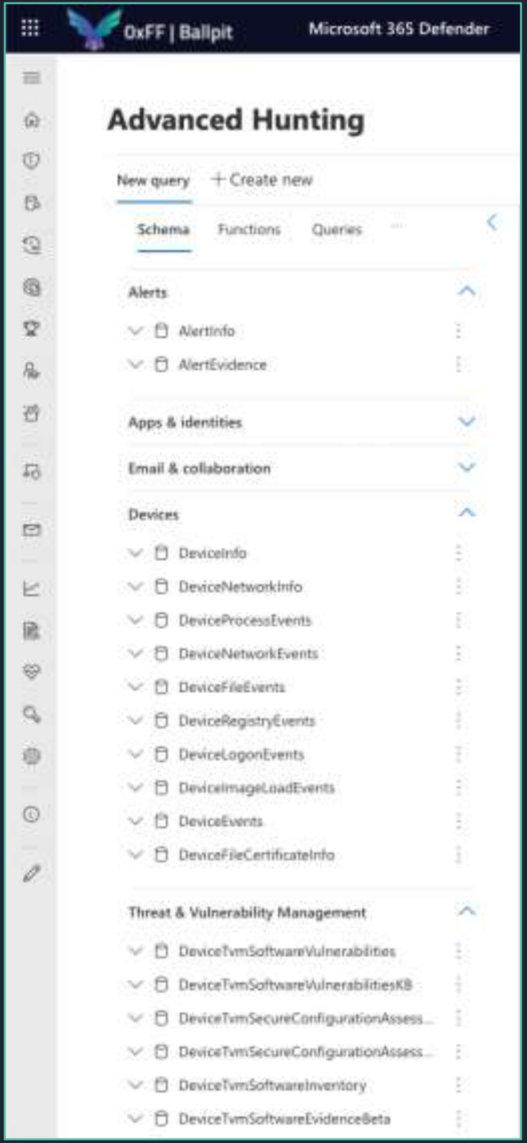
Pay per device / user.

- Includes the storage of generated events.
- Detailed information available for 30 days.
- Timeline/condensed data available for 180 days.

Longer retention possible by copying data to other solutions such as Azure Dataspaces or Azure Sentinel.

- Should be approximately 15-20MB per device per day.

What kind of data can I build detections on hunt with?



Advanced Hunting

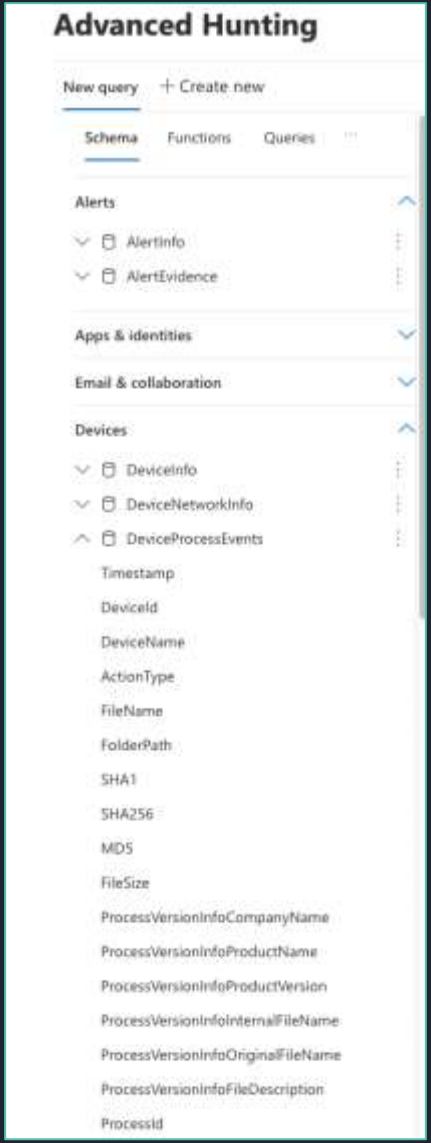
Alerts
- AlertInfo
- AlertEvidence

Apps & identities

Email & collaboration

Devices
- DeviceInfo
- DeviceNetworkInfo
- DeviceProcessEvents
- DeviceNetworkEvents
- DeviceFileEvents
- DeviceRegistryEvents
- DeviceLogonEvents
- DeviceImageLoadEvents
- DeviceEvents
- DeviceFileCertificateInfo

Threat & Vulnerability Management
- DeviceTvmSoftwareVulnerabilities
- DeviceTvmSoftwareVulnerabilitiesKB
- DeviceTvmSecureConfigurationAssess...
- DeviceTvmSecureConfigurationAssess...
- DeviceTvmSoftwareInventory
- DeviceTvmSoftwareEvidenceBeta



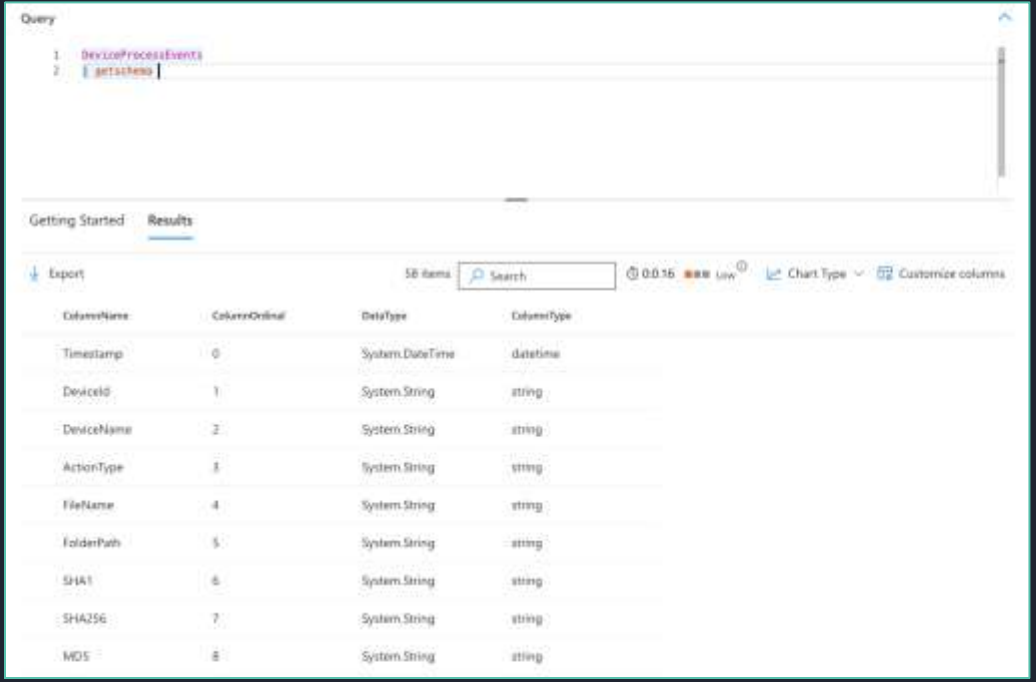
Advanced Hunting

Alerts
- AlertInfo
- AlertEvidence

Apps & identities

Email & collaboration

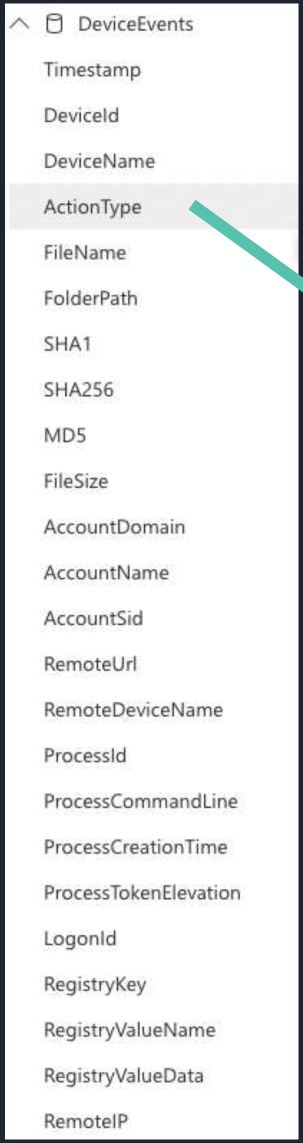
Devices
- DeviceInfo
- DeviceNetworkInfo
- DeviceProcessEvents
  - Timestamp
  - DeviceId
  - DeviceName
  - ActionType
  - FileName
  - FolderPath
  - SHA1
  - SHA256
  - MD5
  - FileSize
  - ProcessVersionInfoCompanyName
  - ProcessVersionInfoProductName
  - ProcessVersionInfoProductVersion
  - ProcessVersionInfoInternalFileName
  - ProcessVersionInfoOriginalFileName
  - ProcessVersionInfoFileDescription
  - ProcessId



```
DeviceProcessEvents
| getschema
```

ColumnName	ColumnOrdinal	DataType	ColumnType
Timestamp	0	System.DateTime	datetime
DeviceId	1	System.String	string
DeviceName	2	System.String	string
ActionType	3	System.String	string
FileName	4	System.String	string
FolderPath	5	System.String	string
SHA1	6	System.String	string
SHA256	7	System.String	string
MD5	8	System.String	string

Data schema



DeviceEvents

Timestamp

DeviceId

DeviceName

ActionType

FileName

FolderPath

SHA1

SHA256

MD5

FileSize

AccountDomain

AccountName

AccountSid

RemoteUrl

RemoteDeviceName

ProcessId

ProcessCommandLine

ProcessCreationTime

ProcessTokenElevation

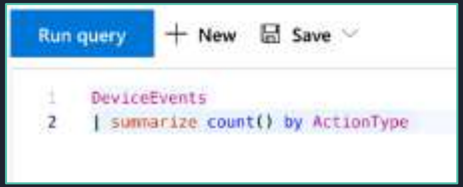
LogonId

RegistryKey

RegistryValueName

RegistryValueData

RemoteIP

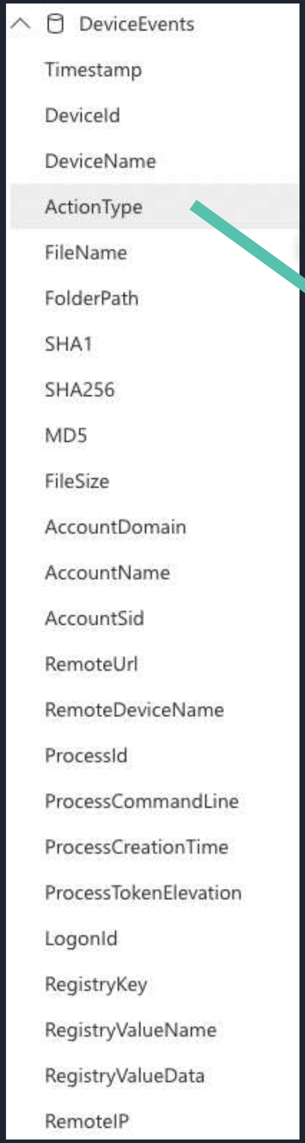


```
DeviceEvents
| summarize count() by ActionType
```

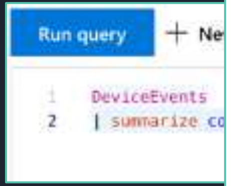
ActionType
AntivirusScanCompleted
ShellLinkCreateFileEvent
AsrOfficeMacroWin32ApiCallsAudited
ProcessPrimaryTokenModified
AntivirusReport
LdapSearch
OpenProcessApiCall
AsrLsassCredentialTheftAudited
DriverLoad
PnpDeviceConnected
ReadProcessMemoryApiCall
NtAllocateVirtualMemoryApiCall
PowerShellCommand
FirewallInboundConnectionBlocked
NtMapViewOfSectionRemoteApiCall
NtAllocateVirtualMemoryRemoteApiCall
CreateRemoteThreadApiCall
ExploitGuardWin32SystemCallBlocked
GetClipboardData
GetAsyncKeyStateApiCall
FirewallOutboundConnectionBlocked
ScreenshotTaken
BrowserLaunchedToOpenUrl
ScheduledTaskCreated
AsrOfficeProcessInjectionAudited
DeviceBootAttestationInfo
AsrExecutableOfficeContentAudited
ScheduledTaskDeleted
ExploitGuardNonMicrosoftSignedAudited
ProcessCreatedUsingWmiQuery
ExploitGuardNonMicrosoftSignedBlocked
ExploitGuardAcgEnforced
ExploitGuardNetworkProtectionAudited
FirewallInboundConnectionToAppBlocked
AsrUntrustedExecutableAudited
UsbDriveMount
WriteProcessMemoryApiCall
AsrOfficeChildProcessAudited
UsbDriveUnmount
ExploitGuardChildProcessAudited
ControlledFolderAccessViolationAudited
UserAccountCreated
AntivirusScanCancelled
ControlledFolderAccessViolationBlocked
MemoryRemoteProtect
AsrExecutableEmailContentAudited
ExploitGuardChildProcessBlocked
AND MUCH, MUCH MORE

Data schema

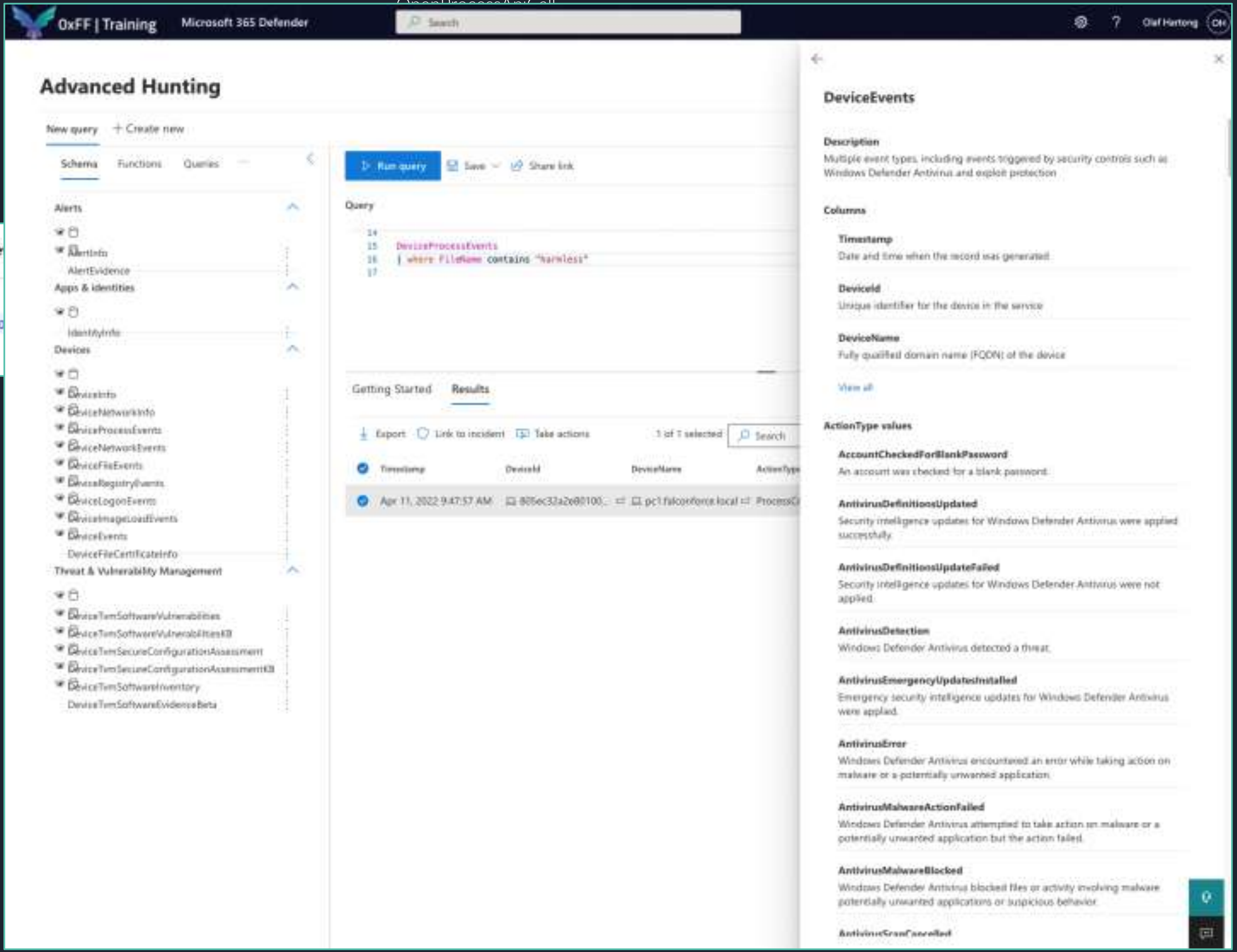
ActionType
AntivirusScanCompleted
ShellLinkCreateFileEvent
AsrOfficeMacroWin32ApiCallsAudited
ProcessPrimaryTokenModified
AntivirusReport
LdapSearch
OpenProcessApiCall



DeviceEvents
Timestamp
DeviceId
DeviceName
ActionType
FileName
FolderPath
SHA1
SHA256
MD5
FileSize
AccountDomain
AccountName
AccountSid
RemoteUrl
RemoteDeviceName
ProcessId
ProcessCommandLine
ProcessCreationTime
ProcessTokenElevation
LogonId
RegistryKey
RegistryValueName
RegistryValueData
RemoteIP



```
DeviceEvents
| summarize co
```



Advanced Hunting

Alerts
AlertInfo
AlertEvidence
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IdentityInfo
Devices
DeviceInfo
DeviceNetworkInfo
DeviceProcessEvents
DeviceNetworkEvents
DeviceFileEvents
DeviceRegistryEvents
DeviceLogonEvents
DeviceImageLoadEvents
DeviceEvents
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Threat & Vulnerability Management
DeviceTvmSoftwareVulnerabilities
DeviceTvmSoftwareVulnerabilitiesKB
DeviceTvmSecureConfigurationAssessment
DeviceTvmSecureConfigurationAssessmentKB
DeviceTvmSoftwareInventory
DeviceTvmSoftwareEvidenceBeta

```
DeviceProcessEvents
| where FileName contains "harmless"
```

Timestamp	DeviceId	DeviceName	ActionType
Apr 11, 2022 9:47:57 AM	805ec32a2e80100...	pc1.falconforce.local	ProcessC

DeviceEvents

Description
Multiple event types, including events triggered by security controls such as Windows Defender Antivirus and exploit protection

Columns

Timestamp
Date and time when the record was generated

DeviceId
Unique identifier for the device in the service

DeviceName
Fully qualified domain name (FQDN) of the device

View all

ActionType values

AccountCheckedForBlankPassword
An account was checked for a blank password.

AntivirusDefinitionsUpdated
Security intelligence updates for Windows Defender Antivirus were applied successfully.

AntivirusDefinitionsUpdateFailed
Security intelligence updates for Windows Defender Antivirus were not applied.

AntivirusDetection
Windows Defender Antivirus detected a threat.

AntivirusEmergencyUpdatesInstalled
Emergency security intelligence updates for Windows Defender Antivirus were applied.

AntivirusError
Windows Defender Antivirus encountered an error while taking action on malware or a potentially unwanted application.

AntivirusMalwareActionFailed
Windows Defender Antivirus attempted to take action on malware or a potentially unwanted application but the action failed.

AntivirusMalwareBlocked
Windows Defender Antivirus blocked files or activity involving malware potentially unwanted applications or suspicious behavior.

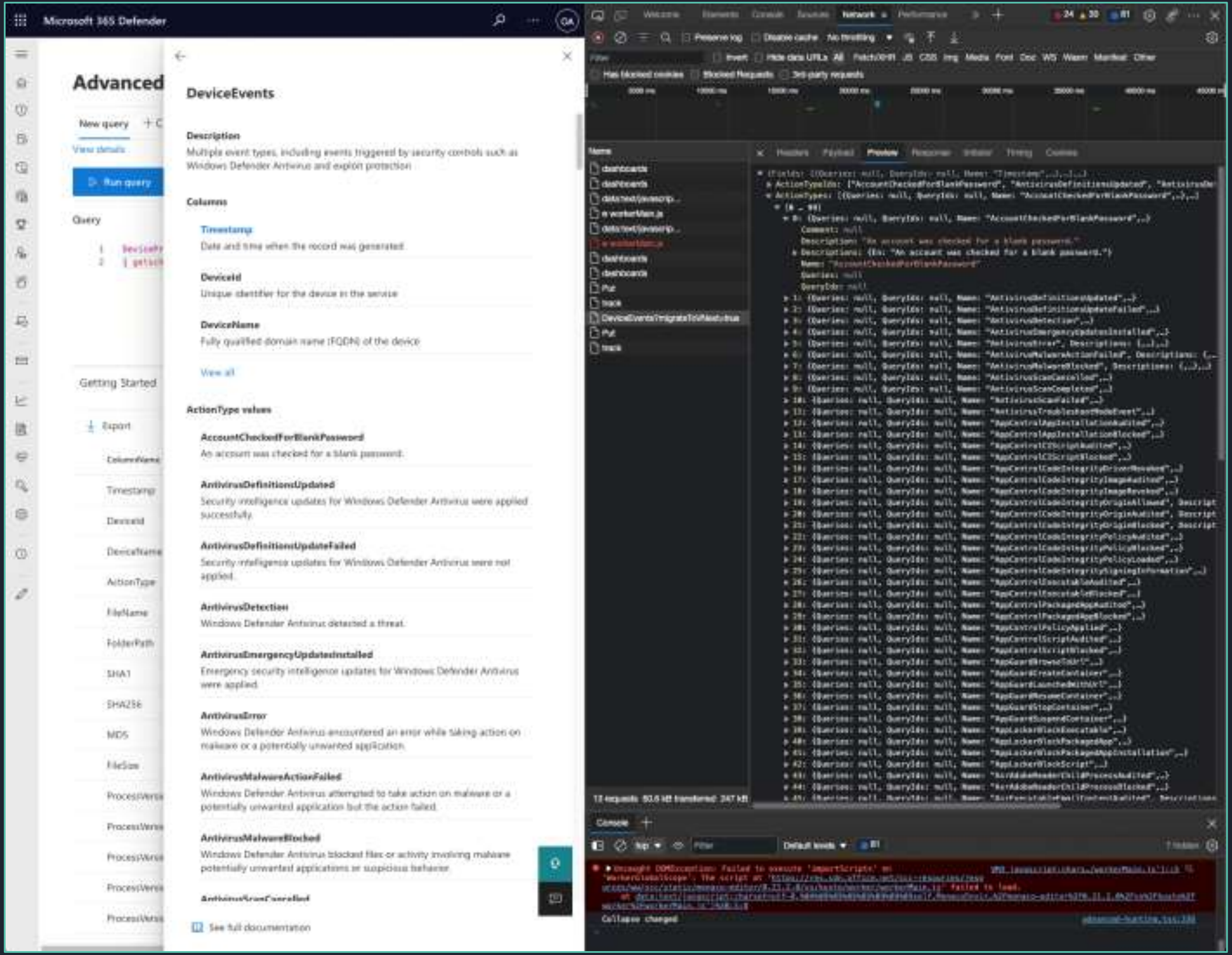
AntivirusScanCancelled

Snatch them from the portal

```
az login --use-device-code -t [TENANTNAME]

az account get-access-token --resource
https://securitycenter.microsoft.com/mtp

curl -v -H "Authorization: Bearer
$AZURE_TOKEN" -H 'Content-Type:
application/json' "https://wdatpprd-
weu.securitycenter.windows.com/api/ine/hun
tingservice/documentation/TableDocumentati
on/DeviceEvents"
```



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See full documentation

Snatch them from the portal

```
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az account get-access-token --resource
https://securitycenter.microsoft.com/mtp

curl -v -H "Aut
$AZURE_TOKEN" -
application/jsc
weu.securitycer
tingservice/doc
on/DeviceEvents
```
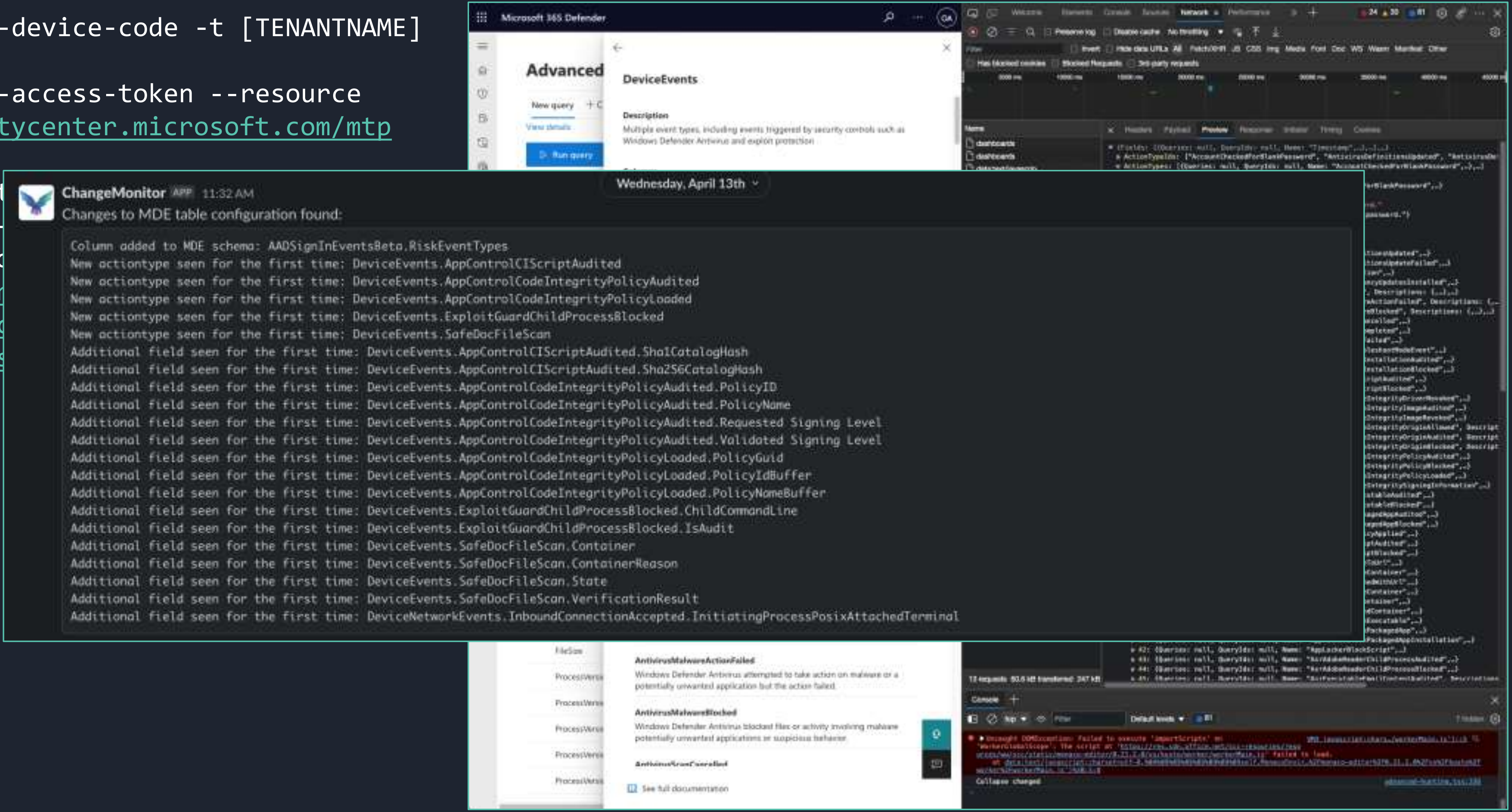


Microsoft 365 Defender
Advanced
New query
View details
Run query
DeviceEvents
Description
Multiple event types, including events triggered by security controls such as Windows Defender Antivirus and exploit protection
AntivirusMalwareActionFailed
Windows Defender Antivirus attempted to take action on malware or a potentially unwanted application but the action failed
AntivirusMalwareBlocked
Windows Defender Antivirus blocked files or activity involving malware potentially unwanted applications or suspicious behavior
See full documentation
Wednesday, April 13th

ChangeMonitor APP 11:32 AM

Changes to MDE table configuration found:

```
Column added to MDE schema: AADSignInEventsBeta.RiskEventTypes
New actiontype seen for the first time: DeviceEvents.AppControlCIScriptAudited
New actiontype seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyAudited
New actiontype seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyLoaded
New actiontype seen for the first time: DeviceEvents.ExploitGuardChildProcessBlocked
New actiontype seen for the first time: DeviceEvents.SafeDocFileScan
Additional field seen for the first time: DeviceEvents.AppControlCIScriptAudited.Sha1CatalogHash
Additional field seen for the first time: DeviceEvents.AppControlCIScriptAudited.Sha256CatalogHash
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyAudited.PolicyID
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyAudited.PolicyName
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyAudited.Requested Signing Level
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyAudited.Validated Signing Level
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyLoaded.PolicyGuid
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyLoaded.PolicyIdBuffer
Additional field seen for the first time: DeviceEvents.AppControlCodeIntegrityPolicyLoaded.PolicyNameBuffer
Additional field seen for the first time: DeviceEvents.ExploitGuardChildProcessBlocked.ChildCommandLine
Additional field seen for the first time: DeviceEvents.ExploitGuardChildProcessBlocked.IsAudit
Additional field seen for the first time: DeviceEvents.SafeDocFileScan.Container
Additional field seen for the first time: DeviceEvents.SafeDocFileScan.ContainerReason
Additional field seen for the first time: DeviceEvents.SafeDocFileScan.State
Additional field seen for the first time: DeviceEvents.SafeDocFileScan.VerificationResult
Additional field seen for the first time: DeviceNetworkEvents.InboundConnectionAccepted.InitiatingProcessPosixAttachedTerminal
```

Do you need those custom detections ?

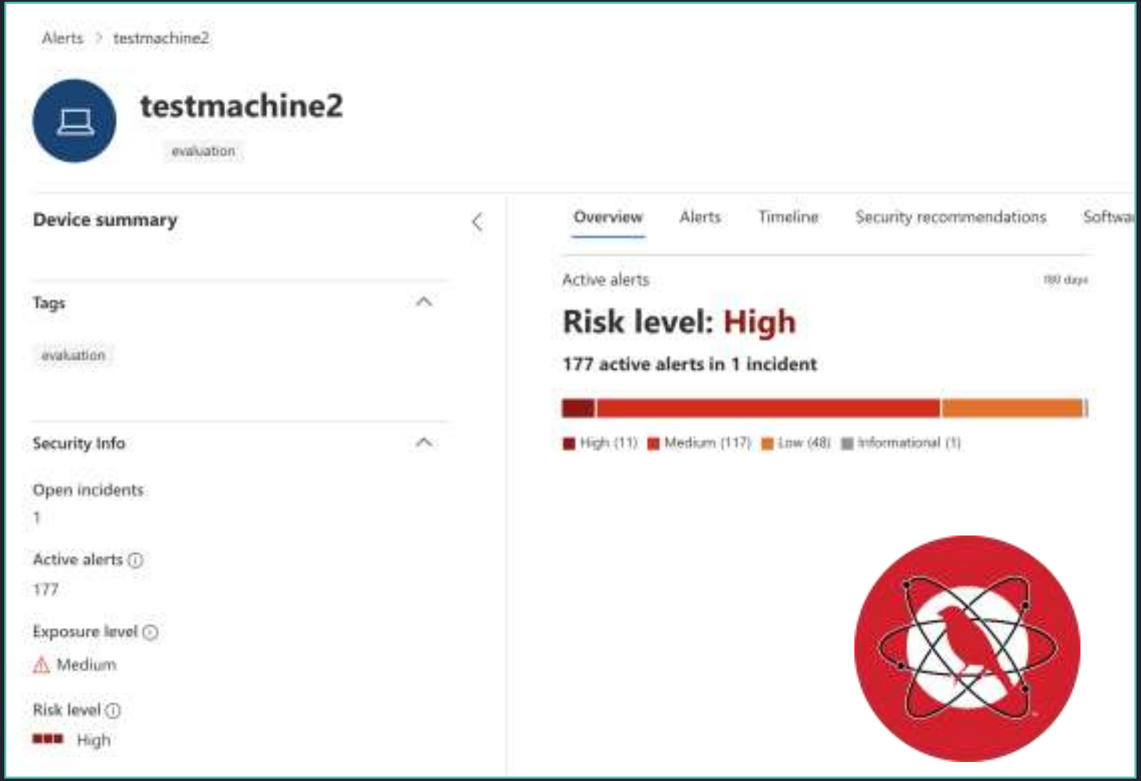
A basic non-scientific test shows you should.

Executed 562 Atomic Red Team (ART) scripts, out of which some failed.

Resulting in 177 alerts based on out of the box rules, so there is a gap.

167 of those alerts are mapped to ATT&CK.

21 of the alerts are mapped to a technique that was not tagged in the ART project



Alerts > testmachine2

testmachine2

evaluation

Device summary

Tags

evaluation

Security Info

Open incidents

1

Active alerts

177

Exposure level

⚠ Medium

Risk level

■■■ High

Overview | Alerts | Timeline | Security recommendations | Softwa

Active alerts

180 days

Risk level: High

177 active alerts in 1 incident

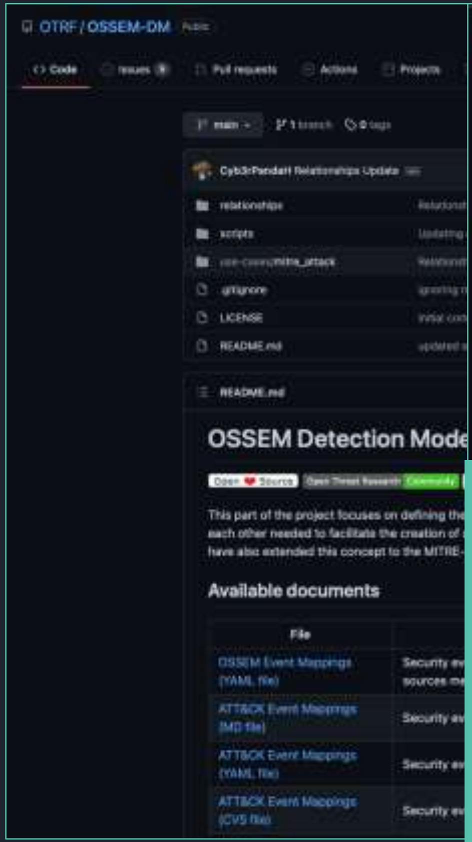
■ High (11) ■ Medium (117) ■ Low (48) ■ Informational (1)

Theoretical telemetry mapping

This can be done based on the schema or the generated data.

Mapping can be done against the OSSEM Detection Model that also is aware of the ATT&CK data sources.

Keep in mind this is biased on two sides: the MITRE mapping as well as the **generated** telemetry.

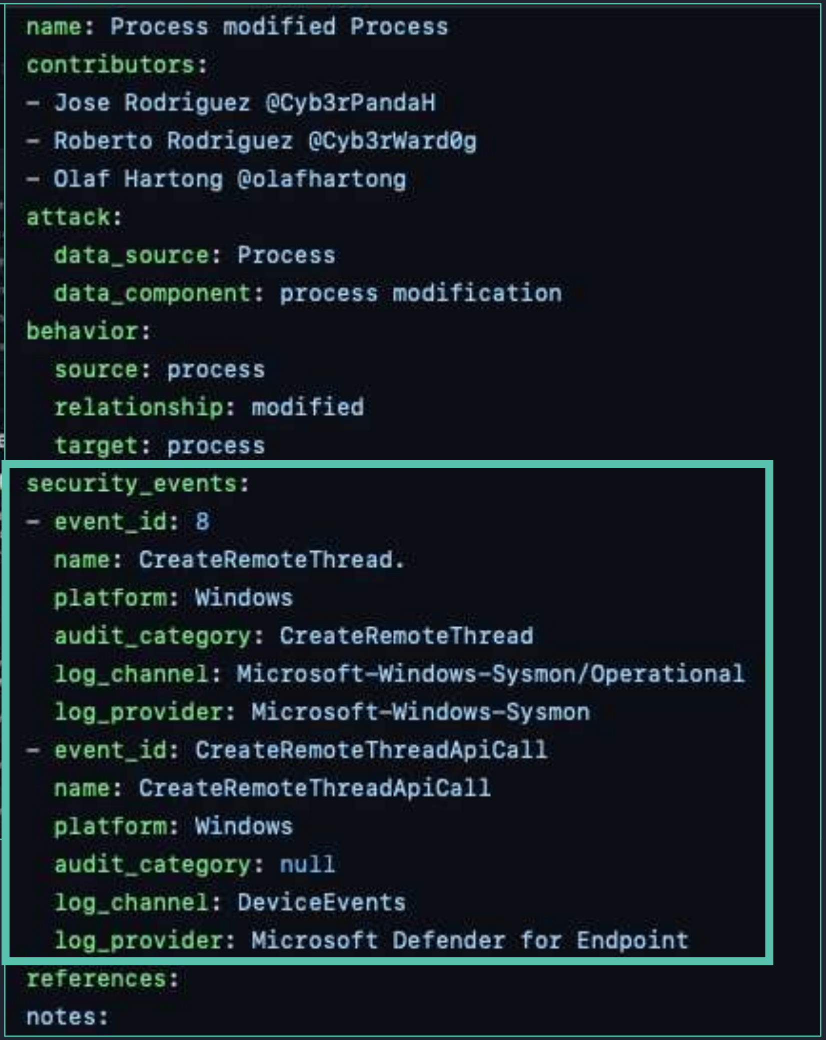


OSSEM Detection Mode

This part of the project focuses on defining the
each other needed to facilitate the creation of
have also extended this concept to the MITRE-

Available documents

File	
OSSEM Event Mappings (YAML file)	Security ev sources m
ATT&CK Event Mappings (MD file)	Security ev
ATT&CK Event Mappings (YAML file)	Security ev
ATT&CK Event Mappings (CVS file)	Security ev

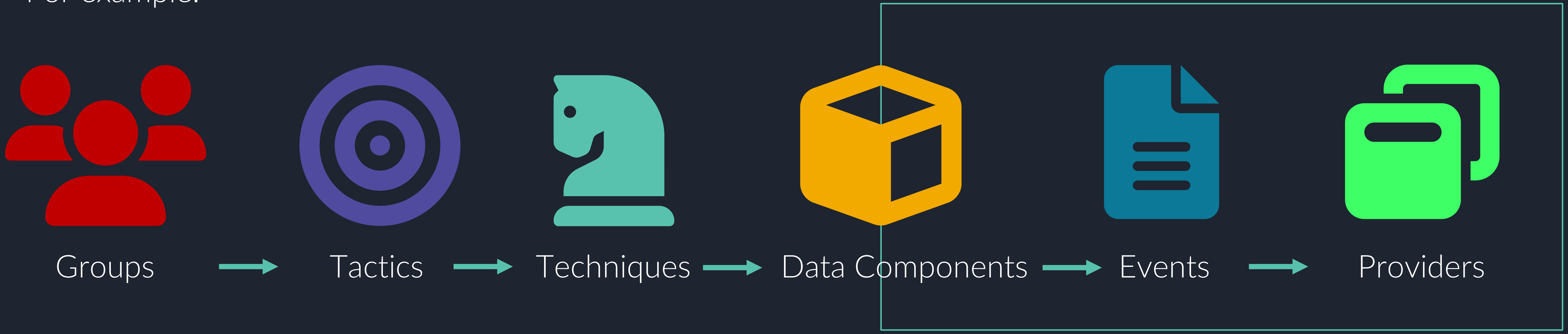


```
name: Process modified Process
contributors:
- Jose Rodriguez @Cyb3rPandaH
- Roberto Rodriguez @Cyb3rWard0g
- Olaf Hartong @olafhartong
attack:
  data_source: Process
  data_component: process modification
behavior:
  source: process
  relationship: modified
  target: process
security_events:
- event_id: 8
  name: CreateRemoteThread.
  platform: Windows
  audit_category: CreateRemoteThread
  log_channel: Microsoft-Windows-Sysmon/Operational
  log_provider: Microsoft-Windows-Sysmon
- event_id: CreateRemoteThreadApiCall
  name: CreateRemoteThreadApiCall
  platform: Windows
  audit_category: null
  log_channel: DeviceEvents
  log_provider: Microsoft Defender for Endpoint
references:
notes:
```

Linking data sources > data components > events

Since ATT&CK contains all kinds relations we can start combining sets of relationships with other sets.

For example:

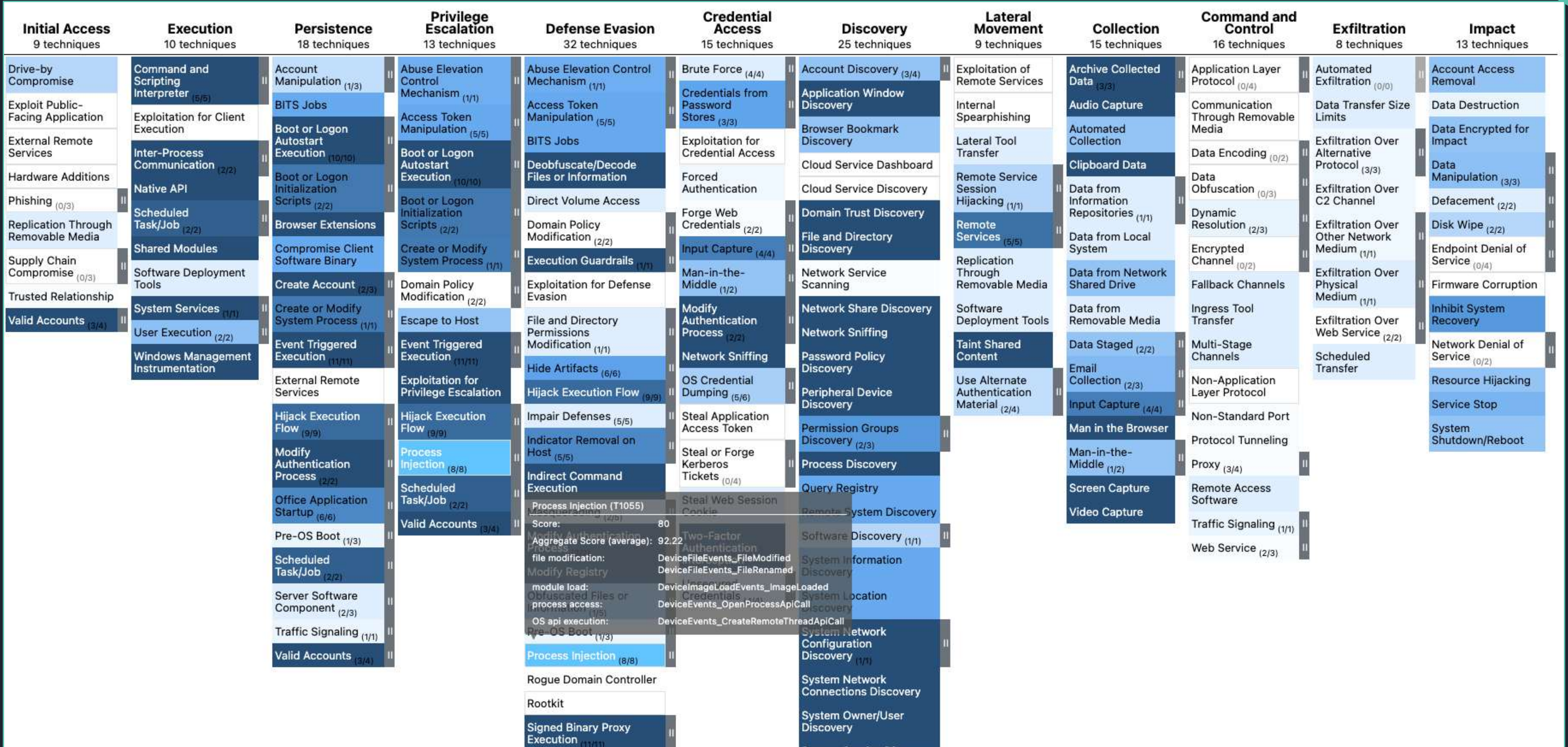


Groups → Tactics → Techniques → Data Components → Events → Providers

The same can be done for;
tools, detection rules, attack/validation scripts, event fields and much, much more!

https://github.com/OTRF/OSSEM-DM

MDE telemetry potential mapping to MITRE ATT&CK



Initial Access
9 techniques

- Drive-by Compromise
- Exploit Public-Facing Application
- External Remote Services
- Hardware Additions
- Phishing (0/3)
- Replication Through Removable Media
- Supply Chain Compromise (0/3)
- Trusted Relationship
- Valid Accounts (3/4)

Execution
10 techniques

- Command and Scripting Interpreter (5/5)
- Exploitation for Client Execution
- Inter-Process Communication (2/2)
- Native API
- Scheduled Task/Job (2/2)
- Shared Modules
- Software Deployment Tools
- System Services (1/1)
- User Execution (2/2)
- Windows Management Instrumentation

Persistence
18 techniques

- Account Manipulation (1/3)
- BITS Jobs
- Boot or Logon Autostart Execution (10/10)
- Boot or Logon Initialization Scripts (2/2)
- Browser Extensions
- Compromise Client Software Binary
- Create Account (2/3)
- Create or Modify System Process (1/1)
- Event Triggered Execution (11/11)
- External Remote Services
- Hijack Execution Flow (9/9)
- Modify Authentication Process (2/2)
- Office Application Startup (6/6)
- Pre-OS Boot (1/3)
- Scheduled Task/Job (2/2)
- Server Software Component (2/3)
- Traffic Signaling (1/1)
- Valid Accounts (3/4)

Privilege Escalation
13 techniques

- Abuse Elevation Control Mechanism (1/1)
- Access Token Manipulation (5/5)
- Boot or Logon Autostart Execution (10/10)
- Boot or Logon Initialization Scripts (2/2)
- Create or Modify System Process (1/1)
- Domain Policy Modification (2/2)
- Escape to Host
- Event Triggered Execution (11/11)
- Exploitation for Privilege Escalation
- Hijack Execution Flow (9/9)
- Process Injection (8/8)
- Scheduled Task/Job (2/2)
- Valid Accounts (3/4)

Defense Evasion
32 techniques

- Abuse Elevation Control Mechanism (1/1)
- Access Token Manipulation (5/5)
- BITS Jobs
- Deobfuscate/Decode Files or Information
- Direct Volume Access
- Domain Policy Modification (2/2)
- Execution Guardrails (1/1)
- Exploitation for Defense Evasion
- File and Directory Permissions Modification (1/1)
- Hide Artifacts (6/6)
- Hijack Execution Flow (9/9)
- Impair Defenses (5/5)
- Indicator Removal on Host (5/5)
- Indirect Command Execution
- Masquerading (2/5)
- Modify Authentication Process
- Modify Registry
- Obfuscated Files or Information (1/5)
- Pre-OS Boot (1/3)
- Process Injection (8/8)
- Rogue Domain Controller
- Rootkit
- Signed Binary Proxy Execution (11/11)

Credential Access
15 techniques

- Brute Force (4/4)
- Credentials from Password Stores (3/3)
- Exploitation for Credential Access
- Forced Authentication
- Forge Web Credentials (2/2)
- Input Capture (4/4)
- Man-in-the-Middle (1/2)
- Modify Authentication Process (2/2)
- Network Sniffing
- OS Credential Dumping (5/6)
- Steal Application Access Token
- Steal or Forge Kerberos Tickets (0/4)
- Steal Web Session Cookie
- Two-Factor Authentication Interception
- Unsecured Credentials

Discovery
25 techniques

- Account Discovery (3/4)
- Application Window Discovery
- Browser Bookmark Discovery
- Cloud Service Dashboard
- Cloud Service Discovery
- Domain Trust Discovery
- File and Directory Discovery
- Network Service Scanning
- Network Share Discovery
- Network Sniffing
- Password Policy Discovery
- Peripheral Device Discovery
- Permission Groups Discovery (2/3)
- Process Discovery
- Query Registry
- Remote System Discovery
- Software Discovery (1/1)
- System Information Discovery
- System Location Discovery
- System Network Configuration Discovery (1/1)
- System Network Connections Discovery
- System Owner/User Discovery

Lateral Movement
9 techniques

- Exploitation of Remote Services
- Internal Spearphishing
- Lateral Tool Transfer
- Remote Service Session Hijacking (1/1)
- Remote Services (5/5)
- Replication Through Removable Media
- Software Deployment Tools
- Taint Shared Content
- Use Alternate Authentication Material (2/4)

Collection
15 techniques

- Archive Collected Data (3/3)
- Audio Capture
- Automated Collection
- Clipboard Data
- Data from Information Repositories (1/1)
- Data from Local System
- Data from Network Shared Drive
- Data from Removable Media
- Data Staged (2/2)
- Email Collection (3/3)
- Input Capture (4/4)
- Man in the Browser
- Man-in-the-Middle (1/2)
- Screen Capture
- Video Capture

Command and Control
16 techniques

- Application Layer Protocol (0/4)
- Communication Through Removable Media
- Data Encoding (0/2)
- Data Obfuscation (0/3)
- Dynamic Resolution (2/3)
- Encrypted Channel (0/2)
- Fallback Channels
- Ingress Tool Transfer
- Multi-Stage Channels
- Non-Application Layer Protocol
- Non-Standard Port
- Protocol Tunneling
- Proxy (3/4)
- Remote Access Software
- Traffic Signaling (1/1)
- Web Service (2/3)

Exfiltration
8 techniques

- Automated Exfiltration (0/0)
- Data Transfer Size Limits
- Exfiltration Over Alternative Protocol (3/3)
- Exfiltration Over C2 Channel
- Exfiltration Over Other Network Medium (1/1)
- Exfiltration Over Physical Medium (1/1)
- Exfiltration Over Web Service (2/2)
- Scheduled Transfer

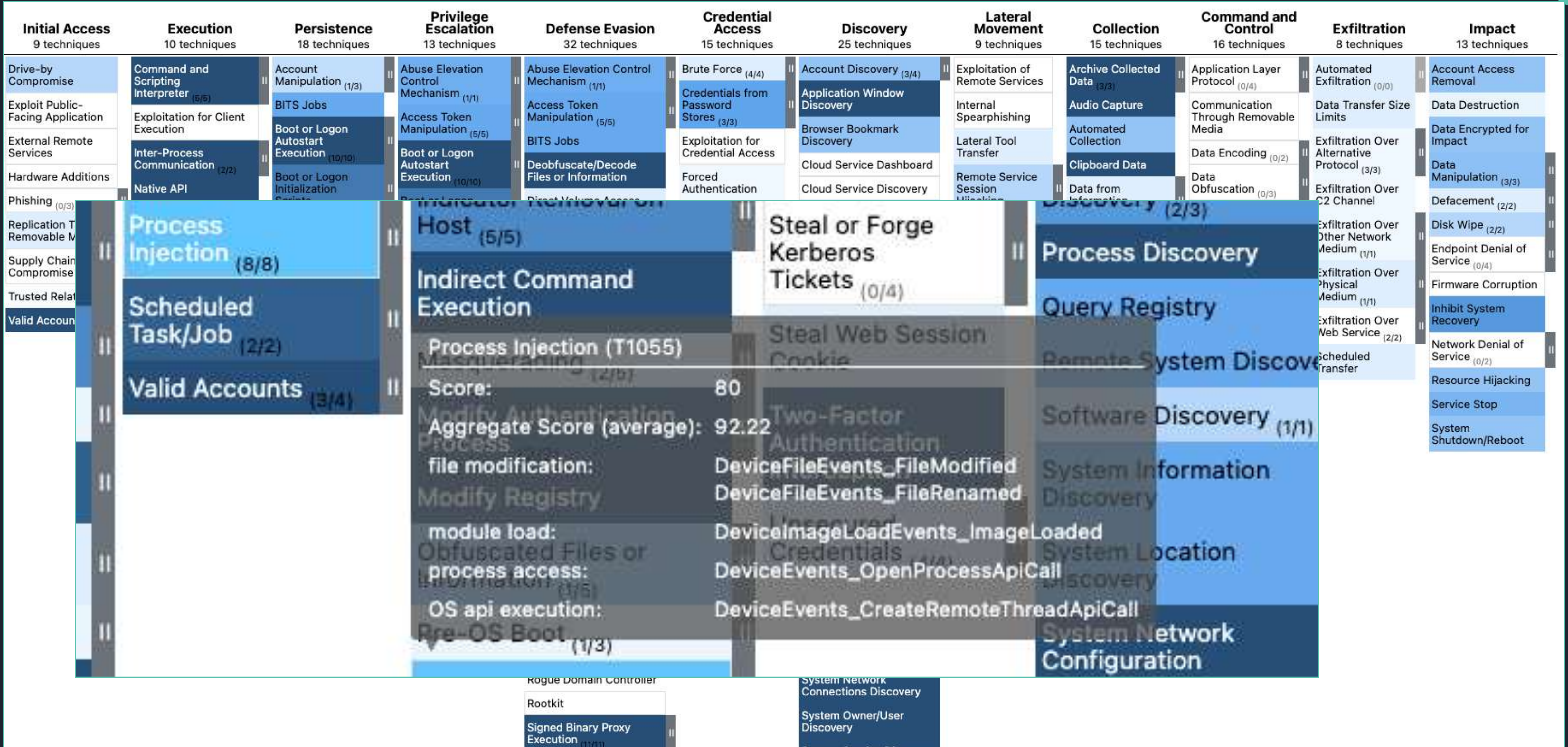
Impact
13 techniques

- Account Access Removal
- Data Destruction
- Data Encrypted for Impact
- Data Manipulation (3/3)
- Defacement (2/2)
- Disk Wipe (2/2)
- Endpoint Denial of Service (0/4)
- Firmware Corruption
- Inhibit System Recovery
- Network Denial of Service (0/2)
- Resource Hijacking
- Service Stop
- System Shutdown/Reboot

Process Injection (T1055)

Score: 80
Aggregate Score (average): 92.22
file modification: DeviceFileEvents_FileModified
DeviceFileEvents_FileRenamed
module load: DeviceImageLoadEvents_ImageLoaded
process access: DeviceEvents_OpenProcessApiCall
OS api execution: DeviceEvents_CreateRemoteThreadApiCall

MDE telemetry potential mapping to MITRE ATT&CK



Initial Access 9 techniques	Execution 10 techniques	Persistence 18 techniques	Privilege Escalation 13 techniques	Defense Evasion 32 techniques	Credential Access 15 techniques	Discovery 25 techniques	Lateral Movement 9 techniques	Collection 15 techniques	Command and Control 16 techniques	Exfiltration 8 techniques	Impact 13 techniques
Drive-by Compromise	Command and Scripting Interpreter (5/5)	Account Manipulation (1/3)	Abuse Elevation Control Mechanism (1/1)	Abuse Elevation Control Mechanism (1/1)	Brute Force (4/4)	Account Discovery (3/4)	Exploitation of Remote Services	Archive Collected Data (3/3)	Application Layer Protocol (0/4)	Automated Exfiltration (0/0)	Account Access Removal
Exploit Public-Facing Application	Exploitation for Client Execution	BITS Jobs	Access Token Manipulation (5/5)	Access Token Manipulation (5/5)	Credentials from Password Stores (3/3)	Application Window Discovery	Internal Spearphishing	Audio Capture	Communication Through Removable Media	Data Transfer Size Limits	Data Destruction
External Remote Services	Inter-Process Communication (2/2)	Boot or Logon Autostart Execution (10/10)	Boot or Logon Autostart Execution (10/10)	BITS Jobs	Exploitation for Credential Access	Browser Bookmark Discovery	Lateral Tool Transfer	Automated Collection	Data Encoding (0/2)	Exfiltration Over Alternative Protocol (3/3)	Data Encrypted for Impact
Hardware Additions	Native API	Boot or Logon Initialization		Deobfuscate/Decode Files or Information	Forced Authentication	Cloud Service Dashboard	Remote Service Session	Clipboard Data	Data Obfuscation (0/3)	Exfiltration Over C2 Channel	Data Manipulation (3/3)
Phishing (0/3)						Cloud Service Discovery		Data from		Exfiltration Over Other Network Medium (1/1)	Defacement (2/2)
Replication T Removable M				Rogue Domain Controller		System Network Connections Discovery				Exfiltration Over Physical Medium (1/1)	Disk Wipe (2/2)
Supply Chain Compromise				Rootkit		System Owner/User Discovery				Exfiltration Over Web Service (2/2)	Endpoint Denial of Service (0/4)
Trusted Relat				Signed Binary Proxy Execution (11/11)						Scheduled Transfer	Firmware Corruption
Valid Accoun											Inhibit System Recovery
											Network Denial of Service (0/2)
											Resource Hijacking
											Service Stop
											System Shutdown/Reboot

Process Injection (8/8)

Scheduled Task/Job (2/2)

Valid Accounts (3/4)

Indicator Removal on Host (5/5)

Indirect Command Execution

Masquerading (2/6)

Modify Authentication Process

Modify Registry

Obfuscated Files or Information (1/6)

Pre-OS Boot (1/3)

Steal or Forge Kerberos Tickets (0/4)

Steal Web Session Cookie

Two-Factor Authentication Interception

Unsecured Credentials

Discovery (2/3)

Process Discovery

Query Registry

Remote System Discovery

Software Discovery (1/1)

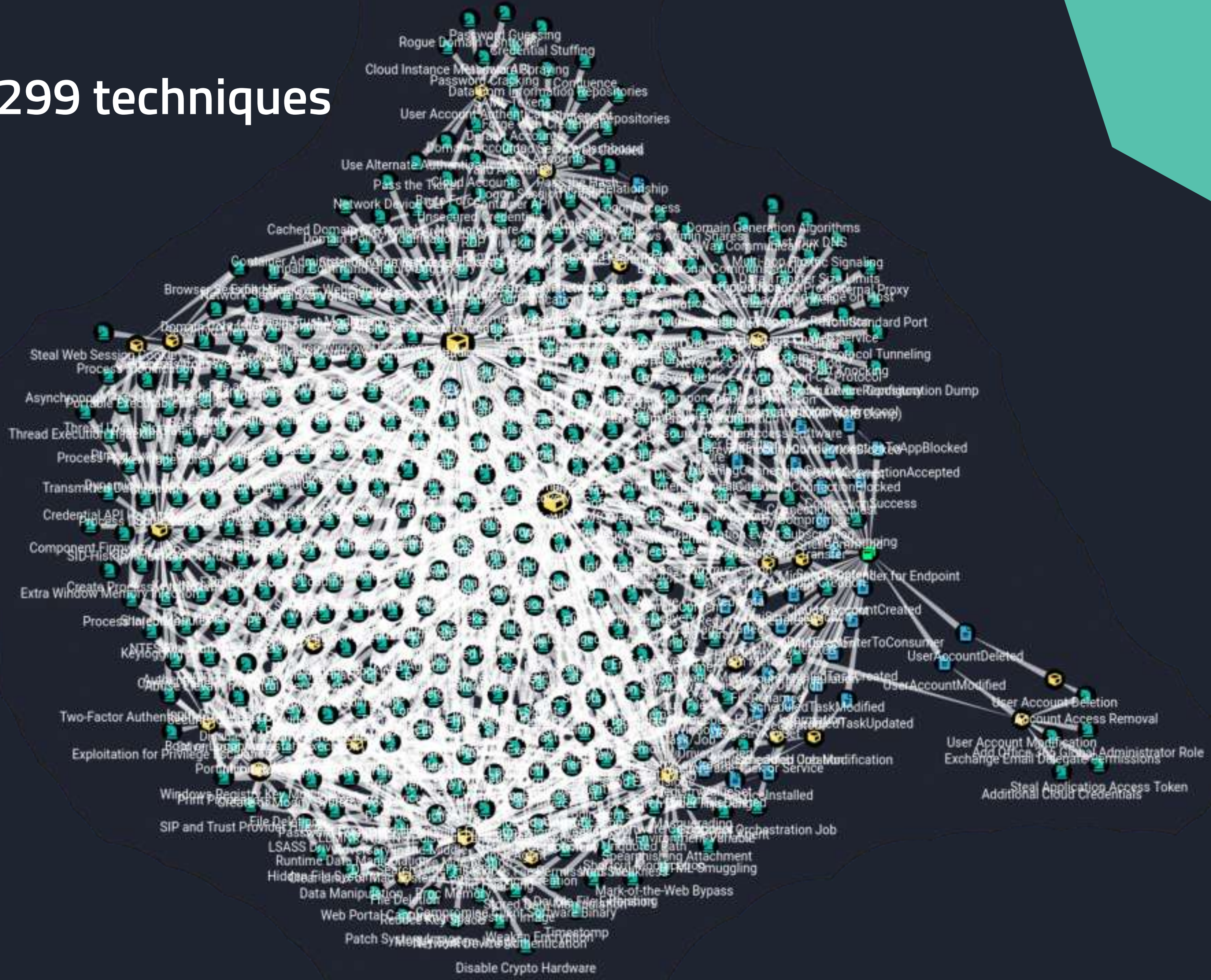
System Information Discovery

System Location Discovery

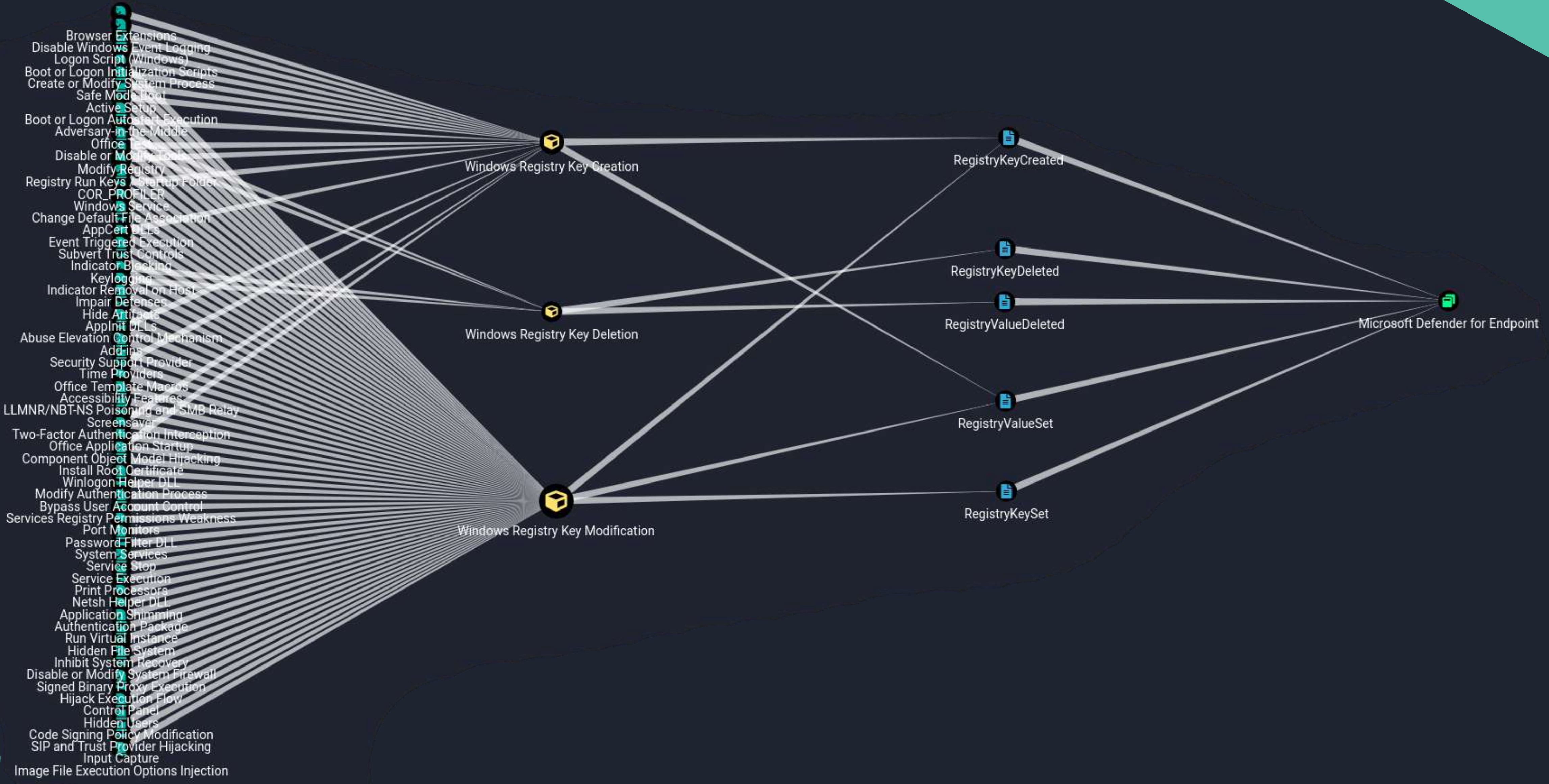
System Network Configuration

Process Injection (T1055)	
Score:	80
Aggregate Score (average):	92.22
file modification:	DeviceFileEvents_FileModified DeviceFileEvents_FileRenamed
module load:	DeviceImageLoadEvents_ImageLoaded
process access:	DeviceEvents_OpenProcessApiCall
OS api execution:	DeviceEvents_CreateRemoteThreadApiCall

Data potential for 299 techniques

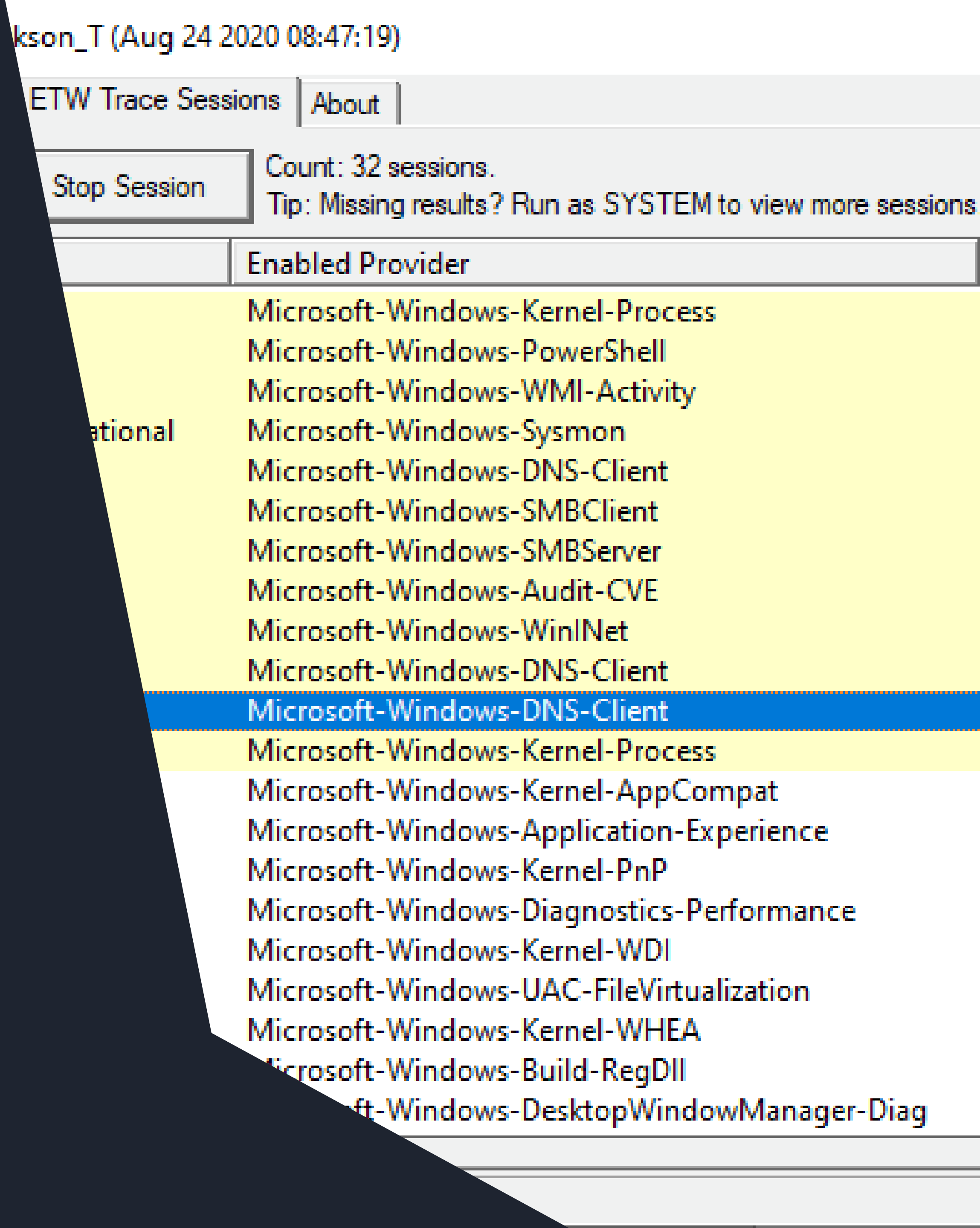


Visualizing relationships


Browser Extensions
Disable Windows Event Logging
Logon Script (Windows)
Boot or Logon Initialization Scripts
Create or Modify System Process
Safe Mode Boot
Active Setup
Boot or Logon Autostart Execution
Adversary-in-the-Middle
Office Test
Disable or Modify Tools
Modify Registry
Registry Run Keys / Startup Folder
COR_PROFILER
Windows Service
Change Default File Association
AppCert DLLs
Event Triggered Execution
Subvert Trust Controls
Indicator Blocking
Keylogging
Indicator Removal on Host
Impair Defenses
Hide Artifacts
AppInit DLLs
Abuse Elevation Control Mechanism
Add-ins
Security Support Provider
Time Providers
Office Template Macros
Accessibility Features
LLMNR/NBT-NS Poisoning and SMB Relay
Screensaver
Two-Factor Authentication Interception
Office Application Startup
Component Object Model Hijacking
Install Root Certificate
Winlogon Helper DLL
Modify Authentication Process
Bypass User Account Control
Services Registry Permissions Weakness
Port Monitors
Password Filter DLL
System Services
Service Stop
Service Execution
Print Processors
Netsh Helper DLL
Application Shimming
Authentication Package
Run Virtual Instance
Hidden File System
Inhibit System Recovery
Disable or Modify System Firewall
Signed Binary Proxy Execution
Hijack Execution Flow
Control Panel
Hidden Users
Code Signing Policy Modification
SIP and Trust Provider Hijacking
Input Capture
Image File Execution Options Injection
Windows Registry Key Creation
Windows Registry Key Deletion
Windows Registry Key Modification
RegistryKeyCreated
RegistryKeyDeleted
RegistryValueDeleted
RegistryValueSet
RegistryKeySet
Microsoft Defender for Endpoint

Where does it get its telemetry?

This is important to understand bypass and tampering opportunities as well as possible blind spots.

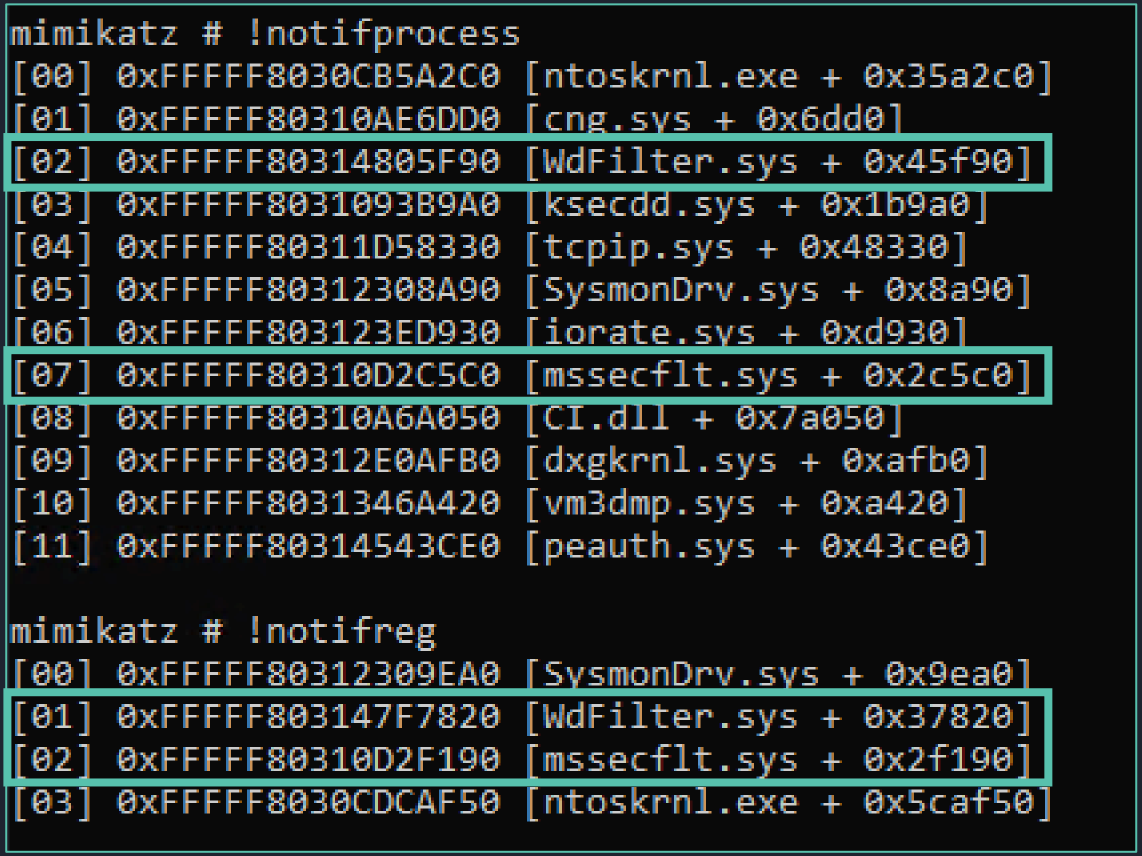


Count: 32 sessions.
Tip: Missing results? Run as SYSTEM to view more sessions

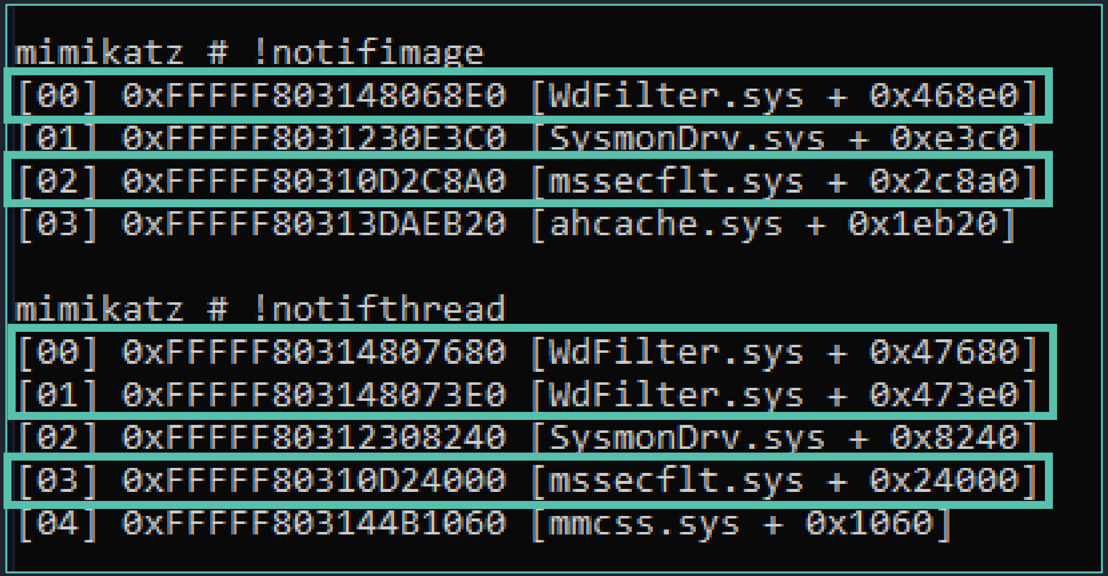
	Enabled Provider
	Microsoft-Windows-Kernel-Process
	Microsoft-Windows-PowerShell
	Microsoft-Windows-WMI-Activity
ational	Microsoft-Windows-Sysmon
	Microsoft-Windows-DNS-Client
	Microsoft-Windows-SMBClient
	Microsoft-Windows-SMBServer
	Microsoft-Windows-Audit-CVE
	Microsoft-Windows-WinINet
	Microsoft-Windows-DNS-Client
	Microsoft-Windows-DNS-Client
	Microsoft-Windows-Kernel-Process
	Microsoft-Windows-Kernel-AppCompat
	Microsoft-Windows-Application-Experience
	Microsoft-Windows-Kernel-PnP
	Microsoft-Windows-Diagnostics-Performance
	Microsoft-Windows-Kernel-WDI
	Microsoft-Windows-UAC-FileVirtualization
	Microsoft-Windows-Kernel-WHEA
	icrosoft-Windows-Build-RegDll
	ft-Windows-DesktopWindowManager-Diag

Kernel Callbacks

The kernel's callback mechanism provides a general way for drivers to request and provide notification when certain conditions are satisfied.

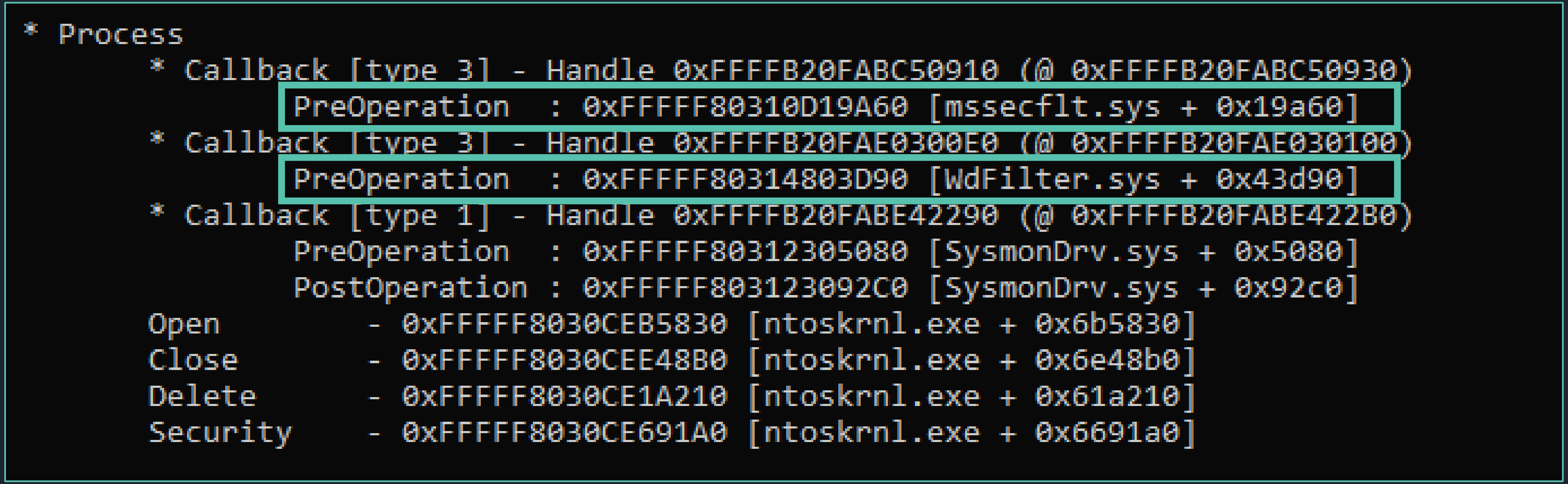


```
mimikatz # !notifprocess
[00] 0xFFFFF8030CB5A2C0 [ntoskrnl.exe + 0x35a2c0]
[01] 0xFFFFF80310AE6DD0 [cng.sys + 0x6dd0]
[02] 0xFFFFF80314805F90 [WdFilter.sys + 0x45f90]
[03] 0xFFFFF8031093B9A0 [ksecdd.sys + 0x1b9a0]
[04] 0xFFFFF80311D58330 [tcpip.sys + 0x48330]
[05] 0xFFFFF80312308A90 [SysmonDrv.sys + 0x8a90]
[06] 0xFFFFF803123ED930 [iorate.sys + 0xd930]
[07] 0xFFFFF80310D2C5C0 [mssecflt.sys + 0x2c5c0]
[08] 0xFFFFF80310A6A050 [CI.dll + 0x7a050]
[09] 0xFFFFF80312E0AFB0 [dxgkrnl.sys + 0xafb0]
[10] 0xFFFFF8031346A420 [vm3dmp.sys + 0xa420]
[11] 0xFFFFF80314543CE0 [peauth.sys + 0x43ce0]

mimikatz # !notifreg
[00] 0xFFFFF80312309EA0 [SysmonDrv.sys + 0x9ea0]
[01] 0xFFFFF803147F7820 [WdFilter.sys + 0x37820]
[02] 0xFFFFF80310D2F190 [mssecflt.sys + 0x2f190]
[03] 0xFFFFF8030CDCAF50 [ntoskrnl.exe + 0x5caf50]
```



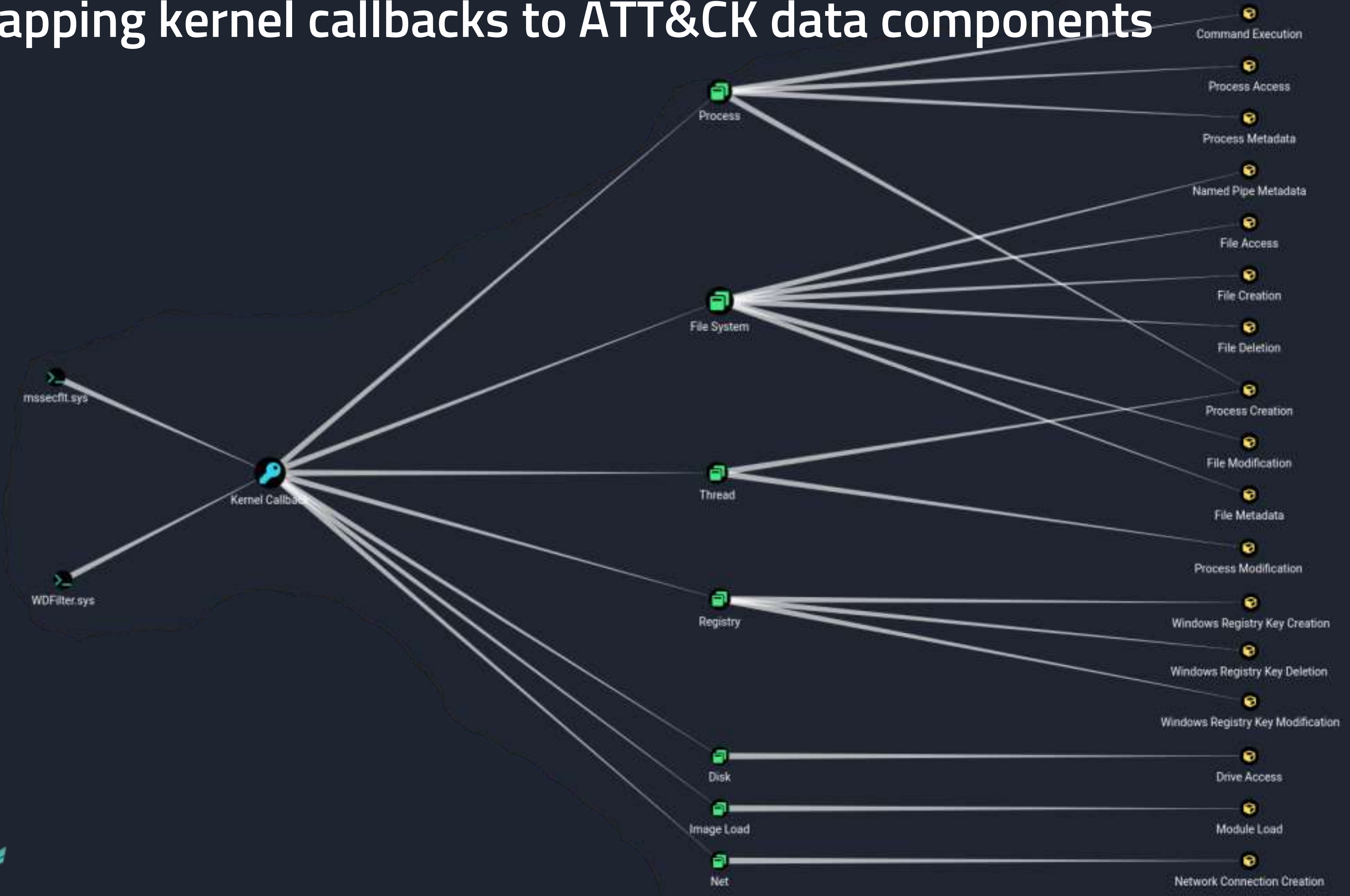
```
mimikatz # !notifimage
[00] 0xFFFFF803148068E0 [WdFilter.sys + 0x468e0]
[01] 0xFFFFF8031230E3C0 [SysmonDrv.sys + 0xe3c0]
[02] 0xFFFFF80310D2C8A0 [mssecflt.sys + 0x2c8a0]
[03] 0xFFFFF80313DAEB20 [ahcache.sys + 0x1eb20]

mimikatz # !notifthread
[00] 0xFFFFF80314807680 [WdFilter.sys + 0x47680]
[01] 0xFFFFF803148073E0 [WdFilter.sys + 0x473e0]
[02] 0xFFFFF80312308240 [SysmonDrv.sys + 0x8240]
[03] 0xFFFFF80310D24000 [mssecflt.sys + 0x24000]
[04] 0xFFFFF803144B1060 [mmcss.sys + 0x1060]
```

Kernel Callbacks

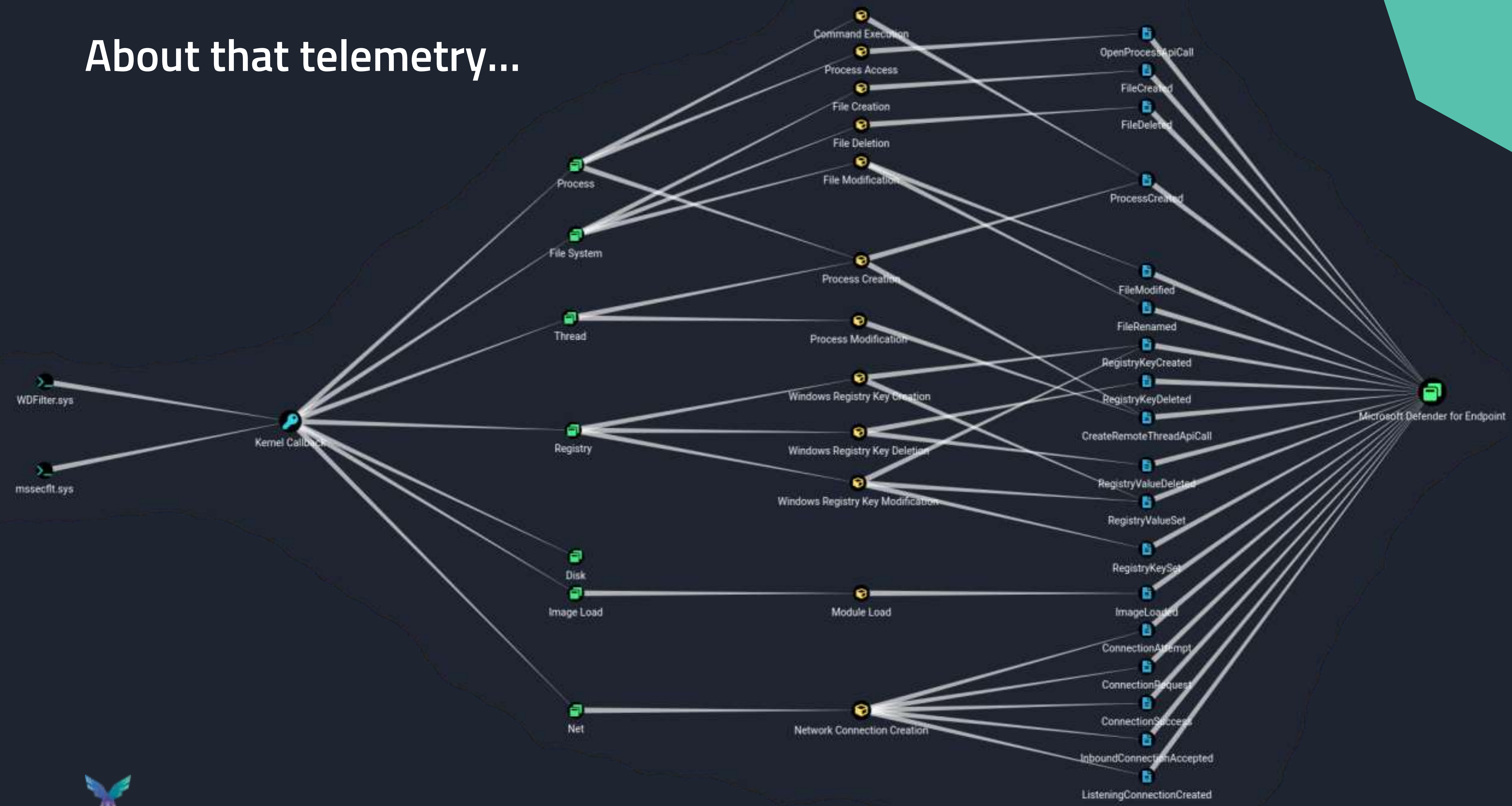


```
* Process
       * Callback [type 3] - Handle 0xFFFFB20FABC50910 (@ 0xFFFFB20FABC50930)
               PreOperation  : 0xFFFFF80310D19A60 [mssecflt.sys + 0x19a60]
       * Callback [type 3] - Handle 0xFFFFB20FAE0300E0 (@ 0xFFFFB20FAE030100)
               PreOperation  : 0xFFFFF80314803D90 [WdFilter.sys + 0x43d90]
       * Callback [type 1] - Handle 0xFFFFB20FABE42290 (@ 0xFFFFB20FABE422B0)
               PreOperation  : 0xFFFFF80312305080 [SysmonDrv.sys + 0x5080]
               PostOperation : 0xFFFFF803123092C0 [SysmonDrv.sys + 0x92c0]
       Open        - 0xFFFFF8030CEB5830 [ntoskrnl.exe + 0x6b5830]
       Close       - 0xFFFFF8030CEE48B0 [ntoskrnl.exe + 0x6e48b0]
       Delete      - 0xFFFFF8030CE1A210 [ntoskrnl.exe + 0x61a210]
       Security    - 0xFFFFF8030CE691A0 [ntoskrnl.exe + 0x6691a0]
```

Mapping kernel callbacks to ATT&CK data components



About that telemetry...



Event Tracing for Windows

Event Tracing for Windows (ETW) provides a mechanism to trace and log events that are raised by user-mode applications and kernel-mode drivers.

ETW is implemented in the Windows operating system and provides a fast, reliable, and versatile set of event tracing features. Its architecture consists of three layers;

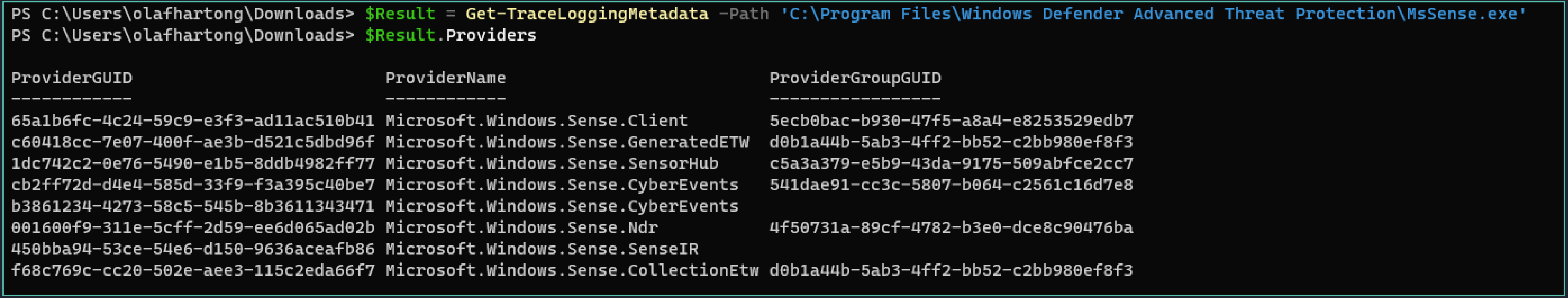
- Event providers
- Event consumers
- Event tracing sessions

Great reference material by Matt Graeber:
https://blog.palantir.com/tampering-with-windows-event-tracing-background-offense-and-defense-4be7ac62ac63
https://posts.specterops.io/data-source-analysis-and-dynamic-windows-re-using-wpp-and-tracelogging-e465f8b653f7

MsSense.exe ETW Providers

MsSense is one of the core components of MDE that routes the telemetry which it gathers in its own set of providers.

Curious about the traces it utilizes I had a look at the trace logging metadata with a script created by Matt Graeber.



```
PS C:\Users\olafhartong\Downloads> $Result = Get-TraceLoggingMetadata -Path 'C:\Program Files\Windows Defender Advanced Threat Protection\MsSense.exe'
PS C:\Users\olafhartong\Downloads> $Result.Providers

ProviderGUID                         ProviderName                          ProviderGroupGUID
------------                         ------------                          -----------------
65a1b6fc-4c24-59c9-e3f3-ad11ac510b41 Microsoft.Windows.Sense.Client        5ecb0bac-b930-47f5-a8a4-e8253529edb7
c60418cc-7e07-400f-ae3b-d521c5dbd96f Microsoft.Windows.Sense.GeneratedETW  d0b1a44b-5ab3-4ff2-bb52-c2bb980ef8f3
1dc742c2-0e76-5490-e1b5-8ddb4982ff77 Microsoft.Windows.Sense.SensorHub     c5a3a379-e5b9-43da-9175-509abfce2cc7
cb2ff72d-d4e4-585d-33f9-f3a395c40be7 Microsoft.Windows.Sense.CyberEvents   541dae91-cc3c-5807-b064-c2561c16d7e8
b3861234-4273-58c5-545b-8b3611343471 Microsoft.Windows.Sense.CyberEvents
001600f9-311e-5cff-2d59-ee6d065ad02b Microsoft.Windows.Sense.Ndr           4f50731a-89cf-4782-b3e0-dce8c90476ba
450bba94-53ce-54e6-d150-9636aceafb86 Microsoft.Windows.Sense.SenseIR
f68c769c-cc20-502e-aee3-115c2eda66f7 Microsoft.Windows.Sense.CollectionEtw d0b1a44b-5ab3-4ff2-bb52-c2bb980ef8f3
```

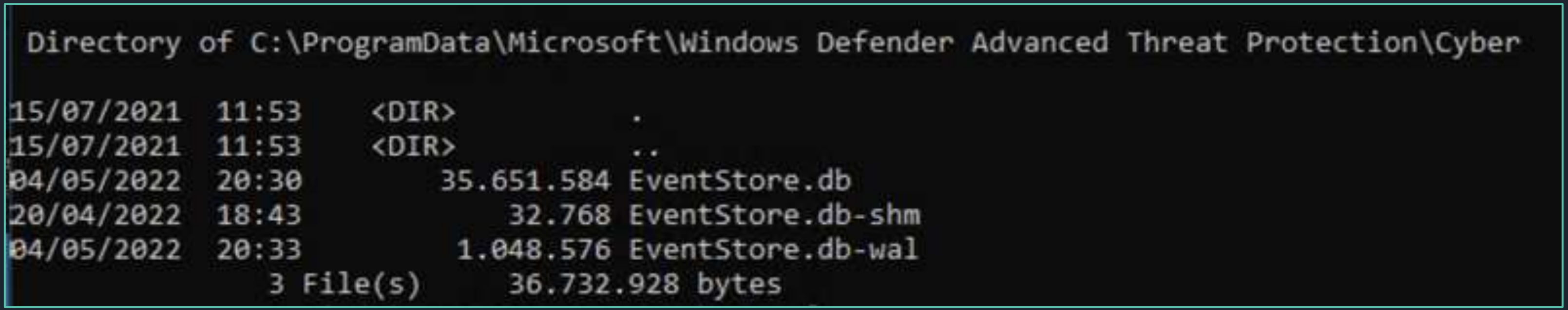
https://gist.github.com/mattifestation/edbac1614694886c8ef4583149f53658

MsSense.exe ETW data

The traced events are stored into a SQLite database in a protected folder on the file system. The table name used is AsimovEvents.

Asimov was the code name in 2014 for the Unified Telemetry Client, which is now deprecated and is replaced by the DiagTrack agent.

On regular intervals the contents of the database gets uploaded and the data gets flushed..



```
 Directory of C:\ProgramData\Microsoft\Windows Defender Advanced Threat Protection\Cyber

15/07/2021  11:53    <DIR>          .
15/07/2021  11:53    <DIR>          ..
04/05/2022  20:30        35.651.584 EventStore.db
20/04/2022  18:43            32.768 EventStore.db-shm
04/05/2022  20:33         1.048.576 EventStore.db-wal
               3 File(s)     36.732.928 bytes
```

Tracing these providers

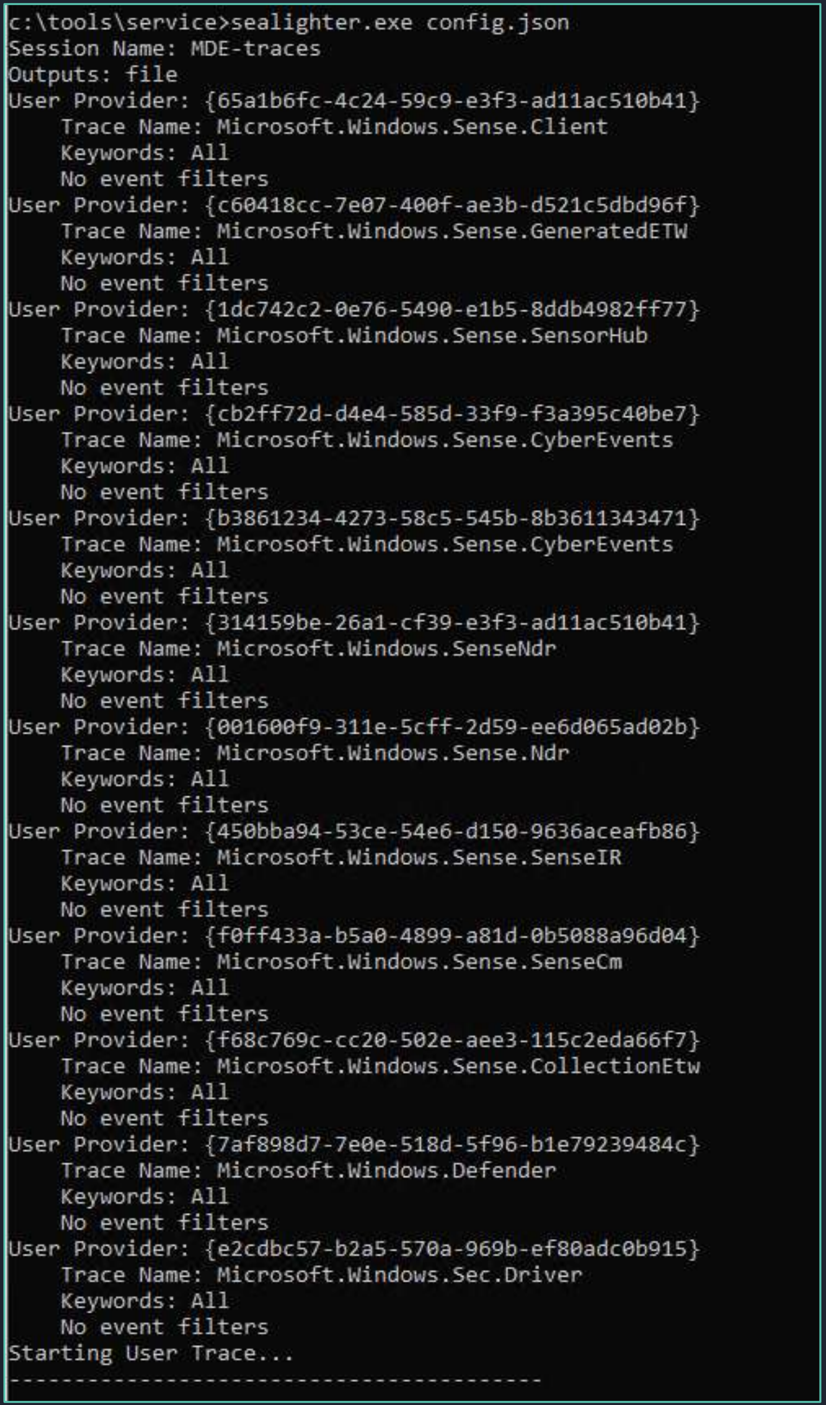
Curious to see what these providers contained I fired up Sealighter to trace these file to a file.

Sealighter is highly configurable and can subscribe to multiple providers at once, user and kernel traces.

Outputs to Stdout, JSON file, or Windows Event Log

https://github.com/pathtofile/Sealighter

Primarily built for research, if you want to use custom ETW events for monitoring SilkETW is probably more suited.



```
c:\tools\service>sealighter.exe config.json
Session Name: MDE-traces
Outputs: file
User Provider: {65a1b6fc-4c24-59c9-e3f3-ad11ac510b41}
    Trace Name: Microsoft.Windows.Sense.Client
    Keywords: All
    No event filters
User Provider: {c60418cc-7e07-400f-ae3b-d521c5dbd96f}
    Trace Name: Microsoft.Windows.Sense.GeneratedETW
    Keywords: All
    No event filters
User Provider: {1dc742c2-0e76-5490-e1b5-8ddb4982ff77}
    Trace Name: Microsoft.Windows.Sense.SensorHub
    Keywords: All
    No event filters
User Provider: {cb2ff72d-d4e4-585d-33f9-f3a395c40be7}
    Trace Name: Microsoft.Windows.Sense.CyberEvents
    Keywords: All
    No event filters
User Provider: {b3861234-4273-58c5-545b-8b3611343471}
    Trace Name: Microsoft.Windows.Sense.CyberEvents
    Keywords: All
    No event filters
User Provider: {314159be-26a1-cf39-e3f3-ad11ac510b41}
    Trace Name: Microsoft.Windows.SenseNdr
    Keywords: All
    No event filters
User Provider: {001600f9-311e-5cff-2d59-ee6d065ad02b}
    Trace Name: Microsoft.Windows.Sense.Ndr
    Keywords: All
    No event filters
User Provider: {450bba94-53ce-54e6-d150-9636aceafb86}
    Trace Name: Microsoft.Windows.Sense.SenseIR
    Keywords: All
    No event filters
User Provider: {f0ff433a-b5a0-4899-a81d-0b5088a96d04}
    Trace Name: Microsoft.Windows.Sense.SenseCm
    Keywords: All
    No event filters
User Provider: {f68c769c-cc20-502e-aee3-115c2eda66f7}
    Trace Name: Microsoft.Windows.Sense.CollectionEtw
    Keywords: All
    No event filters
User Provider: {7af898d7-7e0e-518d-5f96-b1e79239484c}
    Trace Name: Microsoft.Windows.Defender
    Keywords: All
    No event filters
User Provider: {e2cdbc57-b2a5-570a-969b-ef80adc0b915}
    Trace Name: Microsoft.Windows.Sec.Driver
    Keywords: All
    No event filters
Starting User Trace...
----------------------------------------
```

Protected providers

Some of these providers are protected.
You at least to run as a Protected Process Light (PPL) to be able to access them.

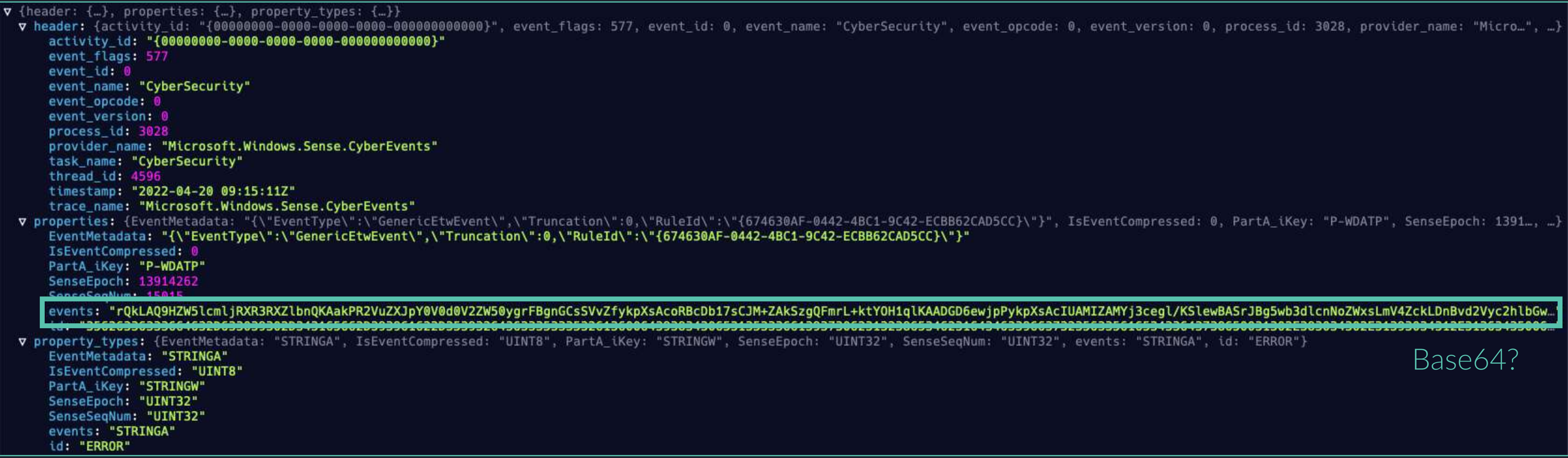
With the Microsoft-Windows-Threat-Intelligence provider you also need a Microsoft Early Launch AntiMalware driver (ELAM) that also runs as PPL.

This can be achieved, albeit a bit cumbersome

Great tool and blog by Patrick Hogan;
https://github.com/pathtofile/PPLRunner
https://blog.tofile.dev/2020/12/16/elam.html

This is also how my colleague Gijs found a spoofing vulnerability
https://medium.com/falconforce/debugging-the-undebuggable-and-finding-a-cve-in-microsoft-defender-for-endpoint-ce36f50bb31

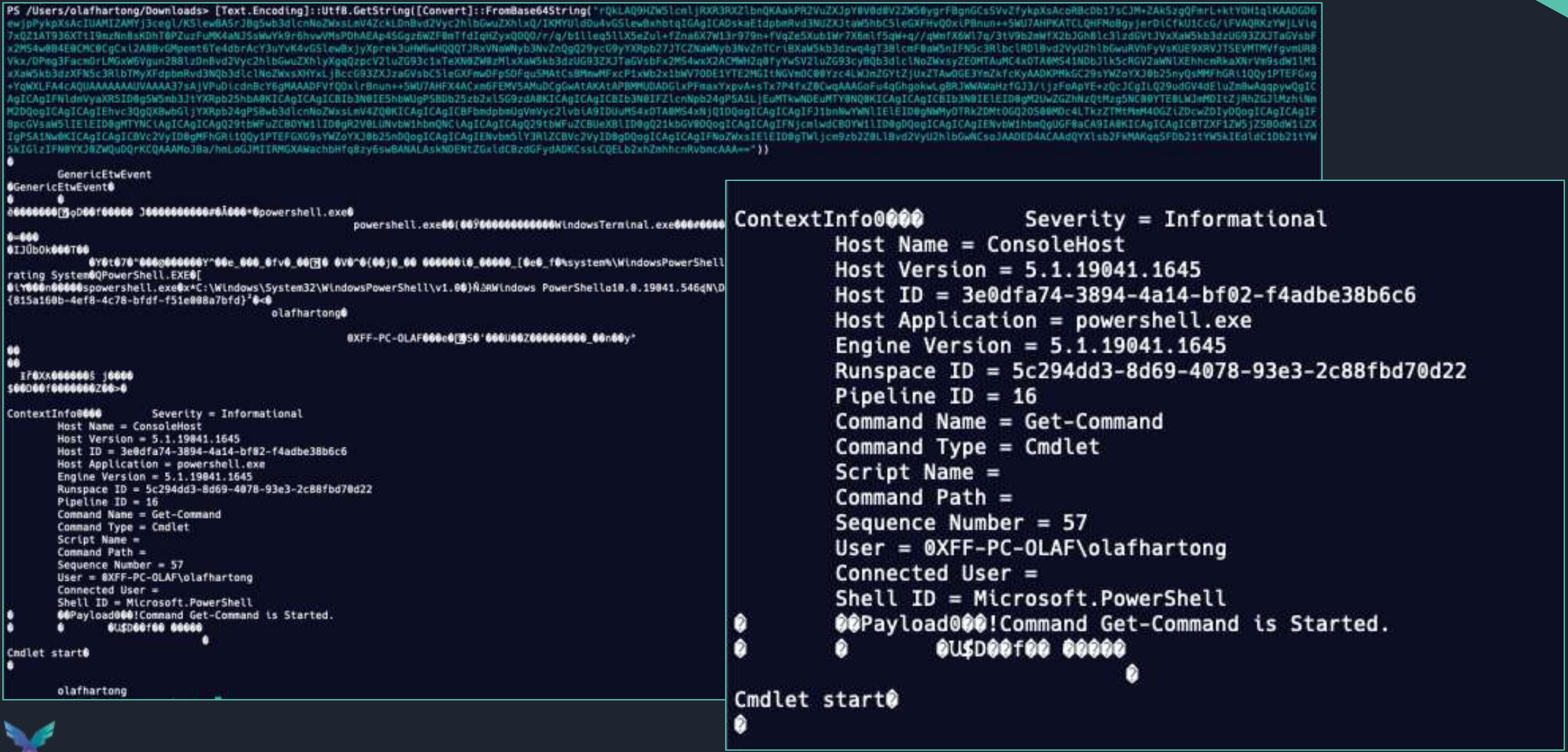
Sample trace



```
▽ {header: {…}, properties: {…}, property_types: {…}}
  ▽ header: {activity_id: "{00000000-0000-0000-0000-000000000000}", event_flags: 577, event_id: 0, event_name: "CyberSecurity", event_opcode: 0, event_version: 0, process_id: 3028, provider_name: "Micro…", …}
      activity_id: "{00000000-0000-0000-0000-000000000000}"
      event_flags: 577
      event_id: 0
      event_name: "CyberSecurity"
      event_opcode: 0
      event_version: 0
      process_id: 3028
      provider_name: "Microsoft.Windows.Sense.CyberEvents"
      task_name: "CyberSecurity"
      thread_id: 4596
      timestamp: "2022-04-20 09:15:11Z"
      trace_name: "Microsoft.Windows.Sense.CyberEvents"
  ▽ properties: {EventMetadata: "{\"EventType\":\"GenericEtwEvent\",\"Truncation\":0,\"RuleId\":\"{674630AF-0442-4BC1-9C42-ECBB62CAD5CC}\"}", IsEventCompressed: 0, PartA_iKey: "P-WDATP", SenseEpoch: 1391…, …}
      EventMetadata: "{\"EventType\":\"GenericEtwEvent\",\"Truncation\":0,\"RuleId\":\"{674630AF-0442-4BC1-9C42-ECBB62CAD5CC}\"}"
      IsEventCompressed: 0
      PartA_iKey: "P-WDATP"
      SenseEpoch: 13914262
      SenseSeqNum: 15015
      events: "rQkLAQ9HZW5lcmljRXR3RXZlbnQKAakPR2VuZXJpY0V0d0V2ZW50ygrFBgnGCsSVvZfykpXsAcoRBcDb17sCJM+ZAkSzgQFmrL+ktYOH1qlKAADGD6ewjpPykpXsAcIUAMIZAMYj3cegl/KSlewBASrJBg5wb3dlcnNoZWxsLmV4ZckLDnBvd2Vyc2hlbGw…"
      id: "[illegible]…"
  ▽ property_types: {EventMetadata: "STRINGA", IsEventCompressed: "UINT8", PartA_iKey: "STRINGW", SenseEpoch: "UINT32", SenseSeqNum: "UINT32", events: "STRINGA", id: "ERROR"}
      EventMetadata: "STRINGA"
      IsEventCompressed: "UINT8"
      PartA_iKey: "STRINGW"
      SenseEpoch: "UINT32"
      SenseSeqNum: "UINT32"
      events: "STRINGA"
      id: "ERROR"
```

Base64?

Base 64 decode



```
PS /Users/olafhartong/Downloads> [Text.Encoding]::Utf8.GetString([Convert]::FromBase64String("
```

rQkLAQ9HZW5lcmljRXR3RXZlbnQKAakPR2VuZXJpYV0dVV2ZW50ygrFBgnGCsSVvZfykpXsAcoRBcDb17sCJM+ZAkSzgQFmrL+ktYOH1qlKAADGD6
ewjpPykpXsAcIUAMIZAMYj3cegl/KSlewBA5rJBg5wb3dlcnNoZWxsLmV4ZckLDnBvd2Vyc2hlbGwuZXhlxQ/IKMYUldDu4vGSlewBxhbtqIGAgICADskaEidpbmRvd3NUZXJtaW5hbC5leGXFHvQOxlPBnun++5WU7AHPKATCLQHFMoBgyjerDlCfkU1CcG/\FVAQRKzYWjLVlq
7xQZ1AT936XTtI9nzNnBsKDhT0PZuzFuMK4aNJSsWwYk9r6hvwVMsPDhAEAp4SGgz6WZF0mTfdIqHZyxQOQO/r/q/b1lleq5llX5eZul+fZna6X7W13r979n+fVqZe5Xub1Wr7X6mlf5qW+q//qWnfX6Wl7q/3tV9b2mWfX2bJGh0lc3lzdGVtJVxXaW5kb3dzUG93ZXJTaGVsbF
x2MS4wBB4E0CMC0CgCxl2A80vGMpemt6Te4dbrAcY3uYvK4vGSlewBxjyXprek3uHW6wHQQQTJRxVNaWNyb3NvZnQgQ29ycG9yYXRpb27JTCZNaWNyb3NvZnTCriBXaW5kb3drwq4gT38lcmF0aW5nIFN5c3RlbclRDl0vd2VyU2hlbGwuRVhFyVsKUE9XRVJTSEVMTMVfgvmUR8
Vkx/DPmg3FacmOrLMGxW6Vgun2B8lzDnBvd2Vyc2hlbGwuZXhlyXgqQzpcV2luZG93c1xTeXN0ZW0zMlxXaW5kb3dzUG93ZXJTaGVsbFx2MS4wxX2ACMWH2q0fyYwSV2luZG93cyBQb3dlclNoZWxsyZEOMTAuMC4xOTA0MS41NDbJlk5cRGV2aWNlXEhhcmRkaXNrVm9sdW1lM1
xXaW5kb3dzXFN5c3RlbTMyXFdpbmRvd3NQb3dlclNoZWxsXHYxLjBccG93ZXJzaGVsbC5leGXFmwDFpSDFquSMAtCsBMmwMFxcP1xWb2x1bWV7ODE1YTE2MGItNGVmOC00Yzc4LWJmZGYtZjUxZTAwOGE3YmZkfcKyAADKPMkGC29sYWZoYXJ0b25nyQsMMFhGRi1QQy1PTEFGxg
+YqWXLFA4cAQUAAAAAAAUVAAAA37sAjVPuDicdnBcY6gMAAADFVfQOxlrBnun++5WU7AHFX4ACxm6FEMV5AMuDCgGwAtAKAtAPBMMUDADGlxPFmaxYxpvA+sTx7P4fxZ0CwqAAAGoFu4qGhgokwLgBRJWWAWaHzfGJ3/\jzFoApYE+zQcJCgILQ29udGV4dEluZm8wAqqpywQgIC
AgICAgIFNldmVyaXR5ID0gSW5mb3JtYXRpb25hbA0KICAgICAgICBIb3N0IE5hbWUgPSBDb25zb2xlSG9zdA0KICAgICAgICBIb3N0IFZlcnNpb24gPSA1LjEuMTkwNDEuMTY0NQ0KICAgICAgICBIb3N0IElEID0gM2UwZGZhNzQtMzg5NC00YTE0LWJmMDItZjRhZGJlMzhiNm
M2DQogICAgICAgIEhvc3QgQXBwbGljYXRpb24gPSBwb3dlcnNoZWxsLmV4ZQ0KICAgICAgICBFbmdpbmUgVmVyc2lvbiA9IDUuMS4xOTA0MS4xNjQ1DQogICAgICAgIFJ1bnNwYWNlIElEID0gNWMyOTRkZDMtOGQ2OS00MDc4LTkzZTMtMmM4OGZiZDcwZDIyDQogICAgICAgIF
BpcGVsaW5lIElEID0gMTYNCiAgICAgICAgQ29tbWFuZCBOYW1lID0gR2V0LUNvbW1hbmQNCiAgICAgICAgQ29tbWFuZCBUeXBlID0gQ21kbGV0DQogICAgICAgIFNjcmlwdCBOYW1lID0gDQogICAgICAgIENvbW1hbmQgUGF0aCA9IA0KICAgICAgICBTZXF1ZW5jZSBOdW1iZX
IgPSA1Nw0KICAgICAgICBVc2VyID0gMFhGRi1QQy1PTEFGXG9sYWZoYXJ0b25nDQogICAgICAgIENvbm5lY3RlZCBVc2VyID0gDQogICAgICAgIFNoZWxsIElEID0gTWljcm9zb2Z0LlBvd2VyU2hlbGwNCsoJAADED4ACAAdQYXlsb2FkMAKqqSFDb21tYW5kIEdldC1Db21tYW
5kIGlzIFN0YXJ0ZWQuDQrKCQAAAMoJBa/hmLoGJMIIRMGXAWachbHfq8zy6swBANALAskNDENtZGxldCBzdGFydADKCssLCQELb2xhZmhhcnRvbmcAAA==

```
"))
�
        GenericEtwEvent
�GenericEtwEvent�
�       �
�������qD��f����� J�����������#�Å���*�powershell.exe�
                                                    powershell.exe��(��Ŷ�����������WindowsTerminal.exe���#����
�=���
�IJÜbOk���T��
             �Y�t�7�"���@������Y^��e_���_�fv�_���� �V�^�(��j�_�� ������i�_�����_[�e�_f�%system%\WindowsPowerShell
rating System�QPowerShell.EXE�[
�iY���n�����spowershell.exe�x*C:\Windows\System32\WindowsPowerShell\v1.0�)ÑΔRWindows PowerShello10.0.19041.546qN\D
{815a160b-4ef8-4c78-bfdf-f51e008a7bfd}²�<�
                                          olafhartong�

                                                  0XFF-PC-OLAF���e���S�'���U��Z���������_��n��y'

��
��
  Ir�XX������$ j����
$��D��f�������Z��>�

ContextInfo����         Severity = Informational
        Host Name = ConsoleHost
        Host Version = 5.1.19041.1645
        Host ID = 3e0dfa74-3894-4a14-bf02-f4adbe38b6c6
        Host Application = powershell.exe
        Engine Version = 5.1.19041.1645
        Runspace ID = 5c294dd3-8d69-4078-93e3-2c88fbd70d22
        Pipeline ID = 16
        Command Name = Get-Command
        Command Type = Cmdlet
        Script Name =
        Command Path =
        Sequence Number = 57
        User = 0XFF-PC-OLAF\olafhartong
        Connected User =
        Shell ID = Microsoft.PowerShell
�       ��Payload���!Command Get-Command is Started.
�       �       �U$D��f�� �����
                          �
Cmdlet start�
�

        olafhartong
```

```
ContextInfo����         Severity = Informational
        Host Name = ConsoleHost
        Host Version = 5.1.19041.1645
        Host ID = 3e0dfa74-3894-4a14-bf02-f4adbe38b6c6
        Host Application = powershell.exe
        Engine Version = 5.1.19041.1645
        Runspace ID = 5c294dd3-8d69-4078-93e3-2c88fbd70d22
        Pipeline ID = 16
        Command Name = Get-Command
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        Sequence Number = 57
        User = 0XFF-PC-OLAF\olafhartong
        Connected User =
        Shell ID = Microsoft.PowerShell
�       ��Payload���!Command Get-Command is Started.
�       �       �U$D��f�� �����
                          �
Cmdlet start�
�
```

What is the binary jibberish?

The data is serialized with Bond.

Bond is a cross-platform framework for working with schematized data. It supports cross-language de/serialization and powerful generic mechanisms for efficiently manipulating data. Bond is broadly used at Microsoft in most of their services.

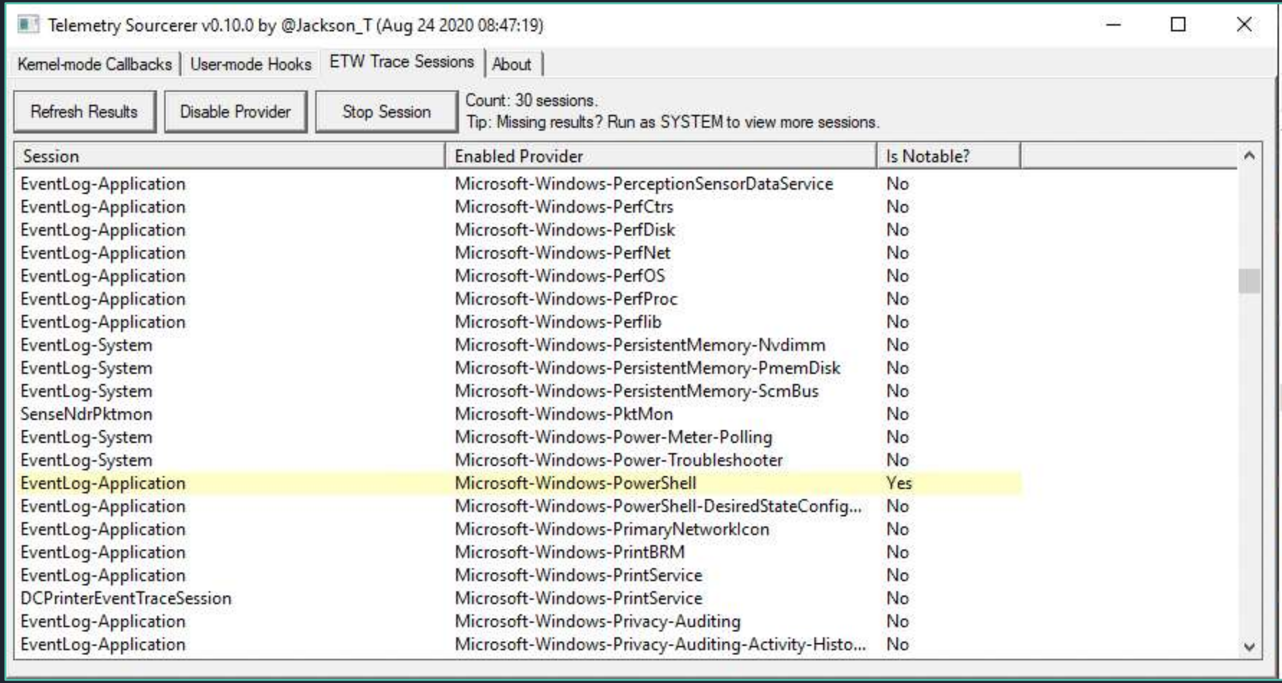
So far I have not found the schema's for these streams.

Next question is where is that data coming from, it clearly looks like PowerShell event logging.

https://github.com/microsoft/bond

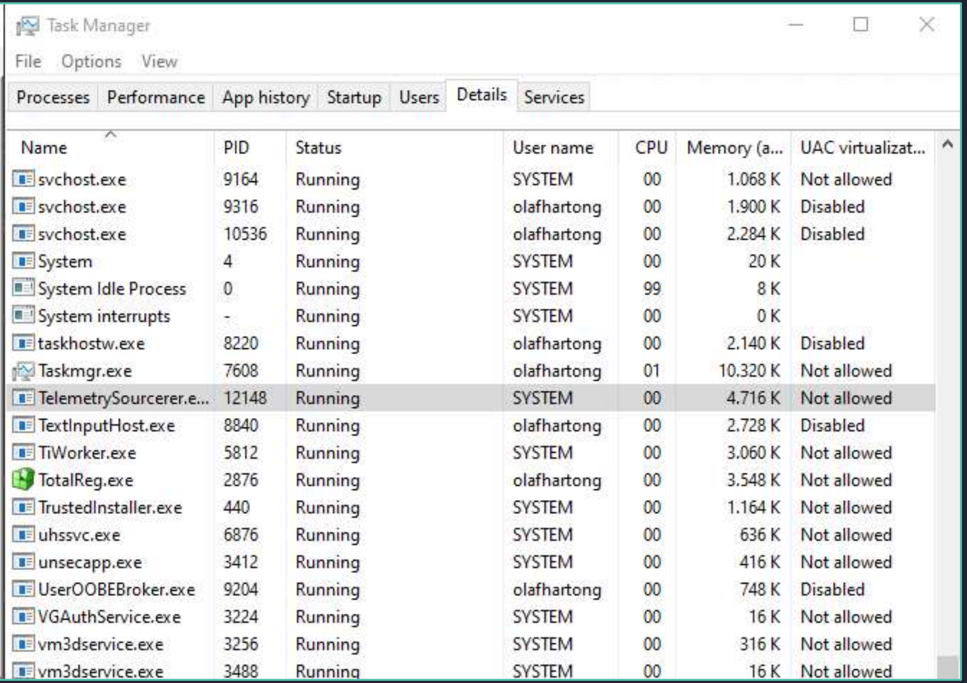
Where is the data coming from?

No direct subscription for anything other than the EventLog service



Count: 30 sessions.
Tip: Missing results? Run as SYSTEM to view more sessions.

Session	Enabled Provider	Is Notable?
EventLog-Application	Microsoft-Windows-PerceptionSensorDataService	No
EventLog-Application	Microsoft-Windows-PerfCtrs	No
EventLog-Application	Microsoft-Windows-PerfDisk	No
EventLog-Application	Microsoft-Windows-PerfNet	No
EventLog-Application	Microsoft-Windows-PerfOS	No
EventLog-Application	Microsoft-Windows-PerfProc	No
EventLog-Application	Microsoft-Windows-Perflib	No
EventLog-System	Microsoft-Windows-PersistentMemory-Nvdimm	No
EventLog-System	Microsoft-Windows-PersistentMemory-PmemDisk	No
EventLog-System	Microsoft-Windows-PersistentMemory-ScmBus	No
SenseNdrPktmon	Microsoft-Windows-PktMon	No
EventLog-System	Microsoft-Windows-Power-Meter-Polling	No
EventLog-System	Microsoft-Windows-Power-Troubleshooter	No
EventLog-Application	Microsoft-Windows-PowerShell	Yes
EventLog-Application	Microsoft-Windows-PowerShell-DesiredStateConfig...	No
EventLog-Application	Microsoft-Windows-PrimaryNetworkIcon	No
EventLog-Application	Microsoft-Windows-PrintBRM	No
EventLog-Application	Microsoft-Windows-PrintService	No
DCPrinterEventTraceSession	Microsoft-Windows-PrintService	No
EventLog-Application	Microsoft-Windows-Privacy-Auditing	No
EventLog-Application	Microsoft-Windows-Privacy-Auditing-Activity-Histo...	No



Name	PID	Status	User name	CPU	Memory (a...	UAC virtualizat...
svchost.exe	9164	Running	SYSTEM	00	1.068 K	Not allowed
svchost.exe	9316	Running	olafhartong	00	1.900 K	Disabled
svchost.exe	10536	Running	olafhartong	00	2.284 K	Disabled
System	4	Running	SYSTEM	00	20 K	
System Idle Process	0	Running	SYSTEM	99	8 K	
System interrupts	-	Running	SYSTEM	00	0 K	
taskhostw.exe	8220	Running	olafhartong	00	2.140 K	Disabled
Taskmgr.exe	7608	Running	olafhartong	01	10.320 K	Not allowed
TelemetrySourcerer.e...	12148	Running	SYSTEM	00	4.716 K	Not allowed
TextInputHost.exe	8840	Running	olafhartong	00	2.728 K	Disabled
TiWorker.exe	5812	Running	SYSTEM	00	3.060 K	Not allowed
TotalReg.exe	2876	Running	olafhartong	00	3.548 K	Not allowed
TrustedInstaller.exe	440	Running	SYSTEM	00	1.164 K	Not allowed
uhssvc.exe	6876	Running	SYSTEM	00	636 K	Not allowed
unsecapp.exe	3412	Running	SYSTEM	00	416 K	Not allowed
UserOOBEBroker.exe	9204	Running	olafhartong	00	748 K	Disabled
VGAuthService.exe	3224	Running	SYSTEM	00	16 K	Not allowed
vm3dservice.exe	3256	Running	SYSTEM	00	316 K	Not allowed
vm3dservice.exe	3488	Running	SYSTEM	00	16 K	Not allowed

So is MDE also making use of the regular EventLogs??

https://github.com/jthuraisamy/TelemetrySourcerer

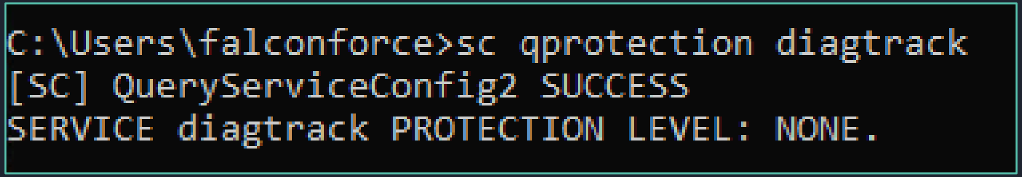
DiagTrack

MDE piggybacks of the Diagtrack service to get most of the ETW event telemetry. This service uses the DiagTrack-Listener subscription. MDE is not subscribing to all these providers itself.

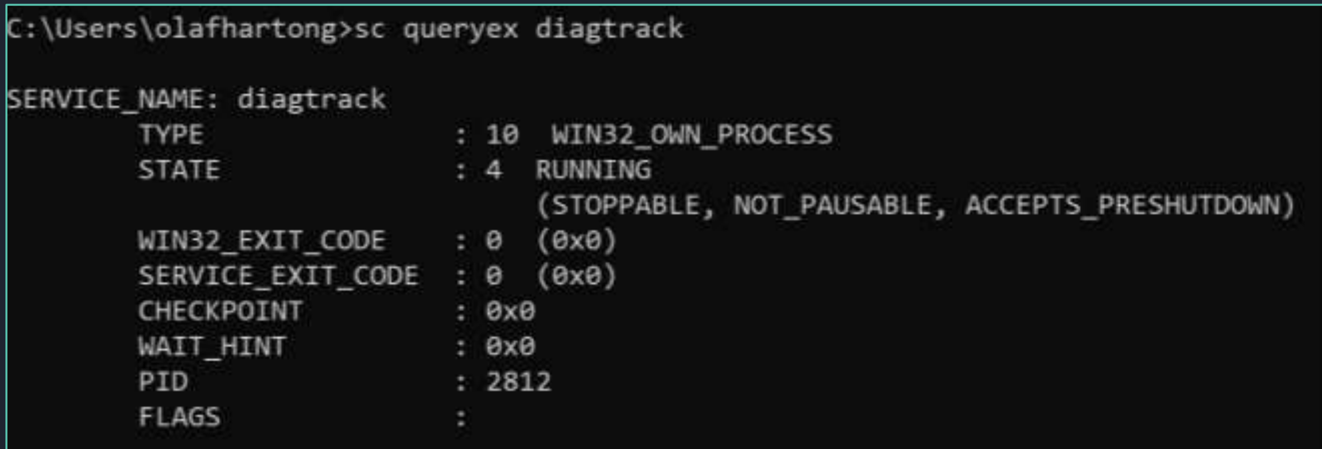
By default, only Local Administrators, Performance Log Users, and services running as LocalSystem, LocalService, NetworkService can control trace sessions and consume event data.

Since MDE uses the MsSense service, which runs as System this is fine.

Looking into this service I learnt this service is not protected. When you stop the DiagTrack service, there is no telemetry sent to the cloud anymore.



```
C:\Users\falconforce>sc qprotection diagtrack
[SC] QueryServiceConfig2 SUCCESS
SERVICE diagtrack PROTECTION LEVEL: NONE.
```



```
C:\Users\olafhartong>sc queryex diagtrack

SERVICE_NAME: diagtrack
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 4  RUNNING
                                (STOPPABLE, NOT_PAUSABLE, ACCEPTS_PRESHUTDOWN)
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0
        PID                : 2812
        FLAGS              :
```

Configuration

MDE Configuration

Like any product MDE also requires a configuration to know what to log.

This configuration is maintained by Microsoft and is downloaded from the internet on a regular basis.

It is stored on the box, in a non-clear text format.
Additionally it is signed and not easily tampered with.

The exact details are up to you to find out ;) *(sorry, not sorry)*

Configuration item examples

- Telemetry sources (ETW providers, Registry Keys etc.)
- Exclusions and Filters (for example; extensions, process names, certificate signatures)
- Capping (global and per event distinct field combination)
- Dynamic data collection
- Agent configuration
- Quotas (volumetric per time period)

Configuration stats

- ~ 70k lines of JSON
- ~ 65 ETW Providers utilized
- ~ 500 registry paths monitored
- ~ 60 data collection commands that fire frequently
- Different settings for high latency environments
- Elevated child process recording quotas for scripting tools and browsers

Configuration - ETW Providers (a selection)

Generic ETW CreateFile Pattern

Microsoft-Windows-ThreatIntelligence < Very intresting provider, only for AV/EDRs

Microsoft-Windows-DNS-Client

Microsoft.Web.Platform

Microsoft-Windows-Win32k

Microsoft-Antimalware-Scan-Interface

Microsoft-Antimalware-UacScan

Microsoft-Windows-TCPIP

Microsoft-Windows-WMI-Activity

Powershell cmdlets < We've just seen these events

Microsoft-Windows-AppLocker

Microsoft-Windows-CodeIntegrity

Microsoft.Windows.OLE.Clipboard

Microsoft-Windows-RemoteDesktopServices-RdpCoreTS

Microsoft-Windows-RPC

Microsoft-Windows-SEC

SecureETW < What would this be?

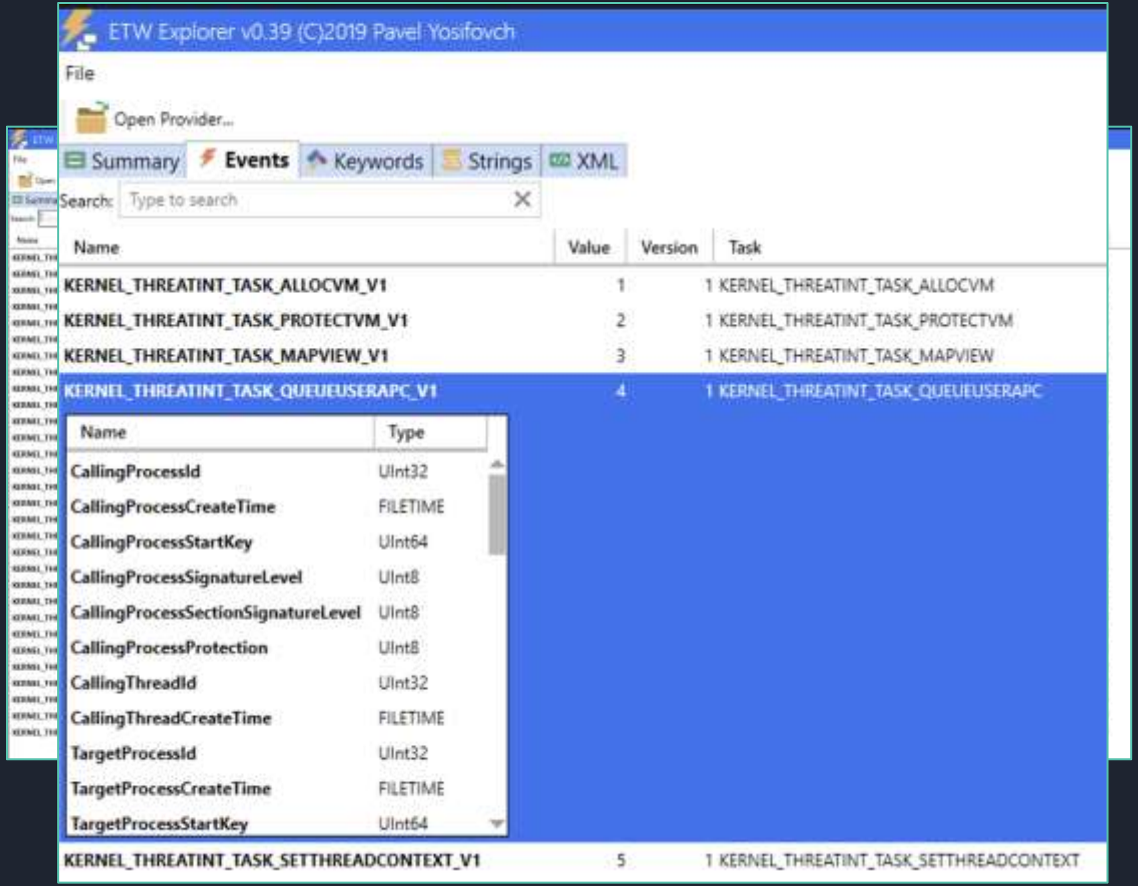
Microsoft-Windows-ThreatIntelligence

Windows native provider, only available to MS Authorized AV and EDR vendors.

Provides very rich telemetry into all kinds of API calls like;

- kernel32!VirtualAllocEx or ntdll!NtAllocateVirtualMemory
- kernel32!QueueUserAPC or ntdll!NtQueueApcThread
- kernel32!ReadProcessMemory or ntdll!NtReadVirtualMemory
- kernel32!SuspendThread or ntdll!NtSuspendThread
- kernel32!SetThreadContext or ntdll!NtSetContextThread
- ntdll!NtLoadDriver

And more



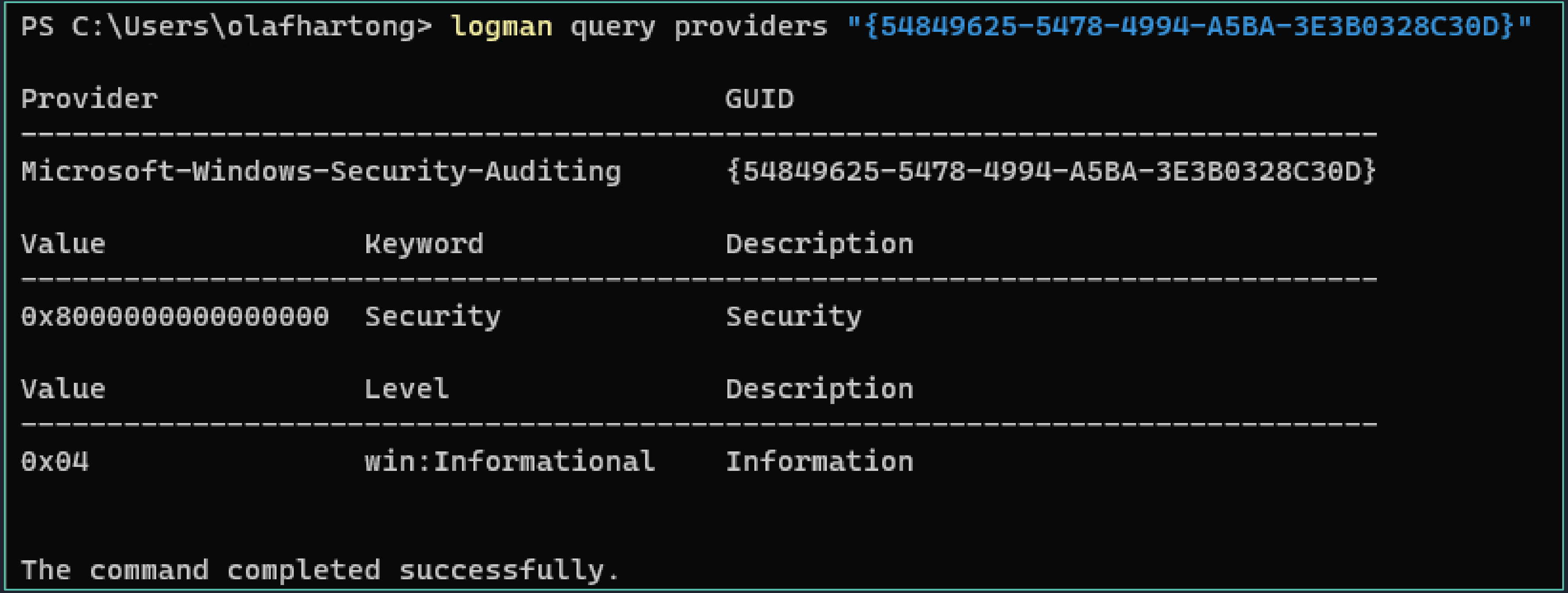
Name	Value	Version	Task
KERNEL_THREATINT_TASK_ALLOCVM_V1	1	1	KERNEL_THREATINT_TASK_ALLOCVM
KERNEL_THREATINT_TASK_PROTECTVM_V1	2	1	KERNEL_THREATINT_TASK_PROTECTVM
KERNEL_THREATINT_TASK_MAPVIEW_V1	3	1	KERNEL_THREATINT_TASK_MAPVIEW
KERNEL_THREATINT_TASK_QUEUEUSERAPC_V1	4	1	KERNEL_THREATINT_TASK_QUEUEUSERAPC
KERNEL_THREATINT_TASK_SETTHREADCONTEXT_V1	5	1	KERNEL_THREATINT_TASK_SETTHREADCONTEXT

Name	Type
CallingProcessId	UInt32
CallingProcessCreateTime	FILETIME
CallingProcessStartKey	UInt64
CallingProcessSignatureLevel	UInt8
CallingProcessSectionSignatureLevel	UInt8
CallingProcessProtection	UInt8
CallingThreadId	UInt32
CallingThreadCreateTime	FILETIME
TargetProcessId	UInt32
TargetProcessCreateTime	FILETIME
TargetProcessStartKey	UInt64

https://github.com/zodiacon/AllTools
https://blog.tofile.dev/2020/12/16/elam.html

SecureETW

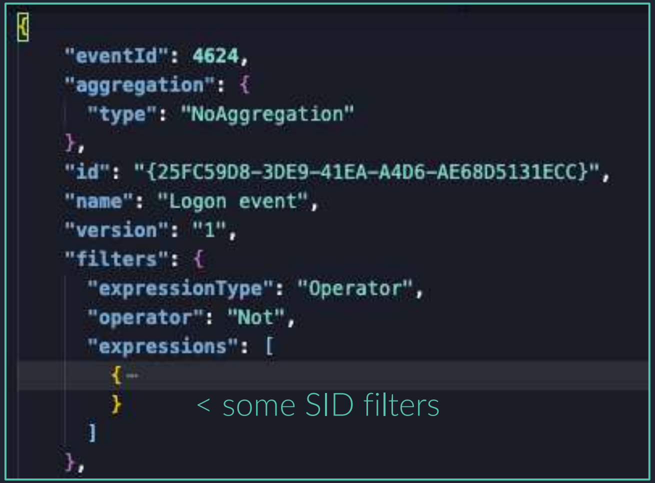
Listed in the configuration with the following
ProviderGuid: {54849625-5478-4994-A5BA-3E3B0328C30D}



```
PS C:\Users\olafhartong> logman query providers "{54849625-5478-4994-A5BA-3E3B0328C30D}"

Provider                                 GUID
-------------------------------------------------------------------------------
Microsoft-Windows-Security-Auditing      {54849625-5478-4994-A5BA-3E3B0328C30D}

Value               Keyword              Description
-------------------------------------------------------------------------------
0x8000000000000000  Security             Security

Value               Level                Description
-------------------------------------------------------------------------------
0x04                win:Informational    Information


The command completed successfully.
```

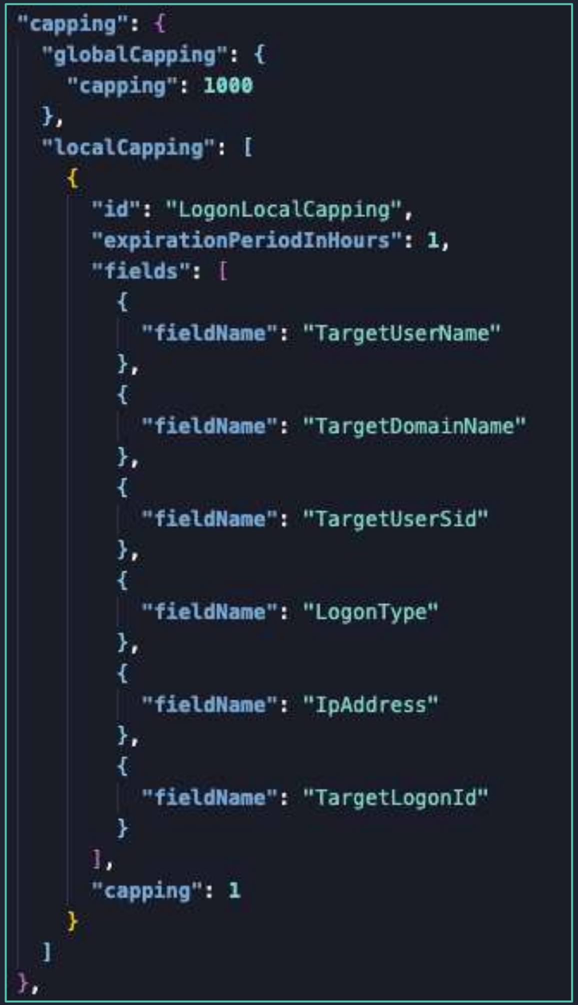
Also known as Microsoft-Windows-Security-Auditing

What does that config look like?

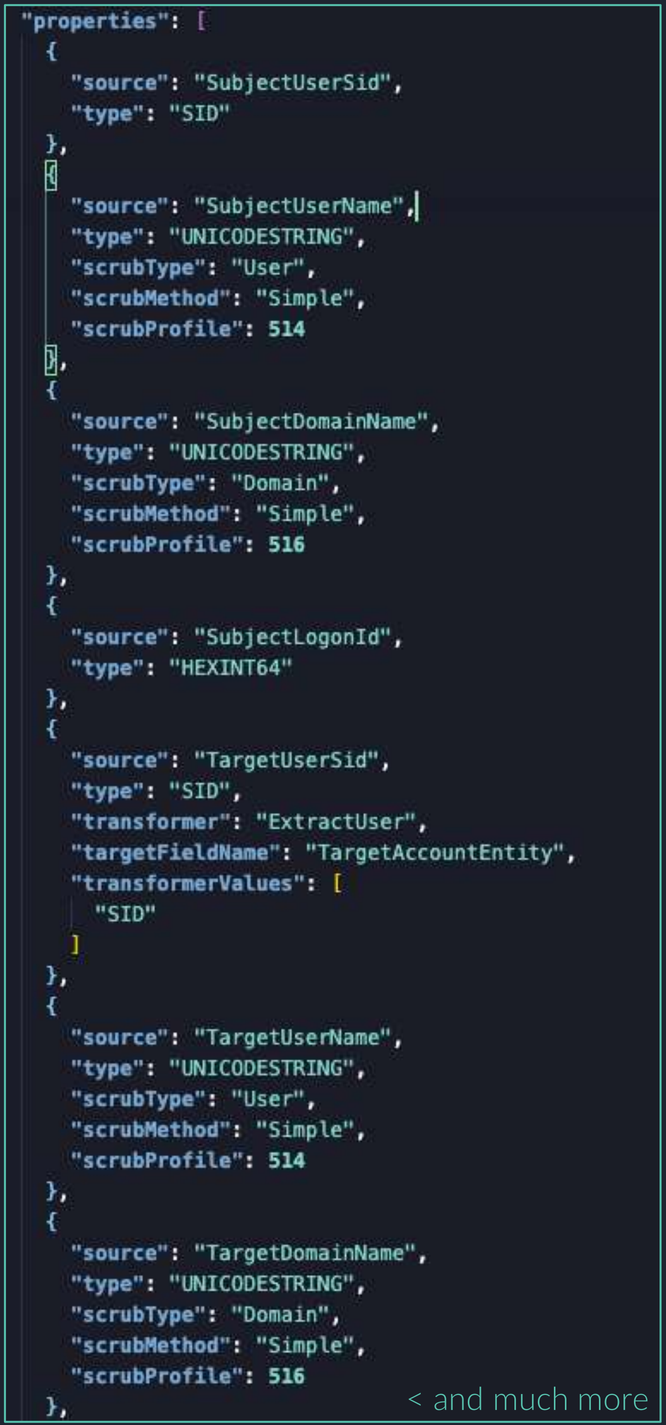


```
{
    "eventId": 4624,
    "aggregation": {
      "type": "NoAggregation"
    },
    "id": "{25FC59D8-3DE9-41EA-A4D6-AE68D5131ECC}",
    "name": "Logon event",
    "version": "1",
    "filters": {
      "expressionType": "Operator",
      "operator": "Not",
      "expressions": [
        {…
        }
      ]
    },
```

< some SID filters



```
"capping": {
  "globalCapping": {
    "capping": 1000
  },
  "localCapping": [
    {
      "id": "LogonLocalCapping",
      "expirationPeriodInHours": 1,
      "fields": [
        {
          "fieldName": "TargetUserName"
        },
        {
          "fieldName": "TargetDomainName"
        },
        {
          "fieldName": "TargetUserSid"
        },
        {
          "fieldName": "LogonType"
        },
        {
          "fieldName": "IpAddress"
        },
        {
          "fieldName": "TargetLogonId"
        }
      ],
      "capping": 1
    }
  ]
},
```

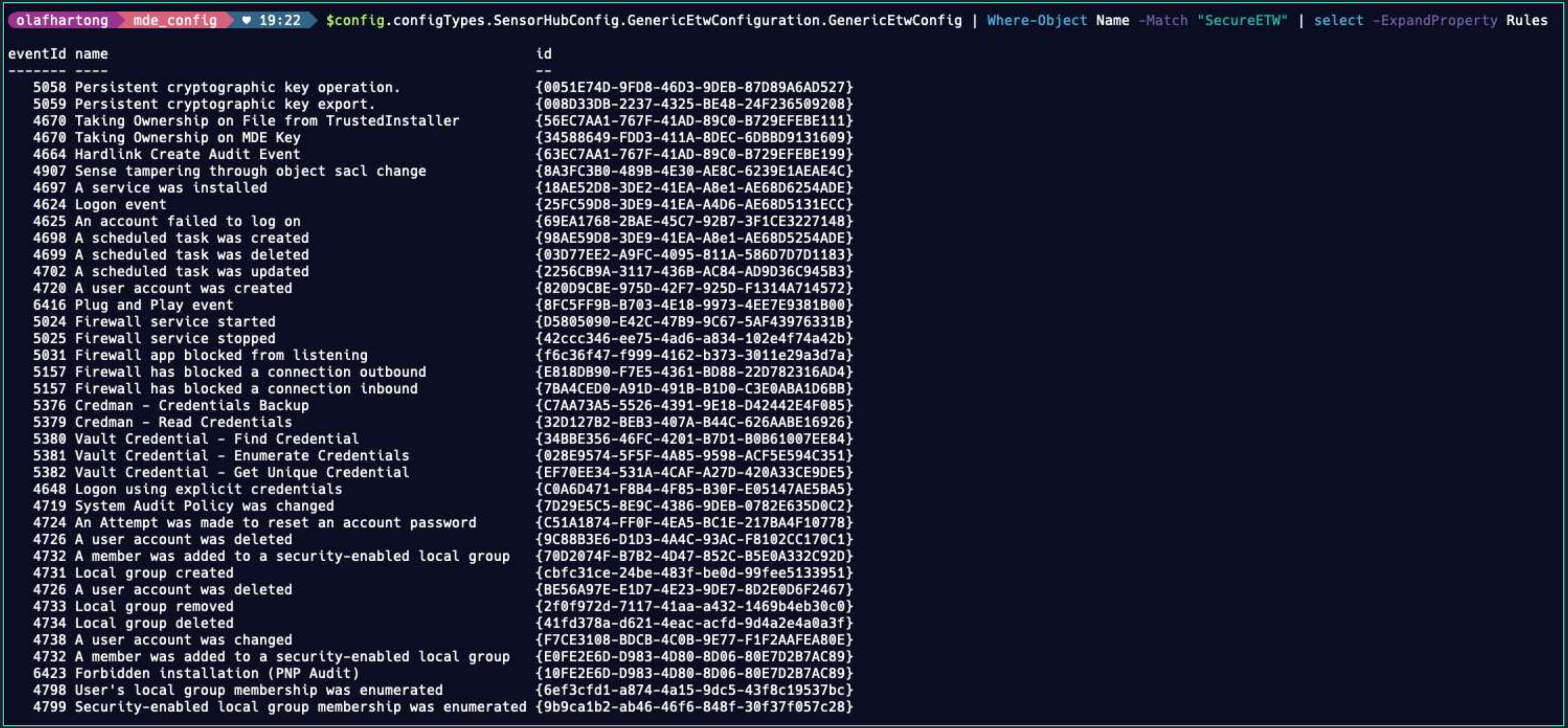


```
"properties": [
  {
    "source": "SubjectUserSid",
    "type": "SID"
  },
  {
    "source": "SubjectUserName",
    "type": "UNICODESTRING",
    "scrubType": "User",
    "scrubMethod": "Simple",
    "scrubProfile": 514
  },
  {
    "source": "SubjectDomainName",
    "type": "UNICODESTRING",
    "scrubType": "Domain",
    "scrubMethod": "Simple",
    "scrubProfile": 516
  },
  {
    "source": "SubjectLogonId",
    "type": "HEXINT64"
  },
  {
    "source": "TargetUserSid",
    "type": "SID",
    "transformer": "ExtractUser",
    "targetFieldName": "TargetAccountEntity",
    "transformerValues": [
      "SID"
    ]
  },
  {
    "source": "TargetUserName",
    "type": "UNICODESTRING",
    "scrubType": "User",
    "scrubMethod": "Simple",
    "scrubProfile": 514
  },
  {
    "source": "TargetDomainName",
    "type": "UNICODESTRING",
    "scrubType": "Domain",
    "scrubMethod": "Simple",
    "scrubProfile": 516
  },
```

< and much more

So, which other EventIDs is it looking for

Currently, the following Events are traced from the Security log:



```
olafhartong  mde_config  ♥ 19:22  $config.configTypes.SensorHubConfig.GenericEtwConfiguration.GenericEtwConfig | Where-Object Name -Match "SecureETW" | select -ExpandProperty Rules

eventId name                                                   id
------- ----                                                   --
   5058 Persistent cryptographic key operation.                {0051E74D-9FD8-46D3-9DEB-87D89A6AD527}
   5059 Persistent cryptographic key export.                   {008D33DB-2237-4325-BE48-24F236509208}
   4670 Taking Ownership on File from TrustedInstaller         {56EC7AA1-767F-41AD-89C0-B729EFEBE111}
   4670 Taking Ownership on MDE Key                            {34588649-FDD3-411A-8DEC-6DBBD9131609}
   4664 Hardlink Create Audit Event                            {63EC7AA1-767F-41AD-89C0-B729EFEBE199}
   4907 Sense tampering through object sacl change             {8A3FC3B0-489B-4E30-AE8C-6239E1AEAE4C}
   4697 A service was installed                                {18AE52D8-3DE2-41EA-A8e1-AE68D6254ADE}
   4624 Logon event                                            {25FC59D8-3DE9-41EA-A4D6-AE68D5131ECC}
   4625 An account failed to log on                            {69EA1768-2BAE-45C7-92B7-3F1CE3227148}
   4698 A scheduled task was created                           {98AE59D8-3DE9-41EA-A8e1-AE68D5254ADE}
   4699 A scheduled task was deleted                           {03D77EE2-A9FC-4095-811A-586D7D7D1183}
   4702 A scheduled task was updated                           {2256CB9A-3117-436B-AC84-AD9D36C945B3}
   4720 A user account was created                             {820D9CBE-975D-42F7-925D-F1314A714572}
   6416 Plug and Play event                                    {8FC5FF9B-B703-4E18-9973-4EE7E9381B00}
   5024 Firewall service started                               {D5805090-E42C-47B9-9C67-5AF43976331B}
   5025 Firewall service stopped                               {42ccc346-ee75-4ad6-a834-102e4f74a42b}
   5031 Firewall app blocked from listening                    {f6c36f47-f999-4162-b373-3011e29a3d7a}
   5157 Firewall has blocked a connection outbound             {E818DB90-F7E5-4361-BD88-22D782316AD4}
   5157 Firewall has blocked a connection inbound              {7BA4CED0-A91D-491B-B1D0-C3E0ABA1D6BB}
   5376 Credman - Credentials Backup                           {C7AA73A5-5526-4391-9E18-D42442E4F085}
   5379 Credman - Read Credentials                             {32D127B2-BEB3-407A-B44C-626AABE16926}
   5380 Vault Credential - Find Credential                     {34BBE356-46FC-4201-B7D1-B0B61007EE84}
   5381 Vault Credential - Enumerate Credentials               {028E9574-5F5F-4A85-9598-ACF5E594C351}
   5382 Vault Credential - Get Unique Credential               {EF70EE34-531A-4CAF-A27D-420A33CE9DE5}
   4648 Logon using explicit credentials                       {C0A6D471-F8B4-4F85-B30F-E05147AE5BA5}
   4719 System Audit Policy was changed                        {7D29E5C5-8E9C-4386-9DEB-0782E635D0C2}
   4724 An Attempt was made to reset an account password       {C51A1874-FF0F-4EA5-BC1E-217BA4F10778}
   4726 A user account was deleted                             {9C88B3E6-D1D3-4A4C-93AC-F8102CC170C1}
   4732 A member was added to a security-enabled local group   {70D2074F-B7B2-4D47-852C-B5E0A332C92D}
   4731 Local group created                                    {cbfc31ce-24be-483f-be0d-99fee5133951}
   4726 A user account was deleted                             {BE56A97E-E1D7-4E23-9DE7-8D2E0D6F2467}
   4733 Local group removed                                    {2f0f972d-7117-41aa-a432-1469b4eb30c0}
   4734 Local group deleted                                    {41fd378a-d621-4eac-acfd-9d4a2e4a0a3f}
   4738 A user account was changed                             {F7CE3108-BDCB-4C0B-9E77-F1F2AAFEA80E}
   4732 A member was added to a security-enabled local group   {E0FE2E6D-D983-4D80-8D06-80E7D2B7AC89}
   6423 Forbidden installation (PNP Audit)                     {10FE2E6D-D983-4D80-8D06-80E7D2B7AC89}
   4798 User's local group membership was enumerated           {6ef3cfd1-a874-4a15-9dc5-43f8c19537bc}
   4799 Security-enabled local group membership was enumerated {9b9ca1b2-ab46-46f6-848f-30f37f057c28}
```

Mapping EventIDs to name and Audit Category

eventId	MDE-Name	AuditCategory	AuditSubCategory
5058	Persistent cryptographic key operation.	System	Other System Events
5059	Persistent cryptographic key export.	System	Other System Events
4670	Taking Ownership on File from TrustedInstaller	Policy Change	Authorization Policy Change
4670	Taking Ownership on MDE Key	Policy Change	Authorization Policy Change
4664	Hardlink Create Audit Event	Object Access	File System
4907	Sense tampering through object sacl change	Policy Change	Audit Policy Change
4697	A service was installed	System	Security System Extension
4624	Logon event	Logon/Logoff	Logon
4625	An account failed to log on	Logon/Logoff	Logon
4698	A scheduled task was created	Object Access	Other Object Access Events
4699	A scheduled task was deleted	Object Access	Other Object Access Events
4702	A scheduled task was updated	Object Access	Other Object Access Events
4720	A user account was created	Account Management	User Account Management
6416	Plug and Play event	Detailed Tracking	Plug and Play Events
5024	Firewall service started	System	Other System Events
5025	Firewall service stopped	System	Other System Events
5031	Firewall app blocked from listening	Object Access	Filtering Platform Connection
5157	Firewall has blocked a connection outbound	Object Access	Filtering Platform Connection
5157	Firewall has blocked a connection inbound	Object Access	Filtering Platform Connection
5376	Credman - Credentials Backup	Account Management	User Account Management
5379	Credman - Read Credentials	Logon/Logoff	Other Logon/Logoff Events
5380	Vault Credential - Find Credential	Logon/Logoff	Other Logon/Logoff Events
5381	Vault Credential - Enumerate Credentials	Logon/Logoff	Other Logon/Logoff Events
5382	Vault Credential - Get Unique Credential	Logon/Logoff	Other Logon/Logoff Events
4648	Logon using explicit credentials	Logon/Logoff	Logon
4719	System Audit Policy was changed	Policy Change	Audit Policy Change
4724	An Attempt was made to reset an account password	Account Management	User Account Management
4726	A user account was deleted	Account Management	User Account Management
4732	A member was added to a security-enabled local group	Account Management	Security Group Management
4731	Local group created	Account Management	Security Group Management
4726	A user account was deleted	Account Management	User Account Management
4733	Local group removed	Account Management	Security Group Management
4734	Local group deleted	Account Management	Security Group Management
4738	A user account was changed	Account Management	User Account Management
4732	A member was added to a security-enabled local group	Account Management	Security Group Management
6423	Forbidden installation (PNP Audit)	Detailed Tracking	Plug and Play Events
4798	User's local group membership was enumerated	Account Management	User Account Management
4799	Security-enabled local group membership was enumerated	Account Management	Security Group Management

Microsoft Audit Policy settings

Audit policy settings **determine whether the operating system generates audit events when certain tasks are performed.**

These settings can be configured on 4 levels:

- No Auditing (0)
- Success (1)
- Failure (2)
- Success and Failure (3)

https://docs.microsoft.com/en-us/windows/security/threat-protection/auditing/basic-security-audit-policies

Are all these events available on all machines?

eventId	MDE-Name	AuditCategory	AuditSubCategory	Required setting	Win10 default	Default Ok?
5058	Persistent cryptographic key operation.	System	Other System Events	3	3	TRUE
5059	Persistent cryptographic key export.	System	Other System Events	3	3	TRUE
4670	Taking Ownership on File from TrustedInstaller	Policy Change	Authorization Policy Change	1	0	*FALSE*
4670	Taking Ownership on MDE Key	Policy Change	Authorization Policy Change	1	0	*FALSE*
4664	Hardlink Create Audit Event	Object Access	File System	1	0	*FALSE*
4907	Sense tampering through object sacl change	Policy Change	Audit Policy Change	1	1	TRUE
4697	A service was installed	System	Security System Extension	1	0	*FALSE*
4624	Logon event	Logon/Logoff	Logon	1	3	TRUE
4625	An account failed to log on	Logon/Logoff	Logon	2	3	TRUE
4698	A scheduled task was created	Object Access	Other Object Access Events	1	0	*FALSE*
4699	A scheduled task was deleted	Object Access	Other Object Access Events	1	0	*FALSE*
4702	A scheduled task was updated	Object Access	Other Object Access Events	1	0	*FALSE*
4720	A user account was created	Account Management	User Account Management	1	1	TRUE
6416	Plug and Play event	Detailed Tracking	Plug and Play Events	1	0	*FALSE*
5024	Firewall service started	System	Other System Events	1	3	TRUE
5025	Firewall service stopped	System	Other System Events	1	3	TRUE
5031	Firewall app blocked from listening	Object Access	Filtering Platform Connection	2	0	*FALSE*
5157	Firewall has blocked a connection outbound	Object Access	Filtering Platform Connection	2	0	*FALSE*
5157	Firewall has blocked a connection inbound	Object Access	Filtering Platform Connection	2	0	*FALSE*
5376	Credman - Credentials Backup	Account Management	User Account Management	1	1	TRUE
5379	Credman - Read Credentials	Logon/Logoff	Other Logon/Logoff Events	2	0	*FALSE*
5380	Vault Credential - Find Credential	Logon/Logoff	Other Logon/Logoff Events	2	0	*FALSE*
5381	Vault Credential - Enumerate Credentials	Logon/Logoff	Other Logon/Logoff Events	2	0	*FALSE*
5382	Vault Credential - Get Unique Credential	Logon/Logoff	Other Logon/Logoff Events	2	0	*FALSE*
4648	Logon using explicit credentials	Logon/Logoff	Logon	1	3	TRUE
4719	System Audit Policy was changed	Policy Change	Audit Policy Change	1	1	TRUE
4724	An Attempt was made to reset an account password	Account Management	User Account Management	3	1	*FALSE*
4726	A user account was deleted	Account Management	User Account Management	1	1	TRUE
4732	A member was added to a security-enabled local group	Account Management	Security Group Management	1	1	TRUE
4731	Local group created	Account Management	Security Group Management	1	1	TRUE
4726	A user account was deleted	Account Management	User Account Management	1	1	TRUE
4733	Local group removed	Account Management	Security Group Management	1	1	TRUE
4734	Local group deleted	Account Management	Security Group Management	1	1	TRUE
4738	A user account was changed	Account Management	User Account Management	1	1	TRUE
4732	A member was added to a security-enabled local group	Account Management	Security Group Management	1	1	TRUE
6423	Forbidden installation (PNP Audit)	Detailed Tracking	Plug and Play Events	1	0	*FALSE*
4798	User's local group membership was enumerated	Account Management	User Account Management	1	1	TRUE
4799	Security-enabled local group membership was enumerated	Account Management	Security Group Management	1	1	TRUE

So, we seem to be having some blind spots

Fortunately, the MDE team tries to help you a bit here.

They’ll enable some of the settings when you install the agent.

eventId	MDE-Name	AuditCategory	AuditSubCategory	Required Setting	Win10 Default	Win10 + Defender	DefaultOk?	PostDefenderInstall
4670	Taking Ownership on File from TrustedInstaller	Policy Change	Authorization Policy Change	1	0	0	FALSE	FALSE
4670	Taking Ownership on MDE Key	Policy Change	Authorization Policy Change	1	0	0	FALSE	FALSE
4664	Hardlink Create Audit Event	Object Access	File System	1	0	3	FALSE	TRUE
4697	A service was installed	System	Security System Extension	1	0	3	FALSE	TRUE
4698	A scheduled task was created	Object Access	Other Object Access Events	1	0	3	FALSE	TRUE
4699	A scheduled task was deleted	Object Access	Other Object Access Events	1	0	3	FALSE	TRUE
4702	A scheduled task was updated	Object Access	Other Object Access Events	1	0	3	FALSE	TRUE
6416	Plug and Play event	Detailed Tracking	Plug and Play Events	1	0	3	FALSE	TRUE
5031	Firewall app blocked from listening	Object Access	Filtering Platform Connection	2	0	0	FALSE	FALSE
5157	Firewall has blocked a connection outbound	Object Access	Filtering Platform Connection	2	0	0	FALSE	FALSE
5157	Firewall has blocked a connection inbound	Object Access	Filtering Platform Connection	2	0	0	FALSE	FALSE
5379	Credman - Read Credentials	Logon/Logoff	Other Logon/Logoff Events	2	0	0	FALSE	FALSE
5380	Vault Credential - Find Credential	Logon/Logoff	Other Logon/Logoff Events	2	0	0	FALSE	FALSE
5381	Vault Credential - Enumerate Credentials	Logon/Logoff	Other Logon/Logoff Events	2	0	0	FALSE	FALSE
5382	Vault Credential - Get Unique Credential	Logon/Logoff	Other Logon/Logoff Events	2	0	0	FALSE	FALSE
4724	An Attempt was made to reset an account password	Account Management	User Account Management	3	1	3	FALSE	TRUE
6423	Forbidden installation (PNP Audit)	Detailed Tracking	Plug and Play Events	1	0	3	FALSE	TRUE

So, we seem to be having some possible blind spots

- However, the categories that are producing a larger volume of telemetry are untouched to not interfere with the log ingestion volume on your SIEM.
- These settings are not documented in the MDE documentation and might be overwritten by Group Policy settings.
- Make sure to check your GPOs and enable the events you care about. Otherwise there will be no telemetry AND no alerts on these events.

PowerShell script to check your environment

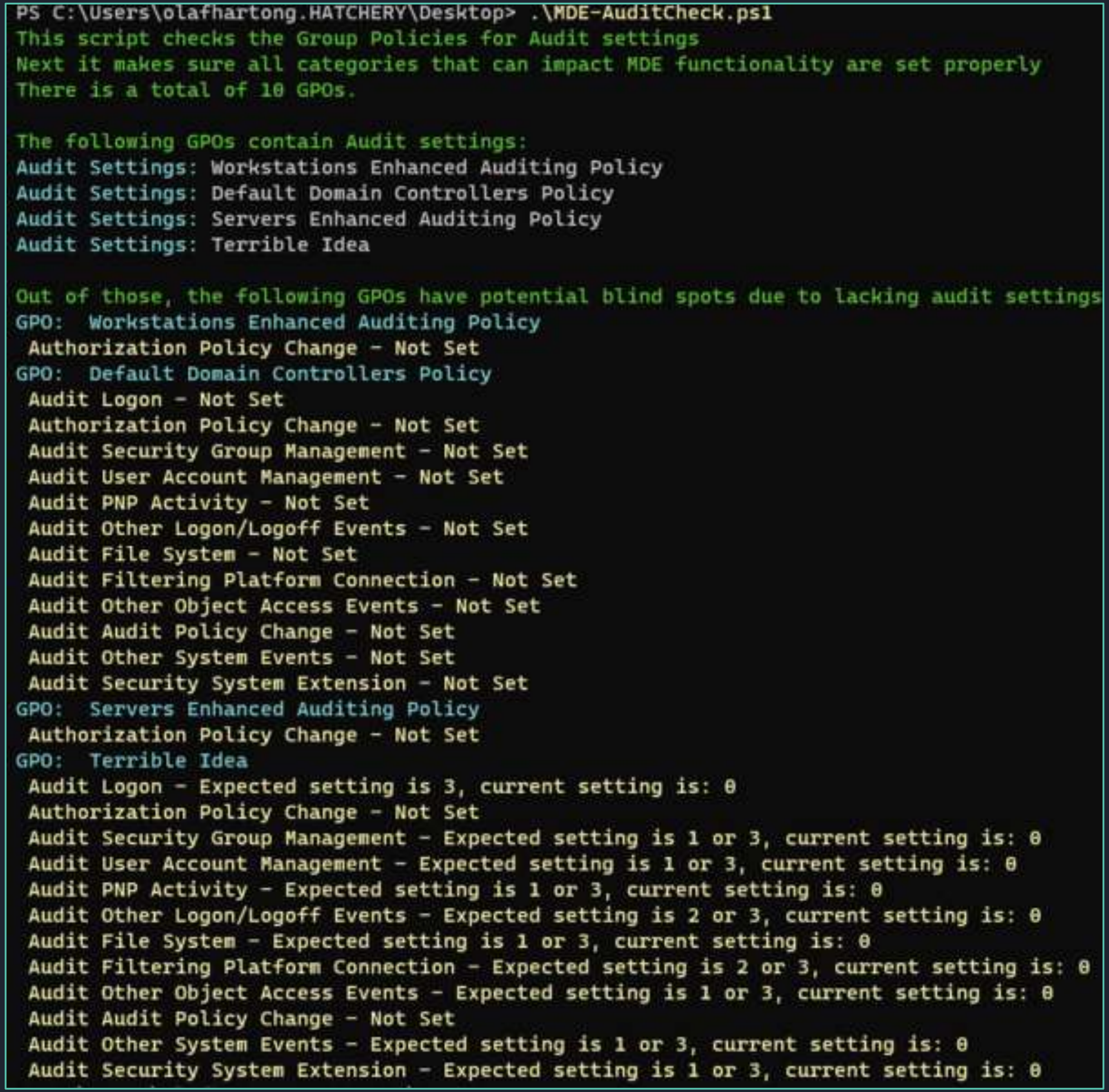
I’ve created an ugly script to check all your GPOs are set properly.

Obviously some are layered so make sure to check that too.

The script relies on the Remote Server Administration Tools (RSAT).

It’s available on my GitHub:

https://github.com/olafhartong/MDE-AuditCheck



```
PS C:\Users\olafhartong.HATCHERY\Desktop> .\MDE-AuditCheck.ps1
This script checks the Group Policies for Audit settings
Next it makes sure all categories that can impact MDE functionality are set properly
There is a total of 10 GPOs.

The following GPOs contain Audit settings:
Audit Settings: Workstations Enhanced Auditing Policy
Audit Settings: Default Domain Controllers Policy
Audit Settings: Servers Enhanced Auditing Policy
Audit Settings: Terrible Idea

Out of those, the following GPOs have potential blind spots due to lacking audit settings
GPO:  Workstations Enhanced Auditing Policy
 Authorization Policy Change - Not Set
GPO:  Default Domain Controllers Policy
 Audit Logon - Not Set
 Authorization Policy Change - Not Set
 Audit Security Group Management - Not Set
 Audit User Account Management - Not Set
 Audit PNP Activity - Not Set
 Audit Other Logon/Logoff Events - Not Set
 Audit File System - Not Set
 Audit Filtering Platform Connection - Not Set
 Audit Other Object Access Events - Not Set
 Audit Audit Policy Change - Not Set
 Audit Other System Events - Not Set
 Audit Security System Extension - Not Set
GPO:  Servers Enhanced Auditing Policy
 Authorization Policy Change - Not Set
GPO:  Terrible Idea
 Audit Logon - Expected setting is 3, current setting is: 0
 Authorization Policy Change - Not Set
 Audit Security Group Management - Expected setting is 1 or 3, current setting is: 0
 Audit User Account Management - Expected setting is 1 or 3, current setting is: 0
 Audit PNP Activity - Expected setting is 1 or 3, current setting is: 0
 Audit Other Logon/Logoff Events - Expected setting is 2 or 3, current setting is: 0
 Audit File System - Expected setting is 1 or 3, current setting is: 0
 Audit Filtering Platform Connection - Expected setting is 2 or 3, current setting is: 0
 Audit Other Object Access Events - Expected setting is 1 or 3, current setting is: 0
 Audit Audit Policy Change - Not Set
 Audit Other System Events - Expected setting is 1 or 3, current setting is: 0
 Audit Security System Extension - Expected setting is 1 or 3, current setting is: 0
```

Sysmon vs MDE

Pros and cons per solution

Sysmon

+ Full control over the config and the data you'll get

+ Best applied to augment MDE or in full parallel

+ Rich and unsampled telemetry

- You must maintain it yourself (config, ingestion and detections)

- Only detection, no response

MDE

+ Fully maintained by Microsoft (config and ingestion)

+ Detection and Response capability, custom detections possible in addition

+ Rich set of telemetry, way more than Sysmon

- The configuration is non-configurable

- Telemetry is sampled for most events

https://medium.com/falconforce/sysmon-vs-microsoft-defender-for-endpoint-mde-internals-0x01-1e5663b10347

Sysmon vs MDE telemetry

Sysmon ID	Sysmon Event Name	MDE Table	ActionType	Notes on MDE
1	Process Creation	DeviceProcessEvents	ProcessCreated	
2	Process Changed a file creation time	n/a	n/a	
3	Network Connection	DeviceNetworkEvents	ConnectionFound, ConnectionSuccess, ConnectionFailed, InboundConnectionAccepted, ListeningConnectionCreated, ConnectionAttempt, ConnectionAcknowledged, ConnectionRequest	Heavily sampled, only 1st seen event
4	*Sysmon Service State Change*	*-*	*-*	
5	Process Terminated	*n/a*	*n/a*	
6	Driver Loaded	DeviceEvents	DriverLoad	No signer information only hashes
7	Image Loaded	DeviceImageLoadEvents	ImageLoaded	Heavily sampled
8	Create Remote Thread	DeviceEvents	CreateRemoteThreadApiCall	Missing info compared to Sysmon: NewThreadId, StartAddress, StartModule, StartFunction
9	*Raw File Access Read*	*n/a*	*n/a*	
10	Process Access	DeviceEvents	ReadProcessMemoryApiCall, WriteToLsassProcessMemory, OpenProcessApiCall	ONLY logged for the lsass.exe process. It does provide TotalBytesCopied on ReadProcessMemoryApiCall. On OpenProcessApiCall is supplies the DesiredAccess in decimalvalues
11	File Create	DeviceFileEvents	FileCreated	
12	Registry Create and Delete	DeviceRegistryEvents	RegistryKeyCreated, RegistryKeyDeleted, RegistryValueDeleted	Filters are applied
13	Registry Value Set	DeviceRegistryEvents	RegistryValueSet	Filters are applied
14	Registry Key and Value Rename	*n/a*	*n/a*	
15	File Create Stream Hash	*n/a*	*n/a*	Seems to be there in MDE but often unpopulated
16	*Sysmon Config Change*	*-*	*-*	
17	Pipe Event Created	DeviceEvents	NamedPipeEvent	Only first seen event, connect or create
18	Pipe Event Connected	*n/a*	*n/a*	
19	WMI EventFilter activity	*n/a*	*n/a*	
20	WMI EventConsumer activity	DeviceEvents	ProcessCreatedUsingWmiQuery	
21	WMI EventConsumerToFilter activity	DeviceEvents	WmiBindEventFilterToConsumer	
22	DNS Query	DeviceEvents	DnsQueryResponse	Response to successful queries
23	FileDelete	DeviceFileEvents	FileDeleted	
24	*ClipboardChange*	*n/a*	*n/a*	
25	Process Tampering	*n/a*	*n/a*	No exposed telemetry, it does have alerts for it
26	FileDeleteDetected	DeviceFileEvents	FileDeleted	No file retention option

Sysmon vs MDE – features / telemetry

Sysmon - Unique

- Clipboard events saving
- Deleted files saving
- Preserve deleted PE files
- Preserve files for configured processes
- Preserve files with configured extensions
- Preserve files for configured SIDs

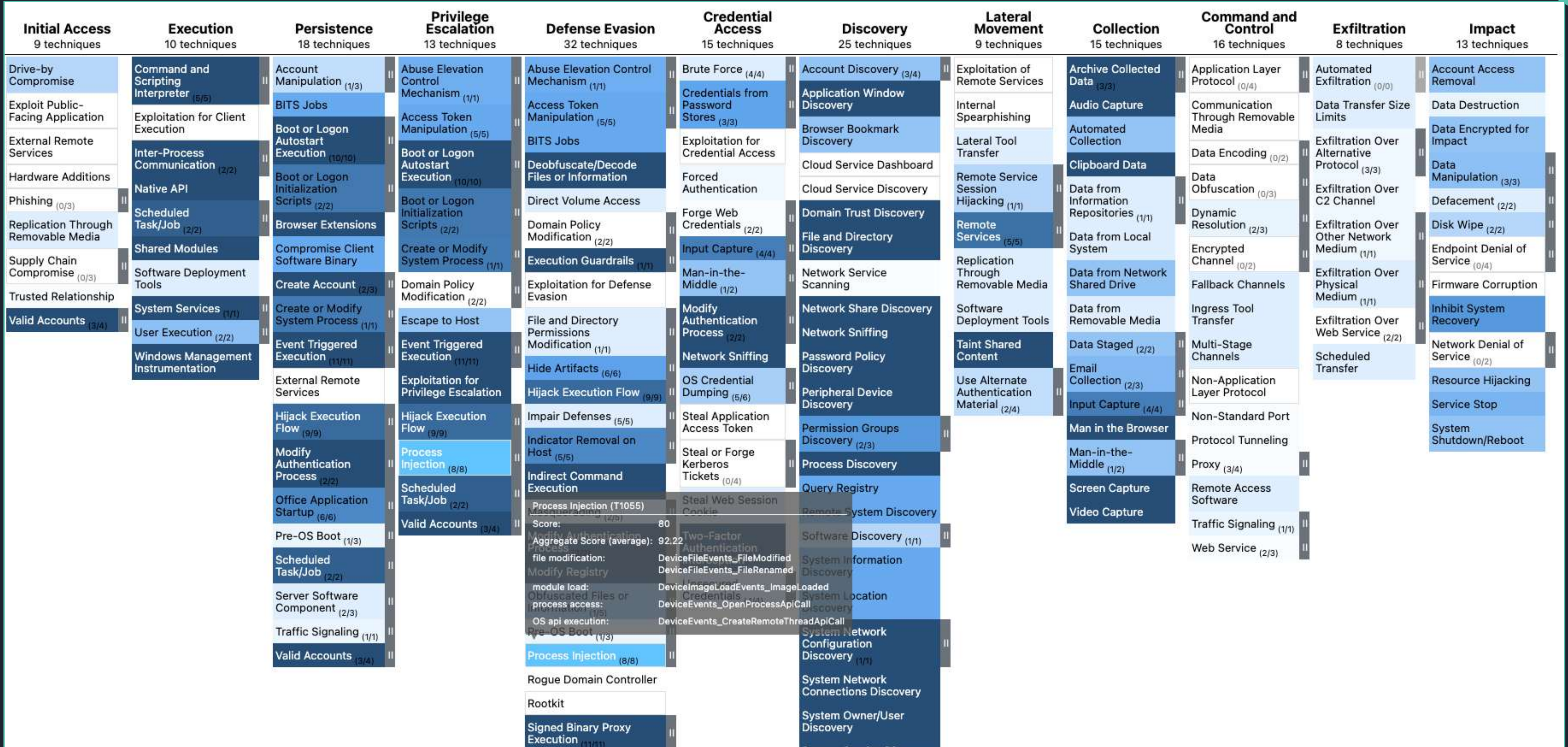
MDE - Unique

DeviceFileEvents	FileRenamed
DeviceFileEvents	FileModified
DeviceLogonEvents	LogonAttempted
DeviceLogonEvents	LogonFailed
DeviceLogonEvents	LogonSuccess
DeviceFileCertificateInfo	-
DeviceInfo	-
DeviceNetworkInfo	-

- AntivirusDetection
- AntivirusDetectionActionType
- AntivirusReport
- AntivirusScanCancelled
- AntivirusScanCompleted
- AntivirusScanFailed
- AppControlCodeIntegritySigningInformation
- AppControlExecutableBlocked
- AppControlScriptBlocked
- AsrAdobeReaderChildProcessBlocked
- AsrExecutableEmailContentBlocked
- AsrExecutableOfficeContentAudited
- AsrExecutableOfficeContentBlocked
- AsrLsassCredentialTheftAudited
- AsrLsassCredentialTheftBlocked
- AsrObfuscatedScriptAudited
- AsrOfficeChildProcessAudited
- AsrOfficeChildProcessBlocked
- AsrOfficeCommAppChildProcessAudited
- AsrOfficeCommAppChildProcessBlocked
- AsrOfficeMacroWin32ApiCallsAudited
- AsrOfficeMacroWin32ApiCallsBlocked
- AsrOfficeProcessInjectionAudited
- AsrOfficeProcessInjectionBlocked
- AsrPsexecWmiChildProcessAudited
- AsrRansomwareBlocked
- AsrUntrustedExecutableAudited
- AsrUntrustedUsbProcessAudited
- AsrUntrustedUsbProcessBlocked
- AuditPolicyModification
- BluetoothPolicyTriggered
- BrowserLaunchedToOpenUrl
- ControlFlowGuardViolation
- ControlledFolderAccessViolationAudited
- ControlledFolderAccessViolationBlocked
- CreateRemoteThreadApiCall
- CredentialsBackup
- DeviceBootAttestationInfo
- DnsQueryResponse
- DriverLoad
- ExploitGuardAcgAudited
- ExploitGuardAcgEnforced
- ExploitGuardChildProcessAudited
- ExploitGuardChildProcessBlocked
- ExploitGuardEafViolationBlocked
- ExploitGuardLowIntegrityImageAudited
- ExploitGuardLowIntegrityImageBlocked
- ExploitGuardNetworkProtectionAudited
- ExploitGuardNonMicrosoftSignedAudited
- ExploitGuardNonMicrosoftSignedBlocked
- ExploitGuardSharedBinaryAudited
- ExploitGuardSharedBinaryBlocked
- ExploitGuardWin32SystemCallBlocked
- FirewallInboundConnectionBlocked
- FirewallInboundConnectionToAppBlocked
- FirewallOutboundConnectionBlocked
- GetAsyncKeyStateApiCall
- GetClipboardData
- LdapSearch
- MemoryRemoteProtect
- NamedPipeEvent
- NtAllocateVirtualMemoryApiCall
- NtAllocateVirtualMemoryRemoteApiCall
- NtMapViewOfSectionRemoteApiCall
- NtProtectVirtualMemoryApiCall
- OpenProcessApiCall
- OtherAlertRelatedActivity
- PnpDeviceAllowed
- PnpDeviceBlocked
- PnpDeviceConnected
- PowerShellCommand
- ProcessCreatedUsingWmiQuery
- ProcessPrimaryTokenModified
- QueueUserApcRemoteApiCall
- ReadProcessMemoryApiCall
- RemoteDesktopConnection
- RemoteWmiOperation
- SafeDocFileScan
- ScheduledTaskCreated
- ScheduledTaskDeleted
- ScheduledTaskUpdated
- ScreenshotTaken
- ScriptContent
- SecurityGroupCreated
- SecurityGroupDeleted
- SecurityLogCleared
- SensitiveFileRead
- ServiceInstalled
- SetThreadContextRemoteApiCall
- ShellLinkCreateFileEvent
- SmartScreenAppWarning
- SmartScreenExploitWarning
- SmartScreenUrlWarning
- SmartScreenUserOverride
- UntrustedWifiConnection
- UsbDriveDriveLetterChanged
- UsbDriveMounted
- UsbDriveUnmounted
- UserAccountAddedToLocalGroup
- UserAccountCreated
- UserAccountDeleted
- UserAccountModified
- UserAccountRemovedFromLocalGroup
- WmiBindEventFilterToConsumer
- WriteToLsassProcessMemory

…. 181 in total

MDE telemetry potential mapping to MITRE ATT&CK

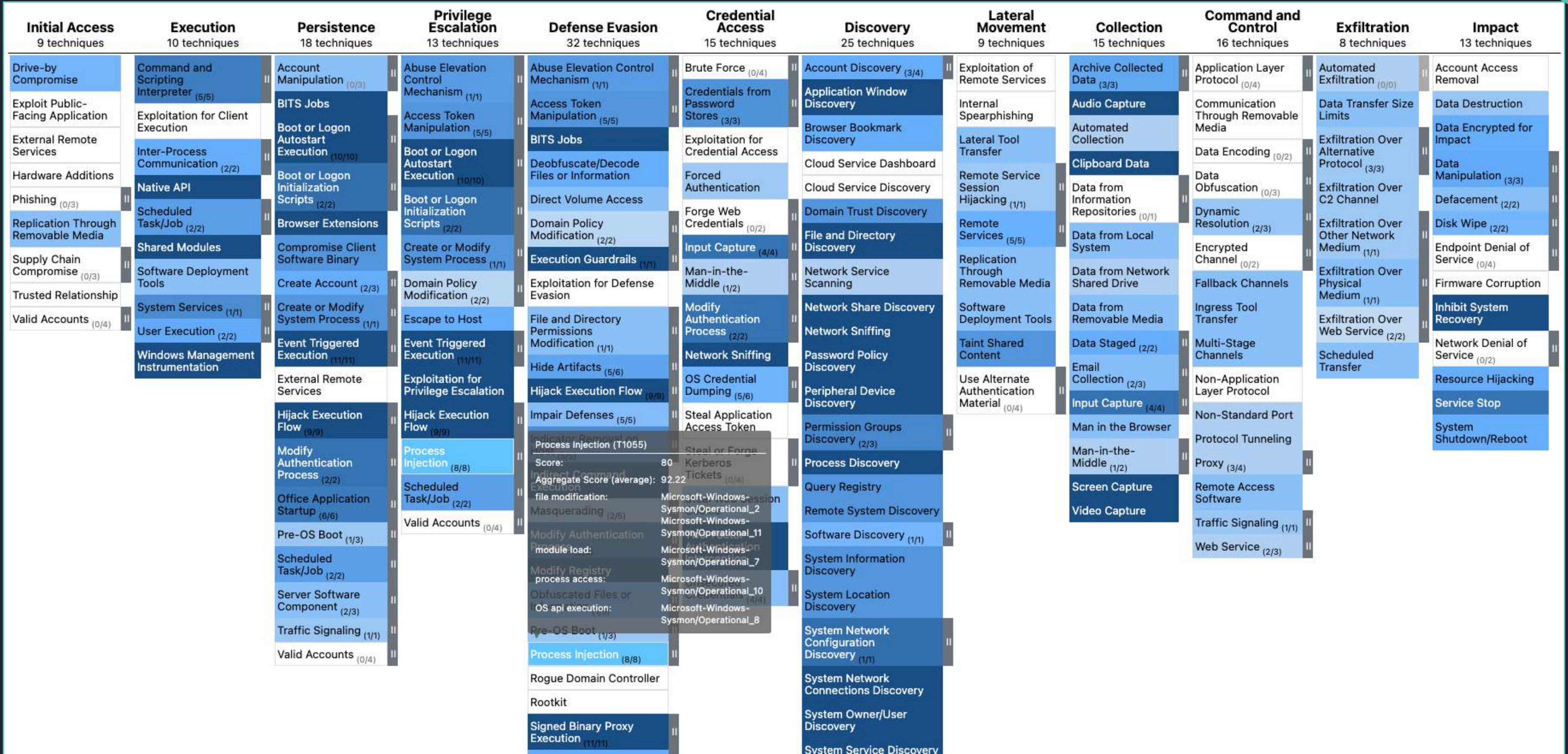


Initial Access 9 techniques	Execution 10 techniques	Persistence 18 techniques	Privilege Escalation 13 techniques	Defense Evasion 32 techniques	Credential Access 15 techniques	Discovery 25 techniques	Lateral Movement 9 techniques	Collection 15 techniques	Command and Control 16 techniques	Exfiltration 8 techniques	Impact 13 techniques
Drive-by Compromise	Command and Scripting Interpreter (5/5)	Account Manipulation (1/3)	Abuse Elevation Control Mechanism (1/1)	Abuse Elevation Control Mechanism (1/1)	Brute Force (4/4)	Account Discovery (3/4)	Exploitation of Remote Services	Archive Collected Data (3/3)	Application Layer Protocol (0/4)	Automated Exfiltration (0/0)	Account Access Removal
Exploit Public-Facing Application	Exploitation for Client Execution	BITS Jobs	Access Token Manipulation (5/5)	Access Token Manipulation (5/5)	Credentials from Password Stores (3/3)	Application Window Discovery	Internal Spearphishing	Audio Capture	Communication Through Removable Media	Data Transfer Size Limits	Data Destruction
External Remote Services	Inter-Process Communication (2/2)	Boot or Logon Autostart Execution (10/10)	Boot or Logon Autostart Execution (10/10)	BITS Jobs	Exploitation for Credential Access	Browser Bookmark Discovery	Lateral Tool Transfer	Automated Collection	Data Encoding (0/2)	Exfiltration Over Alternative Protocol (3/3)	Data Encrypted for Impact
Hardware Additions	Native API	Boot or Logon Initialization Scripts (2/2)	Boot or Logon Initialization Scripts (2/2)	Deobfuscate/Decode Files or Information	Forced Authentication	Cloud Service Dashboard	Remote Service Session Hijacking (1/1)	Clipboard Data	Data Obfuscation (0/3)	Exfiltration Over C2 Channel	Data Manipulation (3/3)
Phishing (0/3)	Scheduled Task/Job (2/2)	Browser Extensions	Create or Modify System Process (1/1)	Direct Volume Access	Forge Web Credentials (2/2)	Cloud Service Discovery	Remote Services (5/5)	Data from Information Repositories (1/1)	Dynamic Resolution (2/3)	Exfiltration Over Other Network Medium (1/1)	Defacement (2/2)
Replication Through Removable Media	Shared Modules	Compromise Client Software Binary	Domain Policy Modification (2/2)	Domain Policy Modification (2/2)	Input Capture (4/4)	Domain Trust Discovery	Replication Through Removable Media	Data from Local System	Encrypted Channel (0/2)	Exfiltration Over Physical Medium (1/1)	Disk Wipe (2/2)
Supply Chain Compromise (0/3)	Software Deployment Tools	Create Account (2/3)	Escape to Host	Execution Guardrails (1/1)	Man-in-the-Middle (1/2)	File and Directory Discovery	Software Deployment Tools	Data from Network Shared Drive	Fallback Channels	Exfiltration Over Web Service (2/2)	Endpoint Denial of Service (0/4)
Trusted Relationship	System Services (1/1)	Create or Modify System Process (1/1)	Event Triggered Execution (11/11)	Exploitation for Defense Evasion	Modify Authentication Process (2/2)	Network Service Scanning	Taint Shared Content	Data from Removable Media	Ingress Tool Transfer	Scheduled Transfer	Firmware Corruption
Valid Accounts (3/4)	User Execution (2/2)	Event Triggered Execution (11/11)	Exploitation for Privilege Escalation	File and Directory Permissions Modification (1/1)	Network Sniffing	Network Share Discovery	Use Alternate Authentication Material (2/4)	Data Staged (2/2)	Multi-Stage Channels		Inhibit System Recovery
	Windows Management Instrumentation	External Remote Services	Hijack Execution Flow (9/9)	Hide Artifacts (6/6)	OS Credential Dumping (5/6)	Network Sniffing		Email Collection (3/3)	Non-Application Layer Protocol		Network Denial of Service (0/2)
		Hijack Execution Flow (9/9)	Process Injection (8/8)	Hijack Execution Flow (9/9)	Steal Application Access Token	Password Policy Discovery		Input Capture (4/4)	Non-Standard Port		Resource Hijacking
		Modify Authentication Process (2/2)	Scheduled Task/Job (2/2)	Impair Defenses (5/5)	Steal or Forge Kerberos Tickets (0/4)	Peripheral Device Discovery		Man in the Browser	Protocol Tunneling		Service Stop
		Office Application Startup (6/6)	Valid Accounts (3/4)	Indicator Removal on Host (5/5)	Steal Web Session Cookie	Permission Groups Discovery (2/3)		Man-in-the-Middle (1/2)	Proxy (3/4)		System Shutdown/Reboot
		Pre-OS Boot (1/3)		Indirect Command Execution	Two-Factor Authentication Interception	Process Discovery		Screen Capture	Remote Access Software		
		Scheduled Task/Job (2/2)		Masquerading (2/5)	Unsecured Credentials (1/4)	Query Registry		Video Capture	Traffic Signaling (1/1)		
		Server Software Component (2/3)		Modify Authentication Process		Remote System Discovery			Web Service (2/3)		
		Traffic Signaling (1/1)		Modify Registry		Software Discovery (1/1)					
		Valid Accounts (3/4)		Obfuscated Files or Information (1/5)		System Information Discovery					
				Pre-OS Boot (1/3)		System Location Discovery					
				Process Injection (8/8)		System Network Configuration Discovery (1/1)					
				Rogue Domain Controller		System Network Connections Discovery					
				Rootkit		System Owner/User Discovery					
				Signed Binary Proxy Execution (11/11)							

Process Injection (T1055)

Score:	80
Aggregate Score (average):	92.22
file modification:	DeviceFileEvents_FileModified DeviceFileEvents_FileRenamed
module load:	DeviceImageLoadEvents_ImageLoaded
process access:	DeviceEvents_OpenProcessApiCall
OS api execution:	DeviceEvents_CreateRemoteThreadApiCall

Sysmon telemetry potential mapping to MITRE ATT&CK



Initial Access 9 techniques

- Drive-by Compromise
- Exploit Public-Facing Application
- External Remote Services
- Hardware Additions
- Phishing (0/3)
- Replication Through Removable Media
- Supply Chain Compromise (0/3)
- Trusted Relationship
- Valid Accounts (0/4)

Execution 10 techniques

- Command and Scripting Interpreter (5/5)
- Exploitation for Client Execution
- Inter-Process Communication (2/2)
- Native API
- Scheduled Task/Job (2/2)
- Shared Modules
- Software Deployment Tools
- System Services (1/1)
- User Execution (2/2)
- Windows Management Instrumentation

Persistence 18 techniques

- Account Manipulation (0/3)
- BITS Jobs
- Boot or Logon Autostart Execution (10/10)
- Boot or Logon Initialization Scripts (2/2)
- Browser Extensions
- Compromise Client Software Binary
- Create Account (2/3)
- Create or Modify System Process (1/1)
- Event Triggered Execution (11/11)
- External Remote Services
- Hijack Execution Flow (9/9)
- Modify Authentication Process (2/2)
- Office Application Startup (6/6)
- Pre-OS Boot (1/3)
- Scheduled Task/Job (2/2)
- Server Software Component (2/3)
- Traffic Signaling (1/1)
- Valid Accounts (0/4)

Privilege Escalation 13 techniques

- Abuse Elevation Control Mechanism (1/1)
- Access Token Manipulation (5/5)
- Boot or Logon Autostart Execution (10/10)
- Boot or Logon Initialization Scripts (2/2)
- Create or Modify System Process (1/1)
- Domain Policy Modification (2/2)
- Escape to Host
- Event Triggered Execution (11/11)
- Exploitation for Privilege Escalation
- Hijack Execution Flow (9/9)
- Process Injection (8/8)
- Scheduled Task/Job (2/2)
- Valid Accounts (0/4)

Defense Evasion 32 techniques

- Abuse Elevation Control Mechanism (1/1)
- Access Token Manipulation (5/5)
- BITS Jobs
- Deobfuscate/Decode Files or Information
- Direct Volume Access
- Domain Policy Modification (2/2)
- Execution Guardrails (1/1)
- Exploitation for Defense Evasion
- File and Directory Permissions Modification (1/1)
- Hide Artifacts (5/6)
- Hijack Execution Flow (9/9)
- Impair Defenses (5/5)
- Indicator Removal on Host
- Indirect Command Execution
- Masquerading (2/5)
- Modify Authentication Process
- Modify Registry
- Obfuscated Files or Information
- Pre-OS Boot (1/3)
- Process Injection (8/8)
- Rogue Domain Controller
- Rootkit
- Signed Binary Proxy Execution (11/11)

Credential Access 15 techniques

- Brute Force (0/4)
- Credentials from Password Stores (3/3)
- Exploitation for Credential Access
- Forced Authentication
- Forge Web Credentials (0/2)
- Input Capture (4/4)
- Man-in-the-Middle (1/2)
- Modify Authentication Process (2/2)
- Network Sniffing
- OS Credential Dumping (5/6)
- Steal Application Access Token
- Steal or Forge Kerberos Tickets (0/4)
- Steal Web Session Cookie
- Two-Factor Authentication Interception
- Unsecured Credentials (4/4)

Discovery 25 techniques

- Account Discovery (3/4)
- Application Window Discovery
- Browser Bookmark Discovery
- Cloud Service Dashboard
- Cloud Service Discovery
- Domain Trust Discovery
- File and Directory Discovery
- Network Service Scanning
- Network Share Discovery
- Network Sniffing
- Password Policy Discovery
- Peripheral Device Discovery
- Permission Groups Discovery (2/3)
- Process Discovery
- Query Registry
- Remote System Discovery
- Software Discovery (1/1)
- System Information Discovery
- System Location Discovery
- System Network Configuration Discovery (1/1)
- System Network Connections Discovery
- System Owner/User Discovery
- System Service Discovery

Lateral Movement 9 techniques

- Exploitation of Remote Services
- Internal Spearphishing
- Lateral Tool Transfer
- Remote Service Session Hijacking (1/1)
- Remote Services (5/5)
- Replication Through Removable Media
- Software Deployment Tools
- Taint Shared Content
- Use Alternate Authentication Material (0/4)

Collection 15 techniques

- Archive Collected Data (3/3)
- Audio Capture
- Automated Collection
- Clipboard Data
- Data from Information Repositories (0/1)
- Data from Local System
- Data from Network Shared Drive
- Data from Removable Media
- Data Staged (2/2)
- Email Collection (2/3)
- Input Capture (4/4)
- Man in the Browser
- Man-in-the-Middle (1/2)
- Screen Capture
- Video Capture

Command and Control 16 techniques

- Application Layer Protocol (0/4)
- Communication Through Removable Media
- Data Encoding (0/2)
- Data Obfuscation (0/3)
- Dynamic Resolution (2/3)
- Encrypted Channel (0/2)
- Fallback Channels
- Ingress Tool Transfer
- Multi-Stage Channels
- Non-Application Layer Protocol
- Non-Standard Port
- Protocol Tunneling
- Proxy (3/4)
- Remote Access Software
- Traffic Signaling (1/1)
- Web Service (2/3)

Exfiltration 8 techniques

- Automated Exfiltration (0/0)
- Data Transfer Size Limits
- Exfiltration Over Alternative Protocol (3/3)
- Exfiltration Over C2 Channel
- Exfiltration Over Other Network Medium (1/1)
- Exfiltration Over Physical Medium (1/1)
- Exfiltration Over Web Service (2/2)
- Scheduled Transfer

Impact 13 techniques

- Account Access Removal
- Data Destruction
- Data Encrypted for Impact
- Data Manipulation (3/3)
- Defacement (2/2)
- Disk Wipe (2/2)
- Endpoint Denial of Service (0/4)
- Firmware Corruption
- Inhibit System Recovery
- Network Denial of Service (0/2)
- Resource Hijacking
- Service Stop
- System Shutdown/Reboot

Process Injection (T1055)

Score:	80
Aggregate Score (average):	92.22
file modification:	Microsoft-Windows-Sysmon/Operational_2 Microsoft-Windows-Sysmon/Operational_11
module load:	Microsoft-Windows-Sysmon/Operational_7
process access:	Microsoft-Windows-Sysmon/Operational_10
OS api execution:	Microsoft-Windows-Sysmon/Operational_8

Wrapping up

- Know your tools, understand their strengths and weaknesses
- Understand what your tools are detecting and HOW they are detecting it
- Continuously reassess this to see what is new or improved
- Augment the weak or blind spots with additional tools
- Go to Henri’s talk at 3PM in Track 2 to see how red teamers apply this knowledge

Thank you! Questions ?

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